PUGET SOUND ENERGY
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C&I Energy Efficiency Retrofit Custom Programs Portfolio Evaluation

Contents:

This document contains both the final **Commercial and Industrial Energy Efficiency Retrofit Custom Programs Evaluation Report** and the Puget Sound Energy **Evaluation Report Response** (ERR). PSE program managers prepare an ERR upon completion of an evaluation of their program. The ERR addresses and documents pertinent adjustments in program metrics or processes subsequent to the evaluation.

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COMMERCIAL AND INDUSTRIAL ENERGY EFFICIENCY RETROFIT CUSTOM PROGRAMS PORTFOLIO EVALUATION

Final Report

Prepared for:
Puget Sound Energy

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February 3, 2012

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Executive Summary

This report describes the market, process, and impact evaluation activities related to PSE's four C&I Program Schedules:

1.) Schedule E250: Commercial/Industrial Electric Retrofit Program
2.) Schedule G205: Commercial/Industrial Gas Retrofit Program
3.) Schedule E258: Large Power User Self-Directed Program
4.) Schedule E257: LED Traffic Signals

Evaluation findings serve to inform Program Schedule improvements anticipated for the 2012-2013 program cycle while also complying with the Washington Utilities and Transportation Commission (WUTC) filing requirements. This report presents the evaluation tasks completed and the corresponding final evaluation findings.

ES Market Evaluation

The market evaluation focused on four priority sectors: hospitals, food processing, the public sector, and offices. Research efforts relied on two parallel efforts: (1) an End User Assessment, through which the team collected data from building occupants to assess opportunities for further energy efficiency retrofits and (2) a Supply Chain Assessment, through which the team conducted in-depth interviews with a variety of market actors to understand the dynamics of the market at a higher level. The project team also conducted in-depth interviews with PSE customers eligible to participate in Schedule 258 and with market actors related to Schedule 257.

Key Findings for Schedules G205/E250

Figure ES 1 summarizes the key findings from the four priority sectors. Additional detail is provided in the accompanying text.

Hospitals represent the strongest opportunity for energy efficiency upgrades among the four sectors identified because of the economies of scale and favorable investment conditions. They **universally own and occupy** their facilities, and their large facilities provide fertile ground for identifying bundles of measures at one facility. Nearly 90 percent of hospitals have plans to invest capital in their facilities in the next two years, which implies that funds may be available for energy efficiency.

Some of the key strategies that PSE may consider leveraging for the hospital sector include the following:

» Achieve deeper penetration of energy efficiency by targeting the **concentrated ownership** in the hospital sector.
» Leverage previous efforts at NEEA and existing industry partnerships, including **strategic energy management plans.**
» Consider technology-specific opportunities: air conditioning units (specifically central chillers), on-site data centers, and retrofits to replace or add fluorescent lighting.

The food processing sector is poised for further engagement with PSE. This is a high-potential market because the **industry itself is creating the demand** for additional energy efficiency investment. The sector's energy use intensity reduction goals create the point of entry for PSE, and individual firms' strategic energy management plans create key starting points for discussion. More than half of food processors report having participated in PSE programs in the past, providing a strong foundation for soliciting deeper participation in the future. PSE's outreach efforts may focus on approaches to achieving the goal at the industry level as well as those goals established by individual firms.

Some of the key strategies that PSE may consider leveraging for the food processing sector include the following:

- Consider whole-building approaches to reach the variety of technology opportunities identified in this sector: lighting (including use of LEDs), food-processing specific technologies (especially process refrigeration/freezing and materials handling/conveyor motors).
- Engage more deeply with the Northwest Food Processing Association, which represents about one-quarter of the food processing facilities in the region; consider joining as a Supplier Member.
- Work with trade allies to develop strategies to address the seasonal nature of the industry and its effects on investment decision making.

The public sector represents a possible target for additional targeting for PSE but not the strongest of those explored for this project. The dynamics differ at the state and local levels. More state government agencies (54 percent) report the intention to invest capital in their facilities in the next two years than local governments (28 percent). Local governments (96 percent) report higher levels of owner occupancy than state governments (29 percent).

If PSE decides to target this sector at all, it may consider the following strategies:

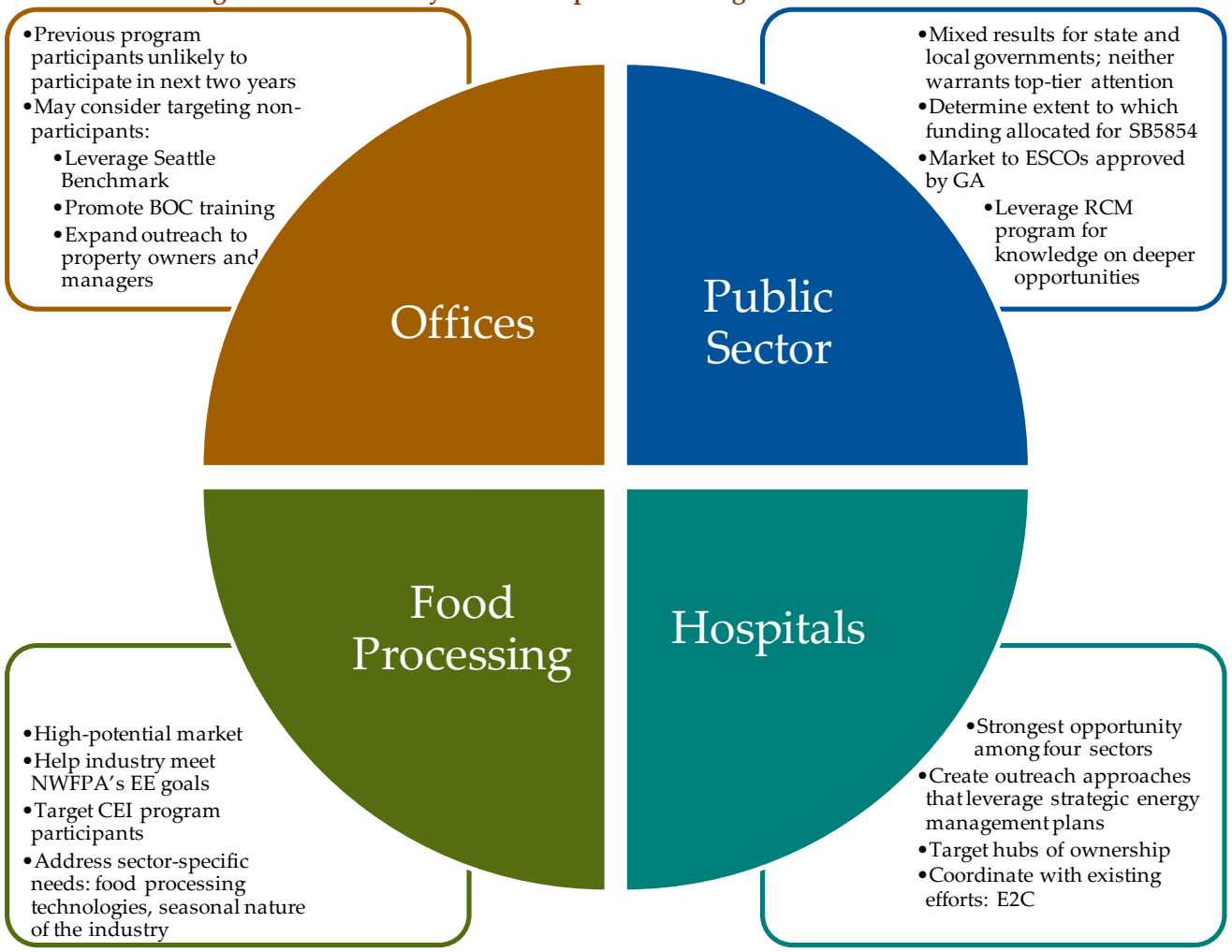
- Segment efforts to reach this sector into those that reach the state government agencies and those that reach local government agencies.
- Determine the extent to which SB 5854 was funded in the 2011-13 capital and operating budgets.
- Leverage existing expertise about these segments, including that held by ESCOs already approved by the Department of General Administration and by participants in PSE's Resource Conservation Manager Program.

Previous participants in PSE's incentive programs from the **office segment** represent the weakest segment of the four investigated for additional targeting by PSE. This segment is challenged economically, with only half of the facilities planning to invest capital in the next two years. They report very narrow bands of remaining opportunity for energy efficiency, with only controls reported by more than 10 percent of respondents as a remaining opportunity. While this segment does have high levels of owner occupancy and substantial facility size, the ownership's receptivity to additional investment overshadows those favorable factors.

PSE may consider further investigation of the market for offices that have not previously participated in PSE programs. Although their capital investment plans may mirror their participating counterparts,

more energy efficiency retrofit opportunities likely exist. In the event that PSE chooses to pursue non-participating office customers, much of the market assessment work conducted for this project can be applied. PSE can leverage the efforts that other market actors have already initiated to deepen penetration of energy efficiency in the offices sector. These efforts include the City of Seattle's benchmark, building Operator Certification (BOC) training offered by NEEC and IBOA, and the development of relationships with industry associations and building owners that NEEA has fostered in the past decade.

Figure ES 1. Summary of Sector-Specific Findings from Market Evaluation



Source: Navigant analysis 2011.

Key Findings for Schedule 257

PSE may consider sunsetting the Schedule 257 offerings due to market saturation and free-ridership issues. Interview findings indicate this market may be transformed. Transportation agencies have already replaced all the old traffic light signals that could be replaced. Further, the role of a utility incentive is minor or ancillary to the decision to replace traffic lights. Replacements make economic sense without the utility incentive due to cost savings in three areas: energy, operating, and maintenance cost savings.

Key Findings for Schedule 258

There is still significant, though diminishing, savings potential among most end uses for Schedule 258 customers. The next tier of savings opportunities is more expensive, and the payback is longer. Major opportunities include retrocommissioning at facilities that condition the majority of their space; installing variable frequency drives in process applications; and considering controls for lights, conversion of high-bay HID lamps to fluorescent, and LEDs for exterior lighting. Some additional opportunities are present at one or two customer sites; these additional details are discussed in the main report.

ES Process Evaluation

Navigant conducted the process evaluation for PSE's Custom Retrofit programs using six analytical components to triangulate key findings: program management interviews, logic model development, customer surveys and in-depth interviews, trade ally interviews, program and customer data-mining and utility program benchmarking. Findings were distilled into overarching findings and findings specific to individual programs including the Custom Grant, EnergySmart Grocer (ESG), Building Energy Optimization (BEOP), Large Power User and LED Traffic Signals programs.

Key Program Findings

PSE's custom retrofit programs are generating considerable energy savings – both through the programs and through spillover, and customer feedback on its longer-running custom programs is quite positive. PSE's programs have penetrated very effectively its largest customers over the past two years while making some inroads among its smaller C&I customers as well. Nonetheless, PSE appears to have a number of opportunities to enhance the efficiency and effectiveness of its custom retrofit programs, particularly its *Schedule E250 programs* – Electric Custom Grant, ESG and BEOP.

Electric program benchmarking suggests that PSE spends more (as a percent of C&I revenue) on its **electric program portfolio** and **electric Custom Grant program** and they cost more (per first year kWh saved) than other regional utilities' (with the possible exception of Seattle City Light for which data is not available at that level) and national best practice utilities. The high concentration of custom program activity in PSE's most active trade allies also suggests that there are opportunities to further leverage the balance of less active trade allies. While a significant percentage of PSE's program cost is incentives, these high incentives are not driving the high savings levels achieved by other programs which are

offering lower incentives. PSE's savings rates (savings as a percent of total C&I consumption) are at about the median level and can similarly be improved.

In contrast, PSE's **Schedule 205 Custom Gas program** is a top performer regionally in 2009 based on Navigant's benchmarking in spite of its low rate of savings relative to its companion electric program. Navigant's PSE gas data mining indicates that considerable savings opportunities remain and that large customer opportunities are likely to be most notable in the real estate/leasing and other services (except public administration) sectors.

Navigant's evaluation of PSE's other individual programs' performance revealed a wide range of variability:

» The **ESG program** has obtained deeper savings than PSE's other programs, but its results compared to Avista's Smart Grocer program suggests there may be considerable remaining savings opportunity in new construction and non-refrigeration measures.

» **BEOP** is clearly a program in an early stage with tremendous potential, and the program structure should continue to be reviewed critically to be sure this potential is realized.

» The **LED Traffic Signals** *program* is a very low cost source of limited savings, but may very well merit discontinuation if the market has been transformed.

» The Schedule 258 **Large Power User Self Direct** *program* is notable for its positive customer feedback and relatively large projects that commanded lower incentives per kWh saved than custom grant projects (excluding BEOP and ESG.)

Recommendations

Navigant recommends that PSE undertake the following nine steps to enhance the efficiency and effectiveness of its C&I custom retrofit programs:

» ***Recommendation 1***. Navigant recommends that PSE **consider applying the Large Power User program concept** of "customer's own funding available to be used or lost" to increase participation of larger Schedule 250 customers.

» ***Recommendation 2***. Navigant recommends that PSE **continue to focus resources on optimizing** its new (Schedule 205, 250, and, ultimately, 258) **BEOP structure** per TA, Customer and best practices findings.

» ***Recommendation 3***. PSE should **assess the potential benefits of reallocating resources from Schedule 205 and 250 custom grant program incentives to TA and customer support and outreach.**

- ***Recommendation 4***. Navigant recommends that PSE assess the potential for **leveraging the success of its ESG program**, both through replicating its structure as feasible and better leveraging PECI's presence at grocers.

- ***Recommendation 5***. Navigant recommends that PSE explore **opportunities to increase Custom Grant program efficiency** and reduce application processing time.

- ***Recommendation 6***. PSE should review the potential to better **utilize its many customer touch points** to market its EE programs.

- ***Recommendation 7.*** Navigant recommends that PSE **continue to invest in enhancing its marketing materials and approach around market segments.**

- ***Recommendation 8***. Navigant recommends that PSE confirm and then develop specific strategies and tactics to address its **target market segments**, leveraging related findings from Navigant's market assessment.

- ***Recommendation 9.*** PSE should ensure that its new **program tracking system** provides the functionality required for future program delivery.

ES Impact Evaluation

The Impact Evaluation aimed to develop measure-, program-, and schedule-level realization rates for the G205, E250, and E258 Commercial/Industrial Retrofit Schedules. Findings from the Impact Evaluation provide PSE staff with the feedback they need to increase program efficacy and to advance the research and policy objectives of PSE staff and the Conservation Resource Advisory Group (CRAG) by providing independent review of program schedule achievements.

The Impact Evaluation found PSE's Commercial/Industrial Retrofit Schedules to be **exceeding** savings targets due to *conservative* and *astute ex ante* project analyses. Table ES 1 provides an overview of the realization rates for each Program Schedule evaluated through this study. A more thorough discussion defining the Impact Evaluation strategies along with each realization rate category is provided below:

Table ES 1. Summary of Program Schedule Realization Rates

Program Schedule	*As Installed* Realization Rate	*As Evaluated* Realization Rate	*Economically Adjusted* Realization Rate
E250 & E258	99.3%	102.3%	105.9%
G205	99.9%	100.3%	102.4%

Overall, the Impact Evaluation of PSE's 2009-2010 C&I Program Schedules aimed to characterize Program Schedule specific energy and demand impacts for commercial and industrial retrofit measures, including:

- » Quantifying the impacts of all retrofit measures and activities on annual gross energy consumption while accounting for any interactions among technologies.
- » Establishing post-implementation performance profiles for installed measures and activities.
- » Explaining discrepancies between the results of this study and the *ex ante* savings estimates.

Evaluation metrics and parameters reported through this study include:

- » Gross program savings estimates and realizations rates, by fuel type (i.e., kWh and Therms), for retrofit projects.
- » Energy usage profiles for C&I technologies metered through on-site Measurement & Verification (M&V) activities.

Navigant adopted a Stratified Ratio Estimation on-site Measurement & Verification (M&V) sampling framework to achieve 90/10 confidence/precision for the evaluation of PSE's *Program Schedule-level* realization rates. Under this approach, Navigant divided the sample population into subgroups (i.e., strata) and selected sample units equal to the portion of the population in each strata. This strategy ensured that Navigant evaluated the largest contributors to program performance, while also addressing a sufficient number of smaller projects that, in aggregate, could represent a substantial percentage of *ex ante* savings. The final sampling framework achieved 90/10 confidence and precision across lighting technologies, 80/20 across the remaining electric technologies, and 80/15 across the gas technologies offered through Schedule G205.

Table ES 2 provides an overview of the Impact Evaluation realization rates for each of the three Program Schedules included through this study:

Table ES 2. Summary of *As Evaluated* Program Schedule Realization Rates (PY 2009 – 2010)

Program Schedule	Program Spending	Ex Ante Savings	Ex Post Savings	Realization Rate
E250 & E258	$39,954,232	152,247 MWh	155,749 MWh	102.3%
G205	$3,864,784	1,424,472 Therms	1,428,745 Therms	100.3%

It should be noted that the realization rates provided in Table ES 2 reflect the difference between expected savings at the time of installation and verified savings more than one year after project completion (*As Evaluated*). And throughout the evaluation, Navigant observed that many participants altered their operating profiles between this timeframe for a myriad of reasons outside the realm of program influence, including:

- » **Idiosyncratic Factors** – changes in equipment usage and operating patterns that are unique to a participant's financial health, employee attrition, and corresponding production schedules.
- » **Economic Factors** – changes in equipment usage and operating patterns as a result of shifts in industry and economic climates.

The Impact Evaluation explored each of these non-programmatic factors while quantifying their impact on project-/program-level realization rates. Navigant distinguished the impacts from each of these factors through discussions with facility personnel and in-depth file reviews to calibrate responses.

Table ES 3 provides an overview of program schedule realization rates when removing the influence of *idiosyncratic factors* on project level savings. This was accomplished by carefully reviewing the documentation on evaluated projects and comparing the pre-installation assumptions used to develop *ex ante* savings estimates to the *ex post* observations and feedback from facility personnel. In addition to the project input assumptions, Navigant also reviewed the *ex ante* calculation methodologies against industry standards and accepted engineering practices. Finally, Navigant collaborated with PSE to ensure that all available information collected during the participation process was properly accounted for in the *ex post* savings analyses.

Collectively, this information was used to reconstruct the project planning/pre-installation conditions along with the corresponding savings that would have been achieved upon project completion (*As Installed Realization Rate)*. The realization rate metric at this particular point in the program cycle is a significant milestone and of key interest from a stakeholder perspective which warranted this additional level of investigation.

Table ES 3. Summary of *As Installed* Program Schedule Realization Rates

Program Schedule	Program Spending	Ex Ante Savings	Ex Post Savings	Realization Rate
E250 & E258	$39,954,232	152,247 MWh	151,181 MWh	99.3%
G205	$3,864,784	1,424,472 Therms	1,423,047 Therms	99.9%

The *As Installed* realization rates provided in Table ES 3 are **conservative**; the realization rates at the point of installation is an instantaneous metric that cannot account for variability in weather patterns and productions schedules which inevitably drive project performance over time. Accordingly, the *As Installed* realization rates only capture overestimates in the *ex ante* savings methodologies, of which PSE's C&I Program Schedules had limited instances of:

- NCI ID #26: The *ex ante* analysis leveraged Regional Technical Forum (RTF) values to calculate refrigeration project savings. Navigant accepted this analysis and assigned an *As Installed* realization rate of 100% to this project. However, the *As Evaluated* realization rate was calculated to be 133%; similar to the realization rates found from a BPA impact study of the Energy Smart Grocer Program from several years ago. In this case, the *As Installed* realization rate was lower than what was actually achieved.
- NCI ID #43: This project involved two pump retrofits at one facility, only one retrofit of which was evaluated. Discussions with facility personnel revealed an overestimate in pump operating hours resulting in an *As Installed* realization rate of 31%. However, the second pump retrofit (not included in the Impact Evaluation sample), achieved a 111% realization rate, resulting in a 71% realization rate for the facility

» NCI ID # 64: This project involved the installation of insulation at a participant facility. The *As Evaluated* realization rate was 94% due to the addition of ceiling fans which were not present at the time of installation. Through discussions with PSE, Navigant recognized that in some cases, ceiling fans actually increase convective heat loss through the roof. In the absence of the ceiling fans, the *As Installed* realization rate was actually 100%.

Section 4.3.1 Idiosyncratic Factors (As Installed Realization Rates) provides additional project level detail influencing the *As Installed* realization rates. The *As Installed* realization rates provide insight into the accuracy of the calculations used to forecast savings in the absence of post-installation data. The results of this effort clearly indicate that PSE's EME's are applying mathematically astute methods to the *ex ante* analyses that are consistent with industry standards and accurately predict *ex post* savings estimates.

The C&I sector is particularly sensitive to economic changes because production throughput, occupancy, and operating schedules are driven by customer demand. Similarly, the changes in equipment usage also affect the efficiency of the baseline and replacement technologies incented through PSE's Program Schedules. Throughout the Impact Evaluation, Navigant encountered a number of participant sites affected by these *economic factors*; a majority of which realized lower than expected *ex post* savings estimates. The subsequent impact of these economic-driven changes on project-/program-level realization rates compound over time because savings estimates apply across a measure lifetime of several years. As such, Navigant recognized the importance of disaggregating the effects of these factors when assessing program performance and developed a robust method that accounted for variations in operating conditions attributed to external economic activity.

For temporary changes in the participant production schedule, Navigant calculated *Economically Adjusted* savings using two consistent baselines:

1.) *Full Production (Ex Ante) Baseline Operating Schedule:* Both pre- and post-installation energy consumption was calculated using the production schedule observed at the time of participation (i.e., full production schedule). Full-production adjusted operating schedules were derived from a comprehensive review of historic production logs relative to current operating schedules.

Current Production (Ex Post) Baseline Operating Schedule: Both pre- and post-installation energy consumption was calculated using the production schedule during the on-site M&V process (i.e., current current production schedule).

Table ES 4 provides an overview of program schedule realization rates when removing the influence of economic factors on project-level realization rates.

Table ES 4. Summary of *Economically Adjusted* Program Schedule Realization Rates

Program Schedule	Program Spending	Ex Ante Savings	Ex Post Savings	Realization Rate
E250 & E258	$39,954,232	152,247 MWh	161,230 MWh	105.9%
G205	$3,864,784	1,424,472 Therms	1,428,745 Therms	102.4%

Examples of the economic factors affecting program realization rates, included:

» **Change in Production Schedules**

- NCI ID #21: This project involved the installation of compressor upgrades at a manufacturing site. Although the *As Evaluated* realization rate was 99%, the facility actually increased their production requirements by consolidating all production into one line as a result of the economic downturn. This increased the load on the compressor, resulting in lower savings. The *Economically Adjusted* realization rate for this project was 109%.

» **Idled Equipment (Temporary Shutdown):**

- NCI ID #65 and NCI ID #66: This project installed fume hood retrofits at a participant lab. As a result of the economic recession, a majority of the fume hoods are now idle with future occupancy (and usage) expectations. The *As Evaluated* realization rates were 70%, but the *As Installed* and *Economically Adjusted* realization rates were both 100%.
- NCI ID #5: This project involved the chiller upgrades at a large facility. As a result of the economic downturn, the facility has since closed but is expected to re-open. And though the *As Evaluated* realization rate is 0%, both the *As Installed* and *Economically Adjusted* realization rates were 100%.

» **Site Closure (Permanent Shutdown):**

- NCI ID #29: This facility installed refrigeration upgrades but as a result of the economic downturn, is permanently closed. Even though the *As Evaluated* realization rate was 0%, Navigant confirmed that the *As Installed* and *Economically Adjusted* realization rates were 100%.

Section 4.3.2 Economic Factors (Economically Adjusted Realization Rates) provides additional detail on the rationale used to identify and account for the economic impacts on Program Schedule realization rates. Navigant recognized that economic volatility occurs periodically, and it is no more valid to choose an "up cycle" than a "down cycle" when evaluating Program Schedule performance. By providing a clear distinction between programmatic and non-programmatic factors affecting the realization rate, future evaluation results will ensure a fair assessment of Program Schedule performance over the EUL of incented measures.

Overall, the Impact Evaluation found PSE's C&I Program Schedules to accurately forecast and assess realized savings. And evaluation experience obtained through this effort revealed the following opportunities to continue **exceeding** performance goals in future Program cycles:

» ***Recommendation 1***. **Standardize** Participant Data Requirements

» ***Recommendation 2***. Request Participants with Energy Management Systems **Provide Pre-/Post-Trend Data**

» ***Recommendation 3***. **Normalize Program Schedule Tracking Databases** to Enhance Reporting and Evaluation Integrity

» ***Recommendation 4***. **Continue to Incorporate an Economic Analysis Component** for Future Evaluations

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1 Introduction

This report describes the market, process, and impact evaluation activities related to PSE's four C&I Program Schedules:

1.) Schedule E250: Commercial/Industrial Electric Retrofit Program
2.) Schedule G205: Commercial/Industrial Gas Retrofit Program
3.) Schedule E258: Large Power User Self-Directed Program
4.) Schedule E257: LED Traffic Signals

Evaluation findings serve to inform Program Schedule improvements anticipated for the 2012-2013 program cycle while also complying with the Washington Utilities and Transportation Commission (WUTC) filing requirements. This report presents the evaluation tasks completed and the corresponding final evaluation findings.

1.1 Scope of the Evaluation

Market Evaluation: The Market Evaluation addressed the following key research questions:

» How is the commercial & industrial EE market structured?

» Which market segments are ripe for future programs?

» How are the major trends shaping the market?

In addition to addressing the research questions, the report enumerates specific opportunities for PSE's intervention in the marketplace. The team seeks to make recommendations actionable for PSE staff, using the analysis from the data collection efforts as justification for the recommendations. This data-driven approach will provide PSE with the information needed to enhance program design with confidence that the adjustments will improve overall program performance.

***Process Evaluation*:** The Process Evaluation identified opportunities to improve the efficiency and cost effectiveness of PSE's C&I Program Schedules by:

» Documenting current program design and operations.

» Identifying and recommending program improvements that will result in more energy savings, better cost-effectiveness and high participant satisfaction.

The evaluation team will analyze process data to triangulate between participant and non-participant survey responses to process questions, PSE staff and implementer in-depth interviews, trade ally interviews, and program material review to identify the most defensible conclusions and recommendations

Impact Evaluation: The impact evaluation addressed the following research objectives to quantify savings across each of PSE's C&I Program Schedules:

- A thorough review of existing tracking systems, secondary literature, and Best Practices literature to guide the development of the Impact Evaluation framework.
- Develop a 90/10 confidence/precision sampling framework using a stratified ratio estimator approach to estimate *Program Schedule-, program-, and measure-level* realization rates.[1]
- Develop performance profiles for measure technologies metered through this effort.
- Quantify Non-Energy Benefits (NEB) and verify input assumptions through a combination of staff surveys, secondary research, and engineering analyses.
- Compile Impact Evaluation findings and recommendations that will continue to improve the energy savings performance of future Program Schedules.

1.2 Organization of Report

This report is organized into three sections, as follows

- Market Evaluation
  - Methodology
  - Preliminary Findings
  - Preliminary Opportunities for PSE Involvement
- Process Evaluation
  - Methodology
  - Customer Database
  - Preliminary Findings
  - Conclusions
- Impact Evaluation
  - Methodology
  - Evaluation Results
  - Factors Influencing Evaluated Realization Rates
  - Validity & Reliability of M&V Findings
  - Impact Evaluation Conclusions and Recommendations

[1] This is consistent with the statistical accuracy of evaluations in other jurisdictions and corresponds with an Enhanced Level of Rigor stipulated in the California Energy Efficiency Evaluation Protocols.

2 Market Evaluation

The analysis in this section provides the broad market context in which PSE DSM programs exist, and thus frames the data presented in the remaining sections of the report. The Market Evaluation considers how PSE interacts with other entities in the market for energy efficiency in commercial and industrial (C&I) energy efficiency opportunities and how those entities interact with one another. These relationships serve as the foundation for market interventions and influence the approaches that PSE takes to achieve the energy efficiency results that it seeks.

The Market Evaluation provides information that PSE can use to enhance its C&I energy efficiency retrofit programs' ability to influence the related markets for energy efficiency. PSE has already developed knowledge about many parts of the market for C&I energy efficiency opportunities through its planning and implementation of existing programs and its interaction with other market actors. The results of this Market Evaluation supplement that information and will help to inform PSE's future program design, especially in terms of marketing strategy.

Table 2-1 summarizes the key research questions addressed by the Market Evaluation. It specifies the location of the discussion surrounding each research question in this report.

Table 2-1. Key Research Questions

Topic Area	Research Questions	Report Location
How is the market structured?	» Who are the major market actors? » How are customers and market actors distributed geographically? » How do products and value flow through the market? » What are the primary sales strategies used by major market actors to promote energy efficiency products and services?	Section 2.2.1
How are the major trends shaping the market?	» Which market forces are the key drivers and barriers to adopting energy efficiency? » How has the economic downturn affected opportunities for financing energy efficiency projects? » What are the effects of changes in codes and standards? » Which high-impact technologies, products, and services will affect the market in the next 2-5 years?	Section 2.2.2
Which market segments are ripe for future programs?	» To what extent are PSE's priority sectors poised for deeper penetration of energy efficiency? » To what extent do energy efficiency project opportunities remain among 258 customers? » How can PSE leverage existing trends in priority sectors to achieve more energy efficiency savings in these sectors?	Section 2.2.3

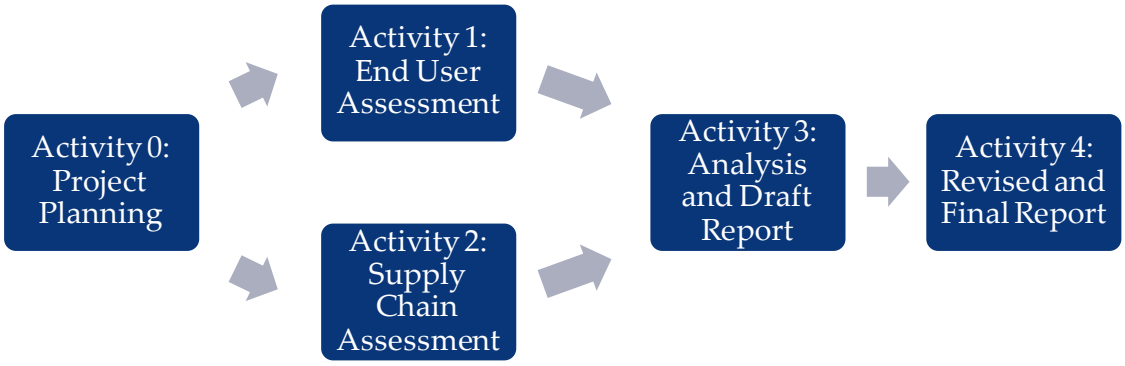
2.1 *Methodology*

The Market Evaluation relied on two key data collection activities, which the evaluation team conducted in parallel as seen in Figure 2.1. The End User Assessment combines secondary research and a survey with targeted end users to create a view of the market for energy efficiency among C&I customers in priority sectors. The Supply Chain Assessment combines secondary research with in-depth interviews of key market actors to establish the broader market context.

The evaluation team has undertaken the data collection for the Market Evaluation with two parallel sets of activities.

- ***End User Assessment:*** The End User Assessment gathers data about the view of energy efficiency from the end user's perspective. The research team has analyzed secondary data and is conducting a survey with end users (e.g., facility or energy managers). The information gathered includes key factors in decision making, opportunities for energy-efficient improvements, and characteristics of the firm and building.
- ***Supply Chain Assessment:*** The Supply Chain Assessment provides information about the broader market for energy efficiency in the priority market segments. This step developed a more comprehensive understanding of the context in which energy efficiency technologies and services are positioned. In addition, it will help to identify key trends that will shape the market in the next two to five years. The supply chain assessment relies on a literature review and in-depth interviews with key market actors.

Figure 2.1. Market Evaluation Activities

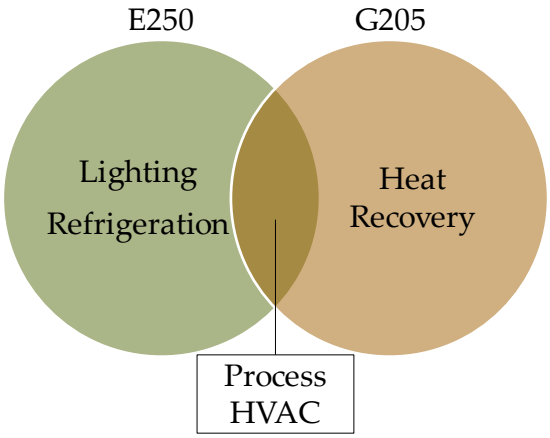


Source: Navigant 2011.

Together with PSE, the evaluation team identified five priority measure categories (*lighting, HVAC, refrigeration, process equipment, and waste heat recovery*) and four priority sectors (*offices, state and local government, hospitals, and industrial food processing*) for the data collection and analysis activities. This approach enables the project team to gather information with enough depth to provide actionable recommendations to PSE. The following discussion introduces the target measure categories and sectors and provides a high-level overview of the approach used to select them. Appendix A includes additional detail on the scoring of the measure categories and sectors.

The final list of priority measure categories has high savings potential as well as strategic priority within PSE's broader programmatic efforts. The evaluation team scored these measure categories based on a threshold number of projects and proportion of overall energy savings, recent increases in the value of incentives awarded, and recent increases in the amount of energy savings reported. PSE provided additional input regarding programmatic priorities. Figure 2.2 presents the final list of measure categories for each schedule that resulted from this meeting.

Figure 2.2. Final Set of Priority Measure Categories



Source: Navigant and PSE analysis 2011.

The evaluation team informed its selection of priority sectors on an analysis of the program-tracking databases and a high-level assessment of the efforts of nearby energy efficiency organizations. The team met with PSE staff to discuss the preliminary findings from those analyses and PSE infused the selection process with its programmatic priorities. As summarized in Figure 2.3, the evaluation focused its deeper analytical efforts on the following group of sectors:

1. **Offices –** As identified in the database analysis, offices have played an important role. Further, Northwest Energy Efficiency Alliance's (NEEA) recent efforts in this sector have prepared the market for more energy efficiency opportunities.
2. **Hospitals –** PSE sees hospitals as a growing sector. With recent NEEA efforts in this sector, the hospitals sector is likely ready for deeper utility engagement.
3. **Public Sector Buildings** (State and local government office-type buildings only; excludes wastewater treatment plants and school facilities.)

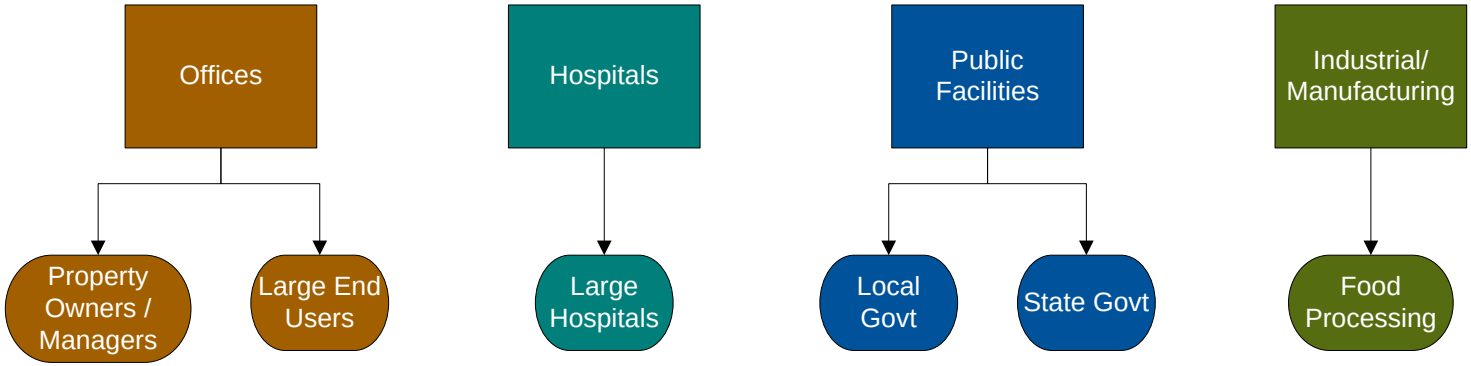
a. Wastewater treatment facilities are better categorized as industrial facilities; this research will not explore them in further depth.

b. Schools have received heightened attention over the past few years and likely have limited opportunities remaining.

4. **Industrial/Manufacturing[2] – Food Processing –**The PSE team sees a growing opportunity in this sector.

The research will focus on these sectors for both Schedule E250 and G205.

Figure 2.3. Final Sector Priorities



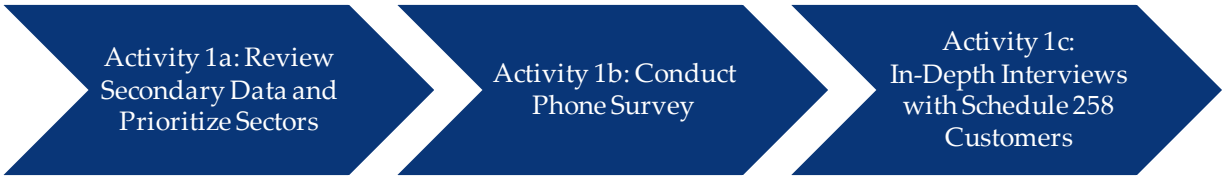
Source: Navigant and PSE analysis 2011.

[2] Data centers were originally included as a second sub-segment of the Industrial/Manufacturing sector. Initial research into this sector indicated that additional stand-alone data centers would likely locate in neighboring service territories due to a variety of factors. As such, PSE directed the evaluation team to eliminate stand-alone data centers from further consideration and focus on the remaining four sectors.

2.1.1 Activity 1: End User Assessment

The End User Assessment gathers information about decisions related to energy efficiency from the end user's perspective. This assessment combines secondary research with a survey of end users (e.g., facility or energy managers) to determine how end users make decisions about energy-efficient equipment, where potential exists for additional energy-efficient retrofits or behavior changes, and what PSE can do to facilitate the adoption of such equipment and practices. Figure 2.4 includes the general methodology.

Figure 2.4. Approach to End User Assessment



Following is an explanation of each of the sub-activities for the End User Assessment.

2.1.1.1 Activity 1a. Review Secondary Data and Prioritize Sectors

Secondary data sources provide an initial look at the current market conditions from the end user's perspective. Analysis of this data will provide a starting point for discussing the prioritization of practices. The key secondary data sources that the Navigant team referred to for this activity included the following:

- PSE's *Energy Efficiency Services 2010 Annual Report of Energy Conservation Accomplishments*[3]
- PSE's CSY databases for each program type
- *Commercial Building Stock Assessment* completed for NEEA[4]

2.1.1.2 Activity 1b: Conduct Survey

Navigant worked with its survey partner, Ewald and Wasserman Research (E&W), to undertake the main data collection effort for the End User Assessment: a survey with end users.

The evaluation team drafted a survey guide to address the research questions identified in Table 2-1. PSE staff added particular value to this process by sharing their broad knowledge of the market for energy efficiency products and services within their service territory. Tailoring the survey to the issues faced by PSE customers and highlighting issues of particular importance to PSE staff helped to focus data collection efforts where they add the most value.

The evaluation team used two key strategies to increase the response rate to the survey in an effort to reduce self-selection bias. First, Navigant and E&W coordinated a letter mailing with PSE to the

[3] PSE. 2010. "Energy Efficiency Services 2010 Annual Report of Energy Conservation Accomplishments."
[4] Cadmus Group. December 2009. *Northwest Commercial Building Stock Assessment.* Northwest Energy Efficiency Alliance.

organizations included in the survey sample. The team has found that a letter received in advance of the survey significantly increases response rate. This letter was sent on PSE letterhead and in a PSE envelope. It introduced the survey team and informed the targeted participants about the purpose of the study. Further, all individuals who participate in the survey will be entered into a drawing for one of two $100 Visa check cards.

2.1.1.3 Activity 1c: Interviews with Schedule 258 Customers and Key Account Representatives

Activity 1c addresses the Large Customer Self-Directed program (258). Given the specialized nature of these customers and projects, in-depth interviews will allow the evaluation team to achieve the following goals:

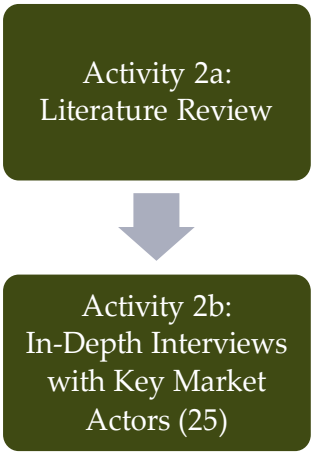
- Determine the extent to which additional project opportunities remain
- Assess the barriers to completing the remaining projects

The evaluation team met with PSE to select the target customers for this segment. The group separated the customers that are eligible for Schedule 258 into three categories based on the PSE team's assessment of their participation in the energy efficiency programs over the past two years. The target sample included four customers with relatively high levels of participation (High or Medium-High), four customers with moderate levels of participation (Medium), and four customers with relatively low levels of participation (Medium-Low or Low). The group identified an additional four customers as alternates in the event that any of the priority customers chose not to participate.

A Navigant team member with deep experience with large customers conducted in-depth phone interviews with these target customers. This individual developed a high-level interview guide (included in Appendix B) to facilitate identification of additional project opportunities and discussion of barriers to project completion.

2.1.2 Activity 2: Supply Chain Assessment

The Supply Chain Assessment incorporated a review of relevant literature and in-depth interviews with key market actors. Activity 2 assembles the information needed to undertake the main data collection effort for this part of the project: a set of in-depth interviews with contractors that install energy efficiency equipment, energy service companies (ESCOs), technology distributors, and key industry associations that are active in the service territory. This section outlines the approaches to the two activities, the Literature Review (Activity 2a) and In-Depth Interviews (Activity 2b).



2.1.2.1 Activity 2a: Literature Review

The literature review provides an overview of the state of the industry's knowledge about the supply chain's approach to distributing energy technologies into the C&I sectors. By leveraging the work already done, the evaluation team targeted the in-depth interview questions toward the issues that have not been previously explored in sufficient depth.

The literature review focused on the sectors identified in Activity 1a. Navigant completed a comprehensive review of the literature on program best practices nationally in these sectors and can leverage the lessons learned in the evaluation of PSE's Schedules G205 and E250.
In addition, the evaluation team provides a high-level look at the *technologies* that are likely to have a significant impact in the C&I markets in the next two to five years. This effort leveraged Navigant's current work in other parts of the country to identify technologies that either (1) have achieved limited market acceptance to date but are poised to expand their reach, or (2) have the potential to emerge in the marketplace in the mid-term and could have greater success with utility support.

2.1.2.2 Activity 2b: In-Depth Interviews with Key Market Actors

Market actors who serve as trusted advisors to end users serve as the most cost-effective means for collecting data about current sales strategies and the anticipated direction of the market. These market factors include energy efficiency service providers (e.g., ESCOs, contractors, and engineering firms or consultants), trade associations, and equipment distributors. They interact with both distributors and customers, providing them with the opportunity to describe which sales strategies work with customers and to identify high-impact emerging products and services.

The Navigant team worked with PSE to develop a group of targeted market actors that leverages existing resources and achieves a sample diverse enough to achieve the study objectives. Navigant conducted analysis of the program databases to identify specific program participants to interview; the in-depth interviews targeted those participants that have achieved high levels of energy savings or that lead in terms of the number of projects completed. The Market Evaluation Team coordinated with the Process Evaluation Team to ensure that Energy Efficiency Service Providers were only contacted once as part of the in-depth interview efforts.

The evaluation team interviewed a total of 25 market actors for this effort. Table 2-2 includes a breakdown of these interviews into the categories described earlier. Appendix C includes the final interview guide for each category of market actors.

Table 2-2. Composition of Market Actor Interviews

Market Actors	Types of Organizations Interviewed	Number of Interviews
Energy Efficiency Service Providers	ESCOs	4
	Engineering Firms/Consultants	2
	Contractors	HVAC: 2 Lighting: 3
Trade Associations (Specific to priority sectors)	» Building Operators and Managers Association » International Facility Managers Association » Department of General Administration » Northwest Food Processors Association » Washington State Hospitals Association	5
Equipment Distributors (Specific to priority measure categories)	HVAC, Lighting, Pumps, Refrigeration, Waste Heat Recovery	HVAC: 1 Lighting: 2 Pumps: 3 Refrigeration: 2 Waste Heat Recovery: 1

Source: Navigant analysis 2011.

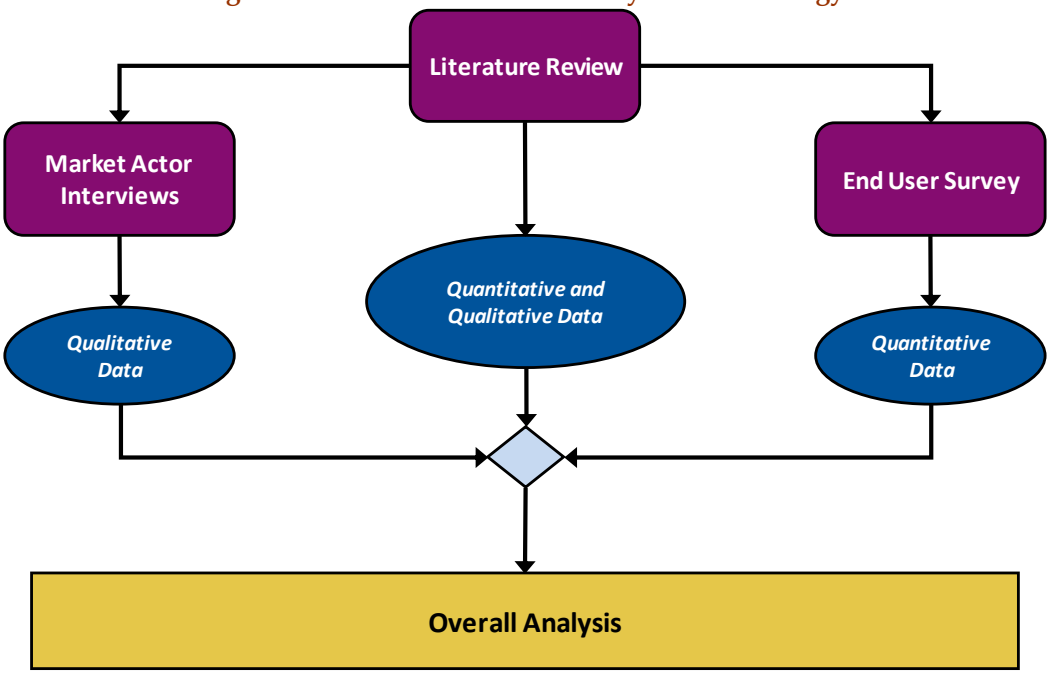
Section 2.2.1 includes additional information about the role of each type of market actor.

2.1.3 Analysis

The results of the Market Evaluation rely on the results of surveys with end users, interviews with the key market actors, and the examination of PSE's existing resources and additional secondary resources.

The analysis focuses on the information that is most useful to PSE in its design and enhancement of its C&I energy efficiency programs, as identified above. The evaluation team identified themes that emerge in the primary data collection efforts and characteristics that define market segments with high potential to respond to PSE intervention. Navigant's analysis incorporates qualitative data collected through interviews, quantitative data from the end user surveys, and a mix of qualitative and quantitative data collected through the literature research exercise, as shown in Figure 2.5.

Figure 2.5. Market Evaluation Analysis Methodology



Source: Navigant analysis 2011.

In addition to addressing the research questions, this report enumerates specific opportunities for PSE's intervention in the marketplace. The team seeks to make the recommendations actionable for PSE staff, using the analysis from the data collection efforts as justification for the recommendations. This data-driven approach will provide PSE with the information needed to enhance program design with confidence that the adjustments will improve overall program performance.

2.2 *Findings*

This section presents the findings of the Market Evaluation. It relies on the data collection efforts already completed. In large part, these findings rely on the market actor interviews, the literature review, and the evaluation team's experience in C&I markets across the country. Together, these analyses will provide clearer direction than can be provided at this time.

This discussion is organized in three sections:

- Section 2.2.1 includes a discussion about the structure of the market, including descriptions of key market actors and the relationships among them (Section 2.2.1.1) and a summary of two of the key mechanisms used in the market: approaches used to promote energy efficiency and financing strategies (Section 2.2.1.2).
- Section 2.2.2 describes trends affecting the C&I retrofit market, including drivers and barriers (Section 2.2.2.1), changes to codes and standards (Section 2.2.2.2), and technologies that are expected to have an impact on the market in the next two to five years (Section 2.2.2.3).

» Section 2.2.3 includes discussions about the direction of the priority sectors that served as the focus of this report: offices (Section 2.2.3.1), the public sector (Section 2.2.3.2), hospitals (2.2.3.3), and food processing (Section 2.2.3.4).

2.2.1 Market Structure

For most C&I energy end users, designing and installing energy efficiency retrofits falls beyond the organizations' core competencies. Choosing appropriate equipment and modifying complex building systems (e.g., electrical or HVAC) requires specialized knowledge and skill sets that most end users do not possess among their in-house staff. The market for retrofit projects has responded, with a variety of companies offering products and services along the supply chain – everything from narrowly targeted products or services to integrated equipment selection, design-build and project financing. These firms vary in size, geographic focus, and the degree to which energy efficiency plays a role in their overall business strategy.

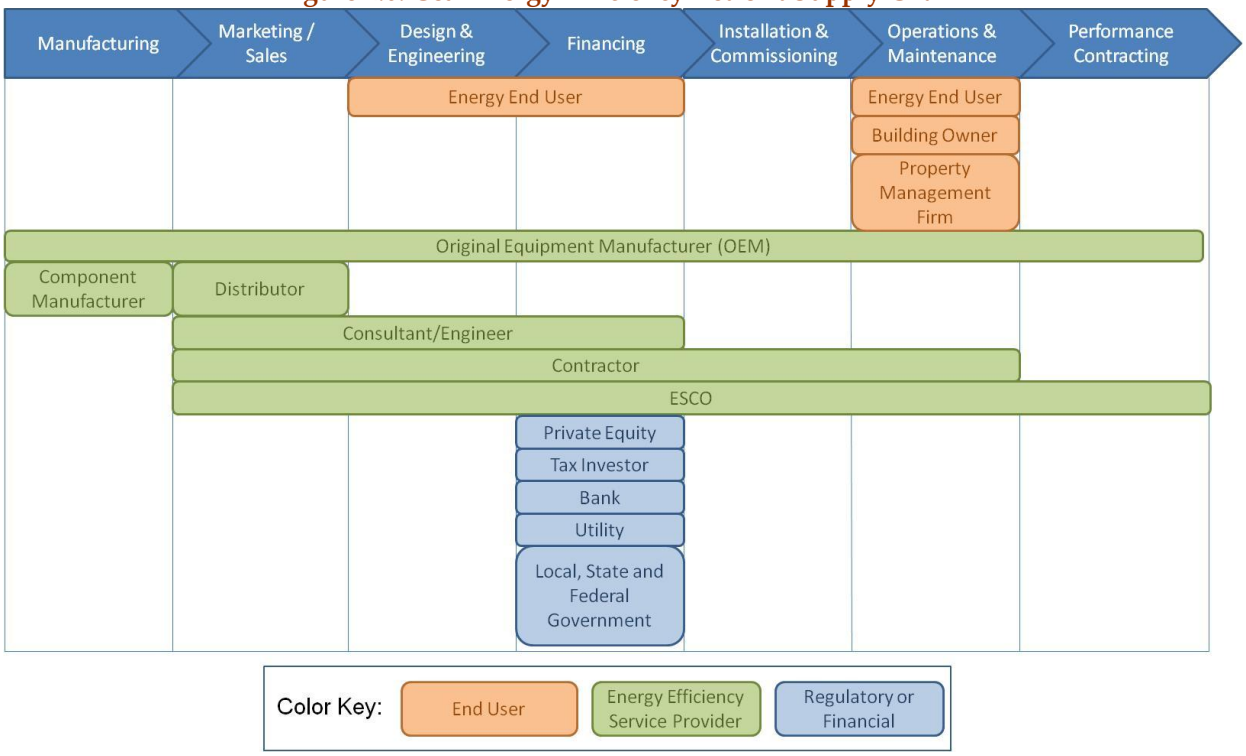
This section begins by describing the service providers and market actors that comprise or influence the supply chain for C&I energy efficiency retrofit projects and highlighting some of the common relationships among different types of firms (Section 2.2.1.1). It then summarizes two of the key market mechanisms used by service providers:

- the sales strategies firms use to generate business and
- common project financing models (Section 2.2.1.2).

2.2.1.1 Market Actors

The market actors relevant to this study fall into three groups: energy end users, energy efficiency service providers, and third-party institutions that provide either regulatory or financial inputs that influence the market for efficiency retrofits. Figure 2.6 illustrates the key market actors and their roles in the energy efficiency retrofit supply chain. The following subsections summarize the characteristics of and services provided by the market actors in each of these categories.

Figure 2.6. C&I Energy Efficiency Retrofit Supply Chain



ENERGY END USERS

This market actor category comprises the broad array of non-residential energy end-use customers that consume electricity and natural gas through the course of their daily operations. These organizations, both private-sector businesses and public-sector institutions, drive overall demand for energy efficiency retrofits and high-efficiency equipment; they are the primary decision makers when it comes to investing in and implementing a retrofit project.

In cases where the energy end user does not own the facility it occupies, the organization will need to coordinate with (and sometimes convince) the building owner or property management firm to complete the project. This often leads to a split-incentive problem between the building owner and the end user (tenant), wherein the building owner is disincentivized to make capital improvements to its facility if its tenant will capture the majority of the benefits from reduced energy use. Section 2.2.3 provides additional characteristics about energy end users in each of the four target sectors upon which this assessment focuses.

ENERGY EFFICIENCY SERVICE PROVIDERS

The energy efficiency services sector comprise diverse business types and capabilities, all linked in some capacity to the design and delivery of retrofit projects to energy end users. Different companies may offer anywhere from one specific service (e.g., lighting installation) to an entire suite of services spanning the retrofit project development value chain (e.g., ESCOs). While the lines dividing different types of firms are increasingly blurred by overlap, this assessment groups these companies into four general categories: equipment manufacturers and distributors, consultants and engineers, contractors, and ESCOs.

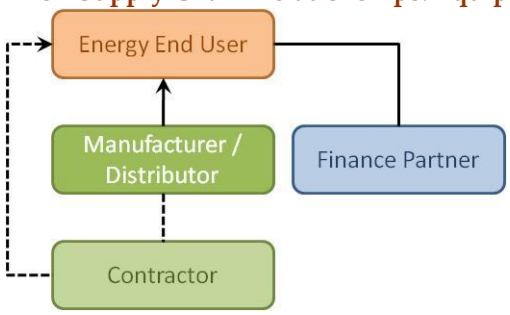
These firms vary considerably in both geography and size. While some operate predominately in Washington State or even the Seattle metropolitan area, several serve customers across the Pacific Northwest (PNW), the nation, and even the globe. This broad reach is particularly characteristic of the larger equipment manufacturers and ESCOs. In terms of size, more than 75 percent of related PNW firms have 100 or fewer employees, while 34 percent have ten or fewer employees.[5] The smaller size of many of these firms may indicate a high degree of specialization in the capabilities and services offered by a single firm (e.g., a lighting retrofit contractor).

Regardless of a company's size, energy efficiency often represents only a portion of many of these firms' revenues or service offerings. For others, retrofit projects may drive the majority of their business. The following descriptions compare the common characteristics and supply chain roles of each of the four primary service provider categories. The graphic under each heading illustrates the typical relationships among different market actors when that section's service provider is acting as the primary project driver.

Equipment Manufacturers & Distributors. Business models range as widely among equipment manufacturers and distributors as they do among efficiency service providers generally. Categories of larger equipment (e.g., HVAC) are characterized by the presence of regional sales representatives from well-established, global manufacturers who work with other service providers (or directly with end users) to market and sell their equipment. Other categories (e.g., lighting) tend to have several independent distributors who may offer products from one or several major manufacturers. For pumps and motors, some equipment providers sell equipment constructed by their own companies as well as that of competing manufacturers.

The variety of equipment providers' approaches to the energy efficiency market also extends along the value chain. As shown in Figure 2.7, some equipment providers and manufacturers design and engineer a project for a customer using the specified equipment, but have a third-party contractor install the equipment. The contractor may operate either under subcontract to the equipment provider or under direct contract to the customer. Some equipment manufacturers and distributors also offer financing, design and installation services directly to end use customers. For example, Trane, one of the leading HVAC manufacturers, has a separate division that provides complete ESCO services.

Figure 2.7. Common Supply Chain Relationships: Equipment Provider

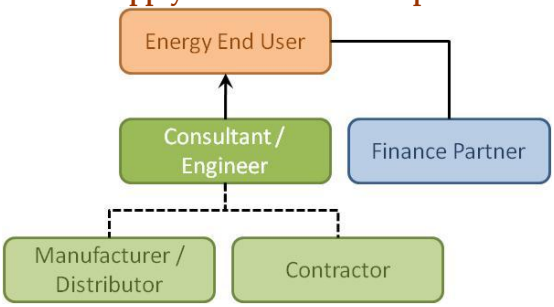


[5] Goldman, C., et al. 2010. "Energy Efficiency Services Sector: Workforce Size and Expectations for Growth." Ernest Orlando Lawrence Berkeley National Laboratory.

The role energy efficiency plays in different equipment providers' business ranges considerably. Both HVAC and lighting equipment providers reported that energy efficiency represents a primary share of sales and revenue. This may reflect the degree to which these two equipment categories have historically been the primary source of cost-effective energy savings for retrofit projects. On the other hand, providers of refrigeration, motor, and pump equipment reported that non-high-efficiency equipment still plays a major role in their business.

Consultants & Engineers. Energy consulting firms and engineering companies can provide a suite of services to end-use customers, ranging from initial identification and prioritization of energy savings opportunities to project design and construction management. While larger firms may provide wide-ranging expertise, some choose to focus on either a particular equipment category (e.g., lighting) or end-user sector (e.g., commercial real estate). This targeted approach may arise for several reasons, including staffing limitations of smaller firms or a desire to differentiate the company through specialization. As with equipment providers, the consultants and engineers operating within PSE's service territory range from smaller local firms (e.g., fewer than 10 employees) to larger firms with national coverage. In addition, energy efficiency-related services may provide anywhere from a small portion to the bulk of an engineering or consulting firm's business.

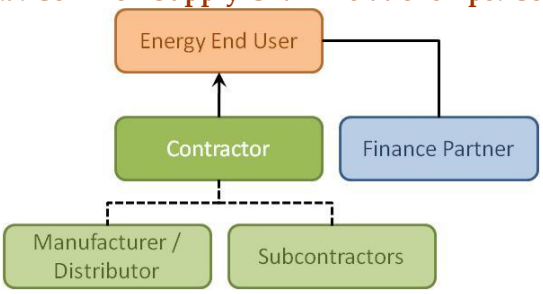
Figure 2.8. Common Supply Chain Relationships: Consultant/Engineer



As mentioned above, *the consultant or engineer may provide construction management services in addition to project design and engineering*. This typically involves the firm either acting as the owner's agent in soliciting competitive bids and overseeing contractors (paid for directly by the owner) or directly subcontracting and managing the construction process themselves, as shown in Figure 2.8 . In some cases, an engineering firm that specializes in a particular discipline (e.g., lighting retrofits) may self-perform the installation of associated equipment on a particular project. In addition, engineering firms may also provide end-use customers with financing options, either through internal funds or by connecting the customer to a third-party lender. Unlike an ESCO, an engineer does not offer performance contracting.

Contractors. Most contractors specialize in a single discipline, such as electrical or mechanical (e.g., HVAC) systems. Primarily focusing on the installation and construction phase of projects, they often serve as subcontractors to an equipment provider, engineering firm, or ESCO on a retrofit project. On the other hand, as shown in Figure 2.9, some contractors offer integrated design-build services, utilizing in-house engineering expertise to both design and construct a project. Similar to other firms, they will competitively bid and subcontract work for the disciplines in which they are less experienced.

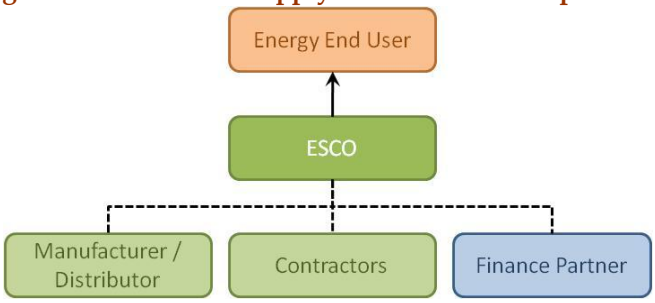
Figure 2.9. Common Supply Chain Relationships: Contractor



While far from widespread, some contractors have also begun offering financing assistance to customers for energy efficiency retrofit projects, primarily through arrangements with third-party lending institutions. In general, contractors derive a smaller share of their business from energy efficiency-related work than engineers or ESCOs, particularly in the mechanical and HVAC (as opposed to lighting and electrical) disciplines.

ESCOs. As shown in Figure 2.10, ESCOs provide end-use customers a complete suite of services related to energy efficiency retrofits – from initial conception and pricing to turnkey engineering and installation, as well as measurement and verification. However, *the key differentiator between an ESCO and any other "full-service" engineering firm or design-build contractor arises from the ESCO's ability to offer a performance contracting mechanism.* The performance contract provides a vehicle for the end-use customer to implement a retrofit project with little to no upfront capital investment. Instead, the end user agrees to pay back the ESCO over time (with interest) based on the energy and operating cost savings created by the efficiency project. The ESCO secures affordable third-party financing by combining a portfolio of potential projects with a reputation for high-quality design and delivery.

Figure 2.10. Common Supply Chain Relationships: ESCO



This savings-based project finance approach enables ESCOs to provide a unique and attractive offering to end-use customers and to secure relatively large projects that otherwise would have trouble finding funding. In particular, public sector entities such as hospitals and K-12 schools with little funding available for efficiency improvements can utilize performance contracting to achieve substantial reductions in energy use and operating costs without large capital outlays. This so-called municipal, university, school, and hospital (MUSH) market represented 69 percent of U.S. ESCO revenues in 2008,

an increase from 2006.[6,7] ESCOs interviewed in PSE's service territory indicated that this trend was continuing, with decreased likelihood of performance contracting among private-sector customers.

Some ESCOs strive to self-perform all installation and construction for a project, with the dual aim of minimizing costs and tightly controlling quality. On the other hand, others generally subcontract all or a large portion of project's construction. Some cite a desire (or requirement under government contracts) to maximize use of local subcontractors, while others explain that their core competencies lie in the identification, design, and financing of profitable projects not in their construction. Similarly, while some ESCOs that participated in the in-depth interviews conducted for this project indicate that energy efficiency related services provide up to half of their revenues, others report ranges between 15 and 33 percent. For many of these larger firms, energy efficiency services represent only one of several business lines.

Regulatory and Financial Market Actors

The final general category of actors affecting the C&I retrofit supply chain comprises third-party organizations that influence the market through various policies and regulations and by making capital available to finance projects. The first of these two influences—policy and regulation—falls primarily to the local, state and federal lawmakers and agencies that set the rules governing energy generation and transmission, utility operations and sales, building codes, and other relevant issues. The specific policies affecting the C&I energy efficiency retrofit market in the PNW are discussed in detail in Section 2.2.2.1.

The second of these influences—the availability of capital—involves a wide range of third-party organizations that work either with the service provider firms described above or directly with end use customers to help finance retrofit projects. Each of these market actors makes capital available in the following ways.

Banks, Private Equity Firms, Tax Investors. These traditional lenders provide funds for retrofits, either in aggregate by funding a portfolio of projects through an ESCO or engineer, or directly to the end customer. In many cases, the reduced risk created by large service providers' expertise and portfolio approach to energy retrofit projects makes them better able to acquire funds than individual customers may be able to achieve alone.

Utilities. Electricity and natural gas utilities, such as PSE, provide incentives for energy efficiency retrofit projects under a variety of programs and focus areas.

Local, State, and Federal Government. Through various programs, grants, and policies, government agencies provide additional incentives for energy efficiency projects. These include economic stimulus-related funds such as the Energy Efficiency Conservation Block Grants (EECBGs) and State Energy Program (SEP) funds, among others detailed in Section 2.2.2.1. In addition, the Washington State Department of General Administration provides various public institutions access to an Energy Savings Performance Contracting (ESPC) Program. While not a direct source of funds itself, the ESPC provides

[6] The other MUSH segments are municipal and state government and universities and colleges.
[7] Goldman, C., et al. 2010. "Energy Efficiency Services Sector: Workforce Size and Expectations for Growth." Lawrence Berkeley National Laboratory.

assistance to publicly owned facilities in selecting and working with a pre-qualified ESCO to implement energy conservation measures without any capital outlay.[8]

2.2.1.2 Market Mechanisms

This section discusses two of the key market mechanisms employed by market actors to help facilitate the development and implementation of retrofit projects. The first subsection discusses the various marketing channels and strategies *used by energy efficiency service providers* to reach customers and sell projects, and the second summarizes the common finance structures employed to fund retrofits.

MARKETING CHANNELS AND SALES STRATEGIES

The sales channels and strategies companies rely upon to generate business are as diverse as the business models and relationships employed by the various firms in the C&I retrofit project supply chain. However, several common themes emerged as the primary business development strategies across all four service provider categories. They include (in no particular order):

- Growing relationships with existing customers (repeat customers)
- Referrals from past and existing clients (i.e., word of mouth)
- Direct sales (e.g., cold calls and "knocking on doors")
- Responding to competitive solicitations (i.e., requests for proposals)
- Networking opportunities (industry trade shows, customer trade organization events)

[8] State of Washington: General Administration. June 2010. "Washington's Program." http://www.ga.wa.gov/eas/epc/municipal.htm

In addition, one or more interviewed service providers mentioned the following strategies as being important to generating leads and winning work.

Proforma Financial Analysis. Several (but not all) interviewed firms explained that they use proforma financial calculations to show customers their expected return on investment (ROI) or payback period for the proposed project. One ESCO additionally mentioned including calculations of projects' carbon footprint reductions alongside the financial analysis. Firms explicitly include forecasted utility incentives in their proforma calculations, citing the importance of utility incentives in moving many projects forward.

Informal Channel Partnerships. While most relationships among service providers remain informal, several firms mentioned the importance of these relationships in generating leads for projects. In particular, equipment providers receive numerous sales opportunities (several estimated about half of their business) from other service providers. Similarly, an ESCO or engineer's informal partnership with or past purchases from a national equipment manufacturer or distributor can generate leads from end-use customers that prefer that provider's equipment. The equipment provider is more likely to refer the customer to a firm that it knows to have previous experience installing and commissioning its equipment. Finally, several contractors also cited being called on by ESCOs and engineering firms to provide competitive bids for projects on a regular basis or as a pre-qualified bidder.

Vertical Integration. In an effort to internalize the benefits of such referrals, some manufacturers and distributors vertically integrate their offerings by starting (or acquiring) a business that offers energy consulting or ESCO services to end-use customers. These subsidiary or sister firms find fungible projects, design the project (specifying the manufacturer's equipment), and solicit and manage any subcontractors required for completion of the retrofit.

Leveraging National Relationships. Rather than looking across the value chain, some engineering firms and ESCOs with a regional or national presence leverage relationships with end-use customers who have several large facilities in multiple locations (e.g., a big box retailer or large commercial real estate firm).

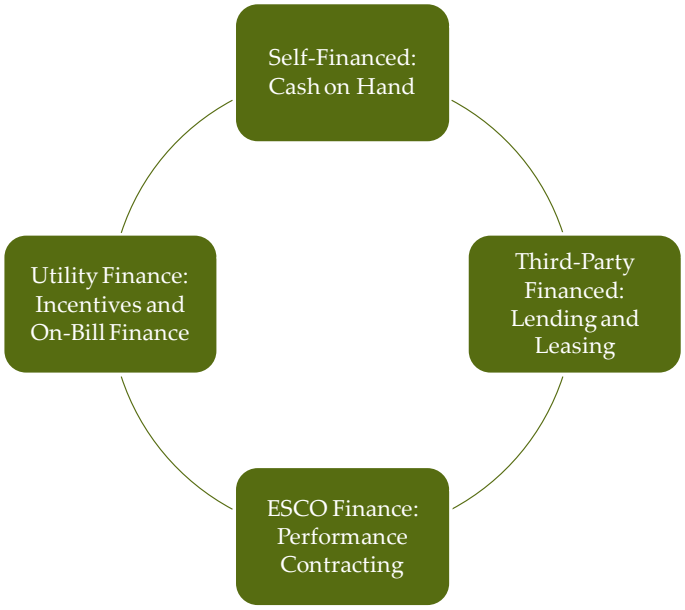
Enhanced Capabilities. Finally, two ESCOs specifically mentioned the potential marketing opportunities created by increasing interest in building management systems and the emerging data analytics capabilities associated with them. The potential improvements such analytics can provide for system monitoring and performance can add greater value to ESCOs offerings, particularly under a performance contracting model.

FINANCING MODELS

Various financial institutions and partners offer service providers and end-use customers opportunities to help fund efficiency retrofit projects. As will be discussed further in Section 2.2.2, the economic downturn has substantially reduced the availability of capital for retrofit projects, despite some owners' increased interest in making such investments. Service providers reported that lending organizations' have become far more selective about the projects for which they will provide funding and are less willing to provide capital for longer-term paybacks (e.g., 15 years).

Several companies affirmed that the downturn has made the availability of alternative financing mechanisms (e.g., performance contracting, grants, etc.) much more important to project viability, especially for public sector customers with cash-strapped budgets. The remainder of this section summarizes the most common project finance structures used in the C&I retrofit market.[9] Figure 2.11 outlines the types of financial structures discussed in this section.

Figure 2.11. Models Used to Finance C&I Energy Efficiency Retrofit Projects



Source: Navigant analysis of market actor interviews 2011.

Self Financed: Cash on Hand. For end-use customers with cash available, self-financing an energy retrofit project commonly provides the greatest return on investment. When the customer does not have to borrow funds from a bank or a service provider, they do not have to factor in interest payments or other lending fees.

Third-Party Financed: Lending and Leasing. Many customers do not have sufficient cash on hand, have other priorities competing for their capital, or simply do not wish to invest spare capital given the risky economic climate. In this case, the customer may seek funding from either a bank (or bonds, in the case of public agencies) or directly from the service provider completing their project. Many service providers maintain informal partnerships with and introduce potential customers to such lenders in the interest of facilitating loans for projects. One firm reported that it will even issue a request for proposals (RFP) to financial institutions on behalf of their customers to find financing. In most situations, the service provider does not take a direct financial stake in the loan transaction.

Occasionally, some service providers may provide direct financing for their customers' projects. They may do so either from funds the firm borrows from a bank or cash on hand; one engineering firm has a

[9] A more detailed discussion of the key considerations among the different financing mechanisms available to support building efficiency upgrades can be found in the U.S. EPA's ENERGY STAR Building Upgrade Manual, Chapter 4. Available online at http://www.energystar.gov/ia/business/EPA_BUM_Full.pdf.

"slush fund" available for projects ranging from $50,000 to $1 million. In either case, the rate of return the service provider expects to earn from the combination of project fees and interest charged to the customer must cover the firm's cost of capital.

Such third-party financing commonly takes two forms:

- In the first, the bank or service provider provides a **simple loan** to the end-use customer. If the lender is a trade ally, they charge an interest rate sufficient to cover their own borrowing costs or the opportunity cost of keeping those funds in a savings account.
- The second, but less common, form of third-party financing uses a **lease agreement** (sometimes called an energy efficient equipment lease). In this model, the third party covers the upfront cost of the equipment and charges the customer a monthly lease payment roughly equal to the savings expected from reduced energy usage. In the case of a capital lease,[10] the customer can effectively buy out and take ownership of the equipment once the capital cost (including any leasing fees) has been paid back to the third party. The contractor that cited this financing model suggested it was well-suited to lighting retrofit customers because utilities essentially verify those projects' expected savings through their incentive programs. This helps to reduce savings uncertainty for the customer.

Several service providers mentioned that they are more likely to *facilitate* third-party financing for customers (as discussed in the previous subsection) rather than holding a loan or lease on their own balance sheet. For example, one ESCO that formerly offered first-party financing reported that they converted to offering exclusively third-party financing in fall 2008.

ESCO Financed: Performance Contracting. Performance contracting is a common form of project finance arrangement offered directly by an ESCO. Similar to the energy efficiency lease agreement, the ESCO designs and installs a retrofit project that can be paid back over the contract term based on the customers' savings from reduced energy consumption. However, in this case the ESCO guarantees the level of savings to the customer and takes on the financial risk that the project may fall short of projections. This encourages the ESCO to help monitor, maintain, and optimize the performance of the installed equipment.

The performance contract plays an essential (and increasing) role in many public sector and non-profit projects (e.g., MUSH). Many of these organizations have received institutional directives to reduce energy use and operating expenses. However, most lack the capital to pursue retrofit projects (even those with short-term paybacks). The performance contract helps reduce that barrier. In addition, because it is typically paid out of operating expenses, the performance contract does not appear on the customer's balance sheet.[11]

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[10] A capital lease essentially allows a customer to purchase equipment through installment payments. For accounting purposes, this lease is considered a purchase and will appear on a customer's balance sheet. An operating lease, on the other hand, is not considered a purchase because the equipment is assumed to remain the property of the lessor. PSE staff indicate that a few contractors that participate in the C&I Retrofit program use this structure.

[11] U.S. EPA. October 2008. "ENERGY STAR Building Upgrade Manual." Environmental Protection Agency. (http://www.energystar.gov/ia/business/EPA_BUM_Full.pdf)

The number and size of projects using performance contracts require a substantial amount of capital. To meet this need, ESCOs typically turn to outside investors such as investment banks, private equity funds, or tax equity investors. An individual end-use customer my face difficulties in securing funds for large, energy efficiency retrofits. On the other hand, ESCOs' familiarity with and reputation in the energy efficiency marketplace improves their ability to secure third-party financing.[12]

Utility Finance: Incentives and On-bill Financing. A majority of the trade allies interviewed cited utility incentives' importance to the economic viability of most C&I retrofit projects. While in some cases it may simply improve a project's economics or help it to achieve a customer's internal hurdle rate, many projects would simply not be implemented without the incentives. When asked what additional steps utilities could take to facilitate implementation of retrofits, several trade allies cited the success of on-bill financing in other utility territories (e.g., San Diego Electric & Gas).

When asked what additional steps utilities could take to facilitate implementation of retrofits, several trade allies cited the success of on-bill financing in other utility territories (e.g., San Diego Electric & Gas).

On-bill financing works on a similar principal as an equipment lease or performance contract. The utility lends the customer all or a portion of the upfront cost of a project and collects repayment of the loan through the customer's monthly energy bill. The utility calculates the monthly loan payment to approximately match the expected average monthly savings from reduced energy use that will result from the project. This finance model takes advantage of an existing loan collection mechanism, thereby eliminating the customer's hassle of another monthly transaction and providing the utility increased certainty of repayment (most organizations pay their monthly energy bill). Unlike performance contracting, however, on-bill financing does not guarantee the level of savings the customer will achieve each month, leaving them exposed to the risk that a project underperforms.

A high level review of several on-bill financing program evaluation reports concluded that utilities have had success with on-bill financing programs and that there are emerging lessons learned from existing programs in the market. This review included programs from four utility territories (Midwest Energy, Hawaiian Electric Company, United Illuminating, and SoCalGas/SDG&E) and captured the following considerations and solutions: Table 2-3 includes the results of this analysis.

[12] Many of these firms are part of larger engineering or manufacturing companies with long histories and large balance sheets that reduce the risk to potential lenders. In addition, combining several performance contracts into a portfolio further reduces the risk that any one project will underperform and inhibit the ESCO's ability to meet its obligations to lenders.

Table 2-3. Four Utilities' Approaches to Addressing Challenges of On-Bill Financing

Risk Considerations	Possible Solutions
Low Participation	» Segment audience during design process » Target specific demographic or geographic area » Ensure payback and up-front costs are assessed during design process and set motivating product qualifications and loan terms » Integrate contractor pool early on to ensure they market the program » Integrate offering with other programs, such as rebates and energy audit services » Market the program adequately » Ensure the program processes are simple for the customer to understand and navigate » Leverage usage data for audience segmentation
Customer and Contractor Dissatisfaction	» Streamline application process to make it simple for participants » Integrate contractors during the design process to ensure buy-in and satisfaction » Embrace program as a customer service opportunity and consider customer service goals during the design process » Ensure prompt payment for contractors » Ensure that savings are visible on customer's bill
Legal Issues	» Review federal, state, and local laws during the design process » Ensure that debt ownership is clearly outlined and compliant with all regulations » Review lending laws thoroughly during the design process
High Administrative Costs	» Invest in staff training and streamlining tools up front » Integrate program with existing systems and tools whenever possible » Assess functionality of existing billing system early on in the design process to ensure tools are leveraged and to identify where adjustments will be needed » Invest in contractor training and outreach and leverage contractor pool as a resource
Customer Default	» Set loan terms that ensure the project provides immediate cost savings to the customer » Develop clear and appropriate credit requirements early in the design phase » Enforce customer credit requirements consistently and aggressively

Sources: Johnson, K., et al. 2010. "Lessons Learned from the Field: Key Strategies for Implementing Successful On-The-Bill Financing Programs" Johnson Consulting Group. Hyams, Michael A., 2009. "On-Bill Financing for Energy Efficiency" Columbia University. Spasarp, Frank, 2011. "On Bill Financing: SDG&E/SoCalGas" US China Energy Efficiency Forum.

2.2.2 Key Market Trends

This section describes the key trends that affect the C&I market's adoption of energy efficiency retrofit projects. It provides additional context as PSE considers which markets are best to target and how to engage with key decision makers in those markets. The market continues to shift at a rapid pace, as the firms regain confidence in the market, policymakers decide to focus more on energy efficiency, and the pace of technological change continues to accelerate. The snapshot provided in this section presents the market factors that are most important to the market today and provides some insight into how the market may shift in the future as the context changes. PSE's relationships with key market actors will continue to provide input to PSE's efforts to influence the market as program implementation evolves.

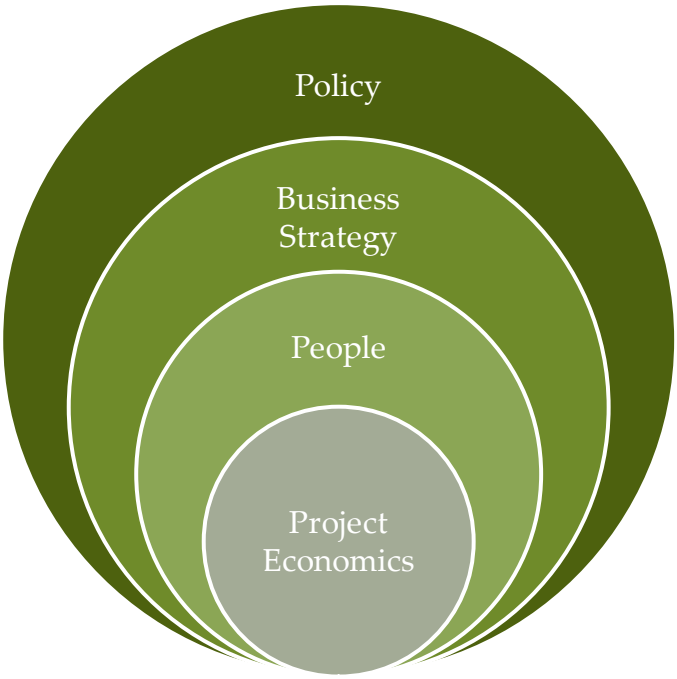
The first part of this section (Section 2.2.2.1) focuses on the drivers and barriers to energy efficiency in the C&I market in the Northwest. The second part of the section (Section 2.2.2.2) begins to explore the implications of changing codes and standards in the region. Finally, the section concludes (Section 2.2.2.3) with a high-level discussion of technologies that have the potential to make an impact on PSE's energy savings targets in the next two to five years.

2.2.2.1 Drivers and Barriers

The drivers and barriers to energy efficiency projects in PSE's service territory have evolved in the past few years. New policies have promoted energy efficiency more visibly than previous ones. While project-level metrics have largely remained the same (return on investment [ROI], payback period), the corporate strategy context within which companies considered them has changed.

Figure 2.12 depicts a framework that the evaluation team used to consider the drivers and barriers to energy efficiency at commercial and industrial facilities in PSE's service territory. The framework first considers the factors with influence over the entire market: **policies** that promote and hinder the adoption of energy efficiency. The next level of analysis considers a set of forces that drive decisions at the organizational level: **business strategies,** which include those goals and strategies established by both private- and public-sector organizations to guide resource allocation decisions. The third set of drivers and barriers relate to a group that has the least amount of consistency among these four levels: **people**. The final set of forces has a significant influence over decisions at the project level: **project economics**.

Figure 2.12. Framework for Considering Drivers and Barriers to Energy Efficiency



Source: Navigant analysis 2011.

The economic downturn that began in late 2008 has had a substantial and multi-faceted effect on the C&I energy efficiency retrofit market. While increased economic uncertainty and tighter capital markets have inhibited project implementation, the drive to reduce operating costs combined with the availability of grants and incentives have partially offset these barriers. This section summarizes several key trends identified by service providers that relate specifically to the economic downturn.

Together, these organizational level drivers and barriers have created a disconnect between **end users' interest in and ability to implement** retrofit projects. Several service providers suggested customers' ***willingness* to pursue projects that had stayed the same or increased** since the start of the recession, due to the drivers stated previously. Their *ability* to implement projects, however, has diminished in many cases due to competing priorities for reduced capital funding internally and unwilling lenders externally. As a result, service providers report that the time to complete a project sale has increased dramatically (e.g., from a six- to nine-month cycle to a cycle that lasts 18-24 months). When the sales cycle is complete, companies sometimes move forward with a smaller project than originally scoped.

POLICY

Policies at the federal and state levels have played significant roles in the adoption of energy efficiency in the C&I markets in recent years. At the federal level, the **American Recovery and Reinvestment Act (ARRA)** of 2009 made $6.3 billion available to state and local governments to promote energy efficiency through the **Energy Efficiency Conservation Block Grants (EECBG)** and **SEP** funds. Some local governments opted to use part of their share of EECBG funds to invest in energy efficiency upgrades in county and municipal government facilities, while other portions of the funds leveraged private funding to support upgrades at private facilities.

In parallel, a **federal tax deduction for energy efficiency in commercial buildings** added another financial incentive for private-sector building owners. The $1.80/square foot tax deduction applies to both new and existing buildings that reduce energy cost and use by 50 percent or more when compared to that building's expected performance under the American Society for Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2001; the building owner can achieve the energy reduction through lighting, HVAC, or building envelope improvements.[13] Alternately, a smaller tax deduction ($0.60/square foot) is available to building owners that install certain equipment that could reasonably achieve, in combination with other measures, the 50 percent reduction in energy.

Washington State's **State Jobs Act** allocated $100 million to energy efficiency in K-12 schools and higher education during 2010.[14] This competitively bid funding[15] drove significant improvements and investment in the schools sector. Several contractors indicated that these funds, which were matched by funds from other public and private sector entities, achieved much of the energy efficiency available in the schools sector.

Finally, Washington State's **energy efficiency resource standard,** originally passed through voter initiative **I-937**, is not a major driver for PSE's customers. Although I-937 drives utility procurement of conservation resources[16], contractors did not identify it as a major driver for customer decision making. This seems reasonable since I-937 is designed to drive acquisition of energy efficiency from the utility perspective. Contractors did cite utility incentives (which relates to I-937) as a driver but not the policy itself.

The only policy-level barrier that contractors mentioned related to an unintended consequence of the state's **energy codes**. As the codes become more rigorous, end users perceive that they have access to fewer financial incentives to replace their equipment early. In many cases, the new codes require more expensive equipment, which extends the payback period or reduces the ROI. In those early replacement cases, the end users are more inclined to maintain the old equipment rather than investing in newer, more efficient equipment; several contractors mentioned this is a meaningful barrier to deeper adoption of energy efficiency. In replace-on-burnout situations, the end user has no choice except to implement a more efficient unit that meets code. In these cases, the financial incentive is less relevant unless it encourages purchase of equipment that further exceeds the new code; PSE incentives are available for end users that decide to exceed code with their new equipment purchase. Section 2.2.2.2 includes further discussion about the ways in which contractors expect codes and standards to shape the market.

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[13] All information about this incentive originated from the Database of State Incentives for Renewables and Efficiency. November 2010. "Energy-Efficient Commercial Buildings Tax Deduction." Available: http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US40F&re=1&ee=1

[14] Governor Chris Gregoire. June 10, 2010. "$100 Million Now Available for School Energy, Operational Improvements." Available: http://www.governor.wa.gov/news/news-view.asp?pressRelease=1514&newsType=1

[15] Washington State Department of Commerce. July 2010. "Jobs Act for K-12 Public Schools and Higher Education Institutions." Available: http://www.commerce.wa.gov/DesktopModules/CTEDPublications/CTEDPublicationsView.aspx?tabID=0&ItemID=8769&MId=884&wversion=Staging

[16] Database of State Incentives for Renewables and Efficiency. March 2011. "Energy Efficiency Resource Standard." Available: http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=WA20R&re=1&ee=1

BUSINESS STRATEGIES

Business strategies provide the broader context in which organizational decisions about energy efficiency are made. Business strategies consider the market context, including policies, competition, investor expectations, and customer values. The approach that executives use to set business strategies varies from one company to the next. While the highest-level corporate policies are driven by forces that affect entire industries, the most effective corporate policies allow flexibility for local decision makers to adapt to the local context. A company's geographic reach, leadership philosophy, and corporate structure typically have the most impact; the organizations in PSE's territory exhibit much diversity in each of these characteristics. Despite this diversity, several common themes emerged related to the effect of business strategy on energy efficiency investment decisions.

Interviewed service providers perceive only one fundamental change in business strategy that is not directly related to the recent economic downturn. Contractors consistently indicate that organizations' **focus on "green" business**[17] plays a major role in energy efficiency investment decisions. Organizations in both the public and private sectors use their green practices in their messaging to the public to assert a competitive advantage. The goal of these communications can include building a positive brand image, offsetting other negative public relations issues (e.g., teacher layoffs), or directly attracting customers. In some cases, certain purchasers, such as Wal-Mart, have required the adoption of green practices among their suppliers.[18] Energy efficiency can play a key role for businesses that pursue the green image or business model.

Contractors consistently indicate that organizations' **focus on "green" business**[1] plays a major role in energy efficiency investment decisions.

All of the remaining findings about business strategy relate to the economic downturn, which has fundamentally reshaped economic activity worldwide. Many of these issues favorably affected energy investment decisions in PSE's service territory, but a few significant ones continue to prevent investments in energy efficiency.

Across the board, **efforts to cut costs** drive investment in energy efficiency among C&I customers. In the public sector, decreased tax revenues have led **public sector** entities to look for opportunities to reduce costs from non-personnel categories, including energy usage. [19] In parallel, public sector entities have deferred maintenance commitments in order to meet budgetary constraints, resulting in the need to

[17] Organizations use the term "green" to mean greenhouse gas (GHG) emission reductions, environmental sustainability, or some other variation on this theme.
[18] Bustillo, M. July 17, 2009. "Wal-Mart to Assign New 'Green' Ratings." *Wall Street Journal.* Available: http://online.wsj.com/article/SB124766892562645475.html
[19] Senator Barbara Boxer. March 30, 2011. "Joint Full Committee and Subcommittee on Oversight Hearing GSA: Opportunities to Cut Costs, Improve Energy Performance, and Eliminate Waste". http://epw.senate.gov/public/index.cfm?FuseAction=PressRoom.PressReleases&ContentRecord_id=0753fb73-802a-23ad-4cec-7324dca60613&IsPrint=true

replace some equipment that is in sub-optimal operating condition.[20] Combined, these trends have contributed to opportunities for energy efficiency investment in the public sector.

In the **private sector**, cost reduction has provided an alternative approach to earning profit during a time when revenues have fallen in many industries.[21] Reductions in fixed costs became necessary when private firms exhausted opportunities to reduce variable costs; historically, many firms considered energy a fixed cost.[22] To meet aggressive cost-cutting targets, contractors report that some companies have adopted corporate mandates to reduce energy use. Investments in energy efficiency help companies to achieve those targets.

On the other hand, the uncertain economic climate has also resulted in business strategies that have negatively impacted investments in energy efficiency. Companies have been more averse to investments in areas **outside of their core competencies**. These non-core investments are seen as higher risk because the firm has less familiarity with the technologies, investment strategies, and long-term impacts of the non-core opportunities. As a result, many companies have decided to focus their limited capital resources on investments that will add value to their core business. Most firms consider energy efficiency outside of their core competencies.

PEOPLE

The people involved in energy efficiency investments have direct impact on the investment decisions and implementation logistics. The most effective projects involve champions within the host organization. These individuals use their credibility with internal decision makers and knowledge of decision-making processes to drive the project through the necessary internal channels. While contractors did not mention these types of champions as key drivers, previous research has documented their role.[23]

On the contrary, service providers report that many individuals at the **leadership level lack familiarity** with energy efficiency. In many cases, leadership does not understand the more efficient technologies, the options for paying for the projects, or the near- or long-term implications of the investment. Service providers must spend additional time during the sales process to provide these individuals with the information that they need to feel comfortable with the investment; in many cases, these interactions come after an initial point of contact (e.g., the facilities manager) has bought into the project. The additional education extends the sales cycle if the executives are open to it and can result in a rejected project if decision makers are not willing to learn.

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[20] See, for example: Thurston County (WA) Development Services Department. August 2010. *Supplement to the Thurston County, WA, Draft Capital Facilities Plan 2011-2016.* Available: http://www.co.thurston.wa.us/planning/cap-facilities-plan/docs/Supplement-2011-2016-2.PDFhttp://www.co.thurston.wa.us/planning/cap-facilities-plan/docs/Supplement-2011-2016-2.PDF or U.S. Department of Labor. November 2009. *Annual Report, Fiscal Year 2009: Performance and Accountability Report.* Available: http://www.dol.gov/_sec/media/reports/annual2009/RSI.htm

[21] Vigna, P. and J. Shipman. July 19, 2010. "Profits Up But Consumers Struggle." *Wall Street Journal.* Available: http://online.wsj.com/article/SB10001424052748704682604575369352459282906.html

[22] Marsan, C.D. July 7, 2008. "Under Pressure: 10 Sources Pushing CIOs to Go Green." *Network World.* Available: http://www.networkworld.com/news/2008/070708-green-cios-pressure.html

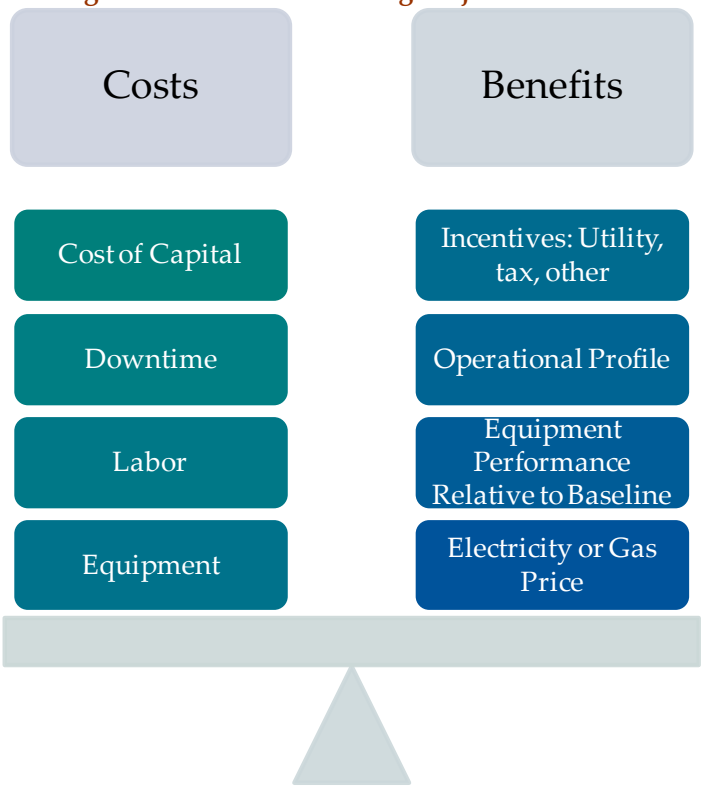
[23] U.S. Environmental Protection Agency (EPA)."Sector Collaborative on Energy Efficiency Accomplishments and Next Steps". July 2008. Available: http://www.epa.gov/cleanenergy/documents/suca/sector_collaborative.pdf

The **availability of trained staff** to assist with project implementation and ongoing maintenance also adversely affects energy efficiency decisions. In some cases, available staff is not familiar with the new equipment and require additional training to increase the likelihood of long-term success; the additional resources required to meet this training need can slow down or cancel a project. In other cases, staff is simply not available to assist because many organizations are operating with very lean staff resources due to the economic downturn.

PROJECT ECONOMICS

Cost-effectiveness, the final component that determines an energy efficiency project's success or failure, was cited most often by service providers as a determinant in project acceptance. If all of the other policies, business strategies, and people are aligned, the project economics will drive the final decision. Some companies measure this bottom line by measuring the ROI, while others measure the simple payback of the project. Either way, the key inputs to the project economics remain similar, as outlined in Figure 2.13.

Figure 2.13. Factors Affecting Project Economics



Source: Navigant analysis 2011.

The **cost of capital** has been the key cost consideration over the past three years. Capital has been constrained by the economic crisis as corporate balance sheets have weakened and investors' risk tolerance has declined, especially in response to concerns about firms' solvency. In some cases, this has manifested itself in higher interest rates charged by lenders; in other cases, it has resulted in companies' expectations of shorter payback periods for investments. As a result, energy efficiency is competing with

a wide range of other investment opportunities for a smaller pool of capital. In many cases, the capital is simply not available to invest in energy efficiency after the firm selects its core business investments.

PSE's incentives have played an important role in alleviating some of this pressure during the economic downturn according to contractors. Depending on the project, the PSE incentive can provide an immediate 100 percent ROI by matching the funds committed by the organization. Further, they can help bridge the gap between an organization's available resources and the cost of the project. They have served a vital role in many projects, according to the contractors interviewed. Many contractors mentioned that it was difficult to compete on competitively bid jobs without the PSE incentive included as part of their package because it reduced the effective cost to the customer so significantly.

In some cases, contractors mentioned customers' **expectations about increasing energy prices** as a driver to invest in energy efficiency. Although energy prices in the Northwest remain low relative to other parts of the country[24], some customers express concern that they will increase in the future. An increase in electricity price makes energy efficiency projects more attractive; it can increase the ROI or decrease the payback time when included in a financial analysis. In this context, energy efficiency becomes a risk mitigation strategy, which can elevate it further in the eyes of business decision makers.

The costs associated with **business interruption** can sometimes trump any favorable opportunities caused by a low cost of capital, expectations about increasing energy prices, or the availability of PSE incentives. One contractor indicated that a single hour of downtime could cost some high-tech manufacturing firms $10 million. That is a major hurdle to overcome in the calculation of ROI or simple payback.

2.2.2.2 Changing Codes and Standards

Codes and standards that affect the market for commercial energy efficiency fall into two general categories: federal equipment and appliance standards and state and local building codes. Federal equipment standards for commercial buildings are based on the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1, which is updated every three years.[25] Following adoption of the updated ASHRAE Standard 90.1, the Department of Energy (DOE) undertakes a formal rulemaking to determine specific updates to existing codes and standards for each type of equipment.

Once new federal standards have been adopted, responsible state agencies must review them to determine whether their own state-level building codes require updates. State building codes must, at a minimum, match the federal requirements; however, states may choose to adopt codes that are more stringent in some areas. Rather than simply adopting the ASHRAE Standard 90.1, many states use an amended version of the International Energy Conservation Code (IECC).[26] The IECC is a model code historically used by state and local governments to regulate commercial buildings. Subsequently,

[24] U.S. Energy Information Administration. "Table 5.6.A. Average Retail Price of Electricity to Ultimate Customer by End-Use, by State."Available: http://www.eia.gov/cneaf/electricity/epm/epm_sum.html

[25] U.S. DOE. 2011. "About the Building Energy Codes Program." Available at: http://www.energycodes.gov/about/. Accessed May 27, 2011.

[26] Conover, D., et al. 2009. "Comparison of Standard 90.1-07 and the 2009 IECC with Respect to Commercial Buildings." Pacific Northwest National Laboratory.

municipalities (e.g., the City of Seattle) may adopt or amend the updated state building code to address local requirements or regulations.

Washington's non-residential energy code, contained in the Washington Administrative Code, is more stringent than federal standards.[27] However, while relatively progressive, Washington's energy code allows a building owner to exempt equipment or systems from certain requirements if they are shown to be economically unviable.[28]

Interviewed service providers demonstrated moderate levels of both awareness and concern regarding upcoming changes to codes and standards that will likely affect their businesses. Speaking generally about tougher code requirements, service providers pointed to increased costs, contractors cutting corners, and delayed equipment replacements as potential drawbacks.

- One interviewee estimated that some recent code changes have added 40 percent to the cost of changing a particular piece of equipment. He suggested this can create a perverse incentive for contractors to complete work without proper permits (and give them an unfair advantage over firms unwilling to bend the rules).
- Another interviewee cited utilities' tendency to only incentivize projects that *exceed* already stringent efficiency-related standard (rather than those that simply meet code).[29] He commented that this effectively increases a customer's cost for early replacement of a piece of inefficient equipment. Rather than spending extra money in order to qualify for the utility incentive and retire the equipment early, building operators may wait for the equipment to fail.

Despite such concerns, service providers also expressed support for the benefits of recent and upcoming energy code requirements. In particular, the added transparency in energy savings that stems from requirements to monitor buildings or individual pieces of equipment can encourage more energy end users to implement energy efficiency retrofits.

An in-depth discussion of changing codes and standards for every type and size of equipment is beyond the scope of this study. Instead, the remainder of this section summarizes specific code and standard changes (at both the federal and state levels) that service providers specifically suggested were likely to affect their business in the next five years.

LIGHTING

One of the more significant upcoming changes to federal standards involves **the phase out of less efficient fluorescent lamps.** Beginning in July 2012, general service four-foot linear fluorescent lamps

[27] Non-residential code in Washington is as stringent as ASHRAE 2007 as of January 2011 (http://www.energycodes.gov/states/state_info.php?stateAB=WA). Comparatively, the federal code requires compliance with the older ASHRAE 2004 (http://www.energycodes.gov/federal/).

[28] Interview with Chuck Murray, Energy Policy Specialist, Department of Commerce, Washington State Energy Office. May 25, 2011.

[29] In cases in which operable equipment is replaced early, PSE's C&I retrofit program bases its incentive calculation on the assumption that the existing equipment is considered baseline. The new equipment must meet code at a minimum, but it is not required to exceed code in order to receive an incentive. This appears to be a point of confusion for some trade allies.

will be required to meet a minimum efficiency of 89 lumens per Watt. This standard will effectively limit the sale of linear fluorescent lamps to (at a minimum) high-performance T8 lamps, and will prohibit the sale of less efficient T12 and standard T8 lamps (e.g., first generation 700-series).[30] Subsequently, beginning in 2014, federal standards will also prohibit standard T8 ballasts, providing additional energy savings from high-performance T8 ballasts.

Some interviewed equipment suppliers are already phasing out their stock of equipment that will no longer meet requirements in 2012 (e.g., 700-series fluorescents and T12s). In anticipation of these changes, many remodel, tenant improvement, or replace-on-burnout projects will likely be designed to meet the stricter code requirements by using high-performance T8 ballasts, even without utility incentives. However, PSE may continue to offer incentives to encourage the early replacement of lighting equipment among potential retrofit customers who would otherwise wait for the need to remodel or for their equipment to burnout.[31]

For state-level code changes, several service providers cited the recently implemented **requirements for lighting controls and daylight harvesting** in Washington's Non-Residential Energy Code (NREC).[32] State code requires the installation of automatic daylight sensing controls in all areas with skylights and windows, as well as automatic shut-off controls for most interior lighting applications.[33] One respondent expressed concern that these sensors would inhibit project ROIs as a result of both increased equipment costs and reduced savings from lighting retrofits (since improved controls mean fewer operating hours and savings opportunities per fixture). However, another service provider expressed satisfaction knowing that the expertise necessary to help customers meet the new requirements would eliminate less-experienced contractors that have recently flooded the lighting retrofit market.

MOTORS

In December 2010, the federal government implemented **higher efficiency standards for general purpose motors** up to 200 horsepower, and extended efficiency standards to special purpose motors that were not previously covered under federal efficiency standards.[34] These standards affect both process equipment (e.g., compressors and conveyors) as well as HVAC equipment. As with lighting equipment, manufacturers and distributors reported that they began phasing out motors that would not meet the new efficiency specifications well before the rule took effect. Despite the decreasing availability of less efficient units to replace burnt-out equipment, utility incentives can continue to encourage early replacements as end users search for energy savings and reductions in operating costs.

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[30] Cooney, K. and R. Maslowski. Navigant Consulting. 2011. "Commercial Lighting Market Transformation Model Development and Market Research – Phase I: T12 Retrofit Market. (Review Draft)" Energy Trust of Oregon.

[31] Starting in July 2012, when a customer with a standard T8 fixture has the lamp burnout, they will have to replace the lamp with a high performance T8. However, this will not produce any energy savings, as high-performance T8 lamps have the same wattage as a standard T8 lamp. With a standard T8 ballast as the baseline, the opportunity for code-driven energy savings will occur in 2014 when high-performance ballasts will replace standard T8 ballasts.

[32] Washington Administrative Code 51-11-1513. (http://apps.leg.wa.gov/wac/default.aspx?cite=51-11-1513)

[33] Lane, M., et al. 2010. "2009 Washington State Non-Residential Energy Code: Lighting and Energy Metering Webinar". Northwest Energy Efficiency Council.

[34] US DOE. 2011. "Appliances & Commercial Equipment Standards: Electric Motors." Accessed May 27, 2011. Available at: http://www1.eere.energy.gov/buildings/appliance_standards/commercial/electric_motors.html

None of the suppliers mentioned this issue in a negative light; rather, one interviewee suggested that the standards had actually helped his company streamline their product lines and offerings. With many products already available at the improved efficiency requirements, the new standards may have simply eliminated lower tier equipment. The interviewed suppliers did not mention any anticipation of state-level codes related to motors or HVAC equipment having a significant impact on their business.

COMMERCIAL REFRIGERATION

Until recently, no federal efficiency standards existed for commercial refrigeration equipment. The first federal standards to go into effect for commercial refrigeration equipment were prescribed by the Energy Policy Act of 2005 (EPACT 2005), which had a compliance date of January 1, 2010. In addition, EPACT 2005 required the DOE to conduct an energy conservation rulemaking for other types of commercial refrigeration equipment. This second set of standards was published in January 2009, and will take effect on January 1, 2012.[35]

The 2009 final rule standards will result in substantial energy savings, and interviewed equipment manufacturers indicated that they have already begun to produce more energy efficient equipment. However, a great deal of uncertainty remains regarding DOE's rules for certification, compliance, and enforcement of the EPACT 2005 and 2009 final rule. In its rulemaking on certification, compliance and enforcement, the DOE used a basic-model approach to certifying that equipment meets the standards; however, most commercial refrigeration equipment is customized to meet each end user's needs. To the degree that such customization causes a piece of equipment to fall outside of the basic-model parameters, the manufacturer could be required to perform extensive tests to confirm its energy performance meets the DOE's requirements. Such uncertainty could create uneasiness and additional costs for manufacturers.

With regulation of this equipment occurring only in the past few years, the initial standards required may have left substantial room for future improvement. Incremental strengthening of the standards may occur due to planned review of the EPACT 2005 and 2009 DOE final rule standards. The first of these reviews is scheduled for 2013, with another being mandated by legislation in 2016.[36] In the near-term, this could leave an opportunity for utilities to incentivize above-code equipment that can achieve significant energy savings.

METERING

Service providers also specifically mentioned Washington State's new requirements related to energy metering. The 2009 NREC requires the metering of energy usage data from building energy supply sources (e.g., grid-supplied or on-site generation) and various energy consuming equipment. Table 2-4 lists the system sizes and capacities above which equipment must have an independent submeter installed. This requirement applies to both new construction and the replacement of existing building systems.[37]

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[35] US DOE. 2011. "Appliances & Commercial Equipment Standards: Commercial Refrigeration Equipment." Accessed May 27, 2011. Available at: http://www1.eere.energy.gov/buildings/appliance_standards/commercial/refrigeration_equipment.html.

[36] US DOE. 2011.

[37] Lane, M., et al. 2010. "2009 Washington State Non-Residential Energy Code: Lighting and Energy Metering Webinar". Northwest Energy Efficiency Council.

Table 2-4. Size Thresholds for Washington NREC Submetering Requirements

Category	Submetering Threshold
Chillers/heat pump systems	> 70 kW (240,000 Btu/h) cooling capacity
Packaged AC unit systems	> 70 kW (240,000 Btu/h) cooling capacity
HVAC fan systems	> 15 kW (20 hp)
Exhaust fan systems	> 15 kW (20 hp)
Make-up air fan systems	> 15 kW (20 hp)
Pump systems	> 15 kW (20 hp)
Cooling towers systems	> 15 kW (20 hp)
Boilers, furnaces and other heating equipment systems	> 300 kW (1,000,000 Btu/h) heating capacity
General lighting circuits	> 15 kVA
Miscellaneous electric loads	> 15 kVA

Source: NEEC 2010. Washington State Non-Residential Energy Code Webcast

Service providers generally discussed this new requirement in a favorable light, acknowledging that it will make building owners more apt to save energy if they can see the results of the money they spend. From PSE's perspective, this new requirement may lend itself to the measurement and verification of incentivized systems and equipment.

SEATTLE'S BUILDING MONITORING ORDINANCE

The benefits of increased transparency of energy savings were also cited in service providers' discussions about the City of Seattle's building energy benchmarking and reporting ordinance. In 2010, the City of Seattle adopted a resolution requiring energy disclosure for non-residential buildings. Buildings over 50,000 square feet must benchmark and report their facilities' energy performance to potential buyers, lenders, lessees, and the City by October 2011 (originally April 2011); buildings over 10,000 square feet must start reporting by April 2012.[38] Again, while the requirement will add additional costs for building owners and property managers, the net effects of increased visibility and awareness are likely to increase overall energy savings.

While this mandate will primarily affect electricity use and savings for Seattle City Light customers, many also receive gas service from PSE. In addition, a similar benchmarking requirement adopted in New York City suggests that spillover effects of such mandates (e.g., improved access to and interest in energy benchmarking resources and tools) may drive additional energy savings in the region as a whole.[39] As ESCOs and other service providers improve their building monitoring and benchmarking capabilities in response to the City of Seattle's requirement, they can offer those expanded services in surrounding municipalities. Such offerings may attract particular interest from commercial building

[38] City of Seattle Department of Planning and Development. 2011. "Our Program: Energy Benchmarking and Reporting." http://www.seattle.gov/dpd/GreenBuilding/OurProgram/PublicPolicyInitiatives/DPDP018682.asp

[39] Lowenberger, A., et al. 2010. "What Drives Energy Performance Scores: Benchmarking NYC High Rise Building Stock." 2010 ACEEE Summer Study on Energy Efficiency in Buildings.

owners in cities surrounding Seattle, who compete for the same building tenants that may consider locating in the greater metropolitan area.

2.2.2.3 High-Impact Technologies on Fast Growth Curves

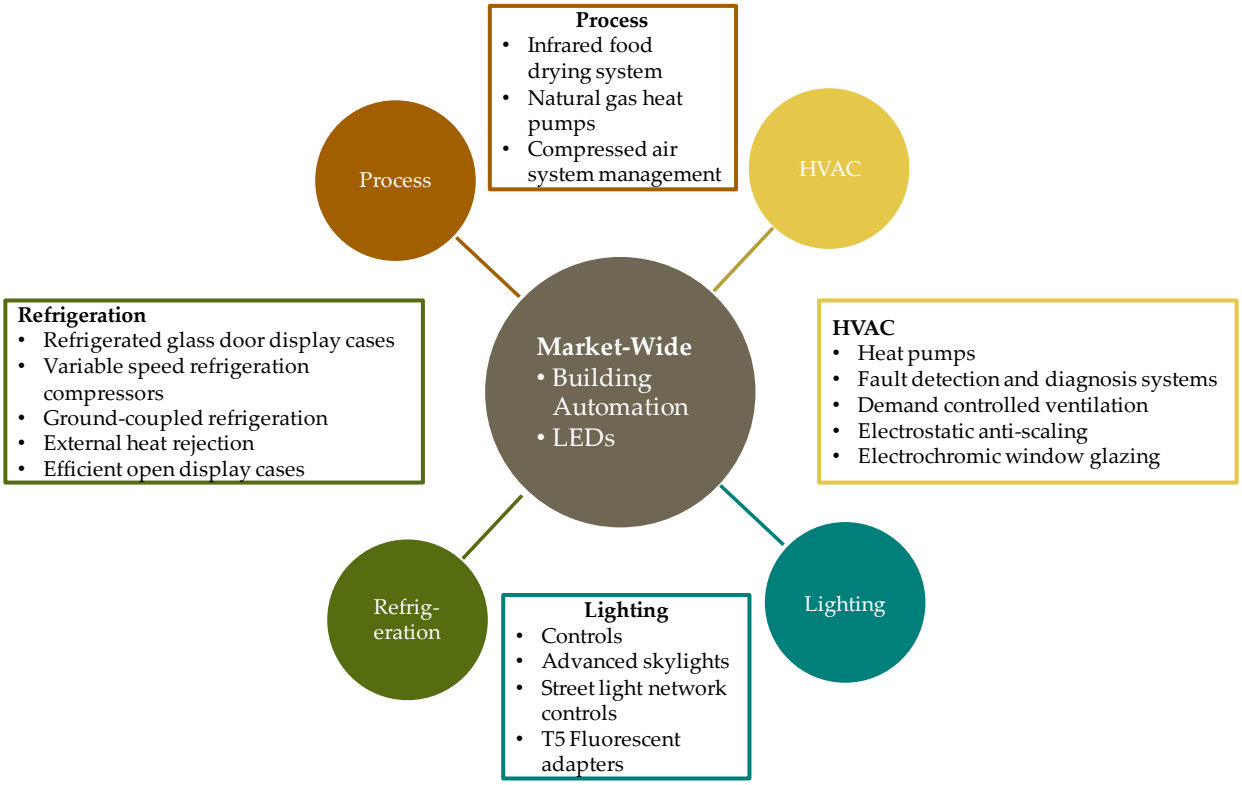
Market actors anticipate that two key technology trends will have the most significant effects on the market for energy efficiency in the next two to five years: building automation and light emitting diodes (LEDs). These technologies are already commercially available, but certain barriers have inhibited widespread adoption to date, most prominently in the case of LEDs. Several market actors have indicated that those barriers have diminished in recent months and will continue to decrease in the near term.

In addition, a broader screening of high-impact technologies in the priority technology sectors indicates that other technologies have the potential to affect the market in the next two to five years. Market actors mentioned several of these technologies during the interviews, but the technologies did not garner as much widespread market recognition as building automation and LEDs. As a result, these are discussed at a higher level in this section.

This section provides an overview of the technologies that are anticipated to affect the market for C&I energy efficiency most significantly in the next two to five years. It begins with a closer look at building automation and LEDs. The last part of this section provides an overview of other technologies in the lighting, HVAC, refrigeration, process, and heat recovery categories that also have potential to make an impact in the next two to five years. The main body of the report covers these technologies at a high level; additional detail on these second-tier technologies is available in Appendix D.

Figure 2.14 summarizes the technologies identified by Navigant.

Figure 2.14. Overview of High-Impact Technologies on Fast Growth Curves



Source: Navigant analysis 2011.

BUILDING AUTOMATION

The value proposition for building automation has grown substantially in the past few years. As "smart grid" technologies have evolved to leverage accelerated developments in information technology, building owners have become more aware of the opportunities to control aspects of building operations from remote location.

Building automation systems incorporate a wide variety of controls. Many of these controls relate directly to energy efficiency:

- Occupancy sensors provide fundamental information to drive energy savings in buildings. Using occupancy sensors, automation systems can reduce energy use in unoccupied spaces for many loads, including lighting, HVAC, vending machines (refrigeration and lighting) and more.[40]
- Lighting sensors (photocells) monitor ambient light levels, allowing for modulation of artificial light sources. Many areas of buildings have sufficient daylight from skylights and windows; by monitoring light levels, automation systems can reduce artificial lighting without impacting occupant comfort.

[40] Reliant Energy: Vending Machine Energy Savings. Available: http://www.reliant.com/en_US/Page/Generic/Public/esc_purchasing_advisor_vending_machine_energy_savings_bus_gen.jsp

- » HVAC controls, driven by a variety of sensors, reduce load by minimizing HVAC load based on occupancy, fresh air requirements, air temperature, and time of day.
- » Carbon dioxide (CO_2) sensors offer an indirect form of occupancy sensing to directly determine the amount of outside air that needs to be introduced to each room by the ventilation system in order to meet fresh air requirements in building standards.

Outdoor air temperature and humidity sensors enable the use of HVAC economizers and boiler temperature modulation (outdoor temperature reset). Economizers entrain greater amounts of outdoor air when outdoor air demands lower energy consumption to condition than re-circulated air. When outdoor temperatures are moderate during heating season, boiler temperature modulation maintains occupant comfort while reducing losses.

Other controls may be only indirectly or not at all related to energy efficiency. For example, differential pressure switches on a filter can determine if it is dirty; this alarm provides benefits beyond energy efficiency (i.e., reduced downtime), but a clean filter also increases the efficiency of the system. In addition, building automation systems can control security and sprinkler systems, which have little to do with energy efficiency.

Building automation is gaining broader interest from building owners and ESCOs because it enables technicians to identify issues from a remote site. This enables decision makers to determine the most appropriate staff to deploy to address the issue without having to send out a generalist first; this reduces the number of person-hours and costs for troubleshooting. Further, ESCOs find value in building automation because they can determine reasons for sub-par energy performance, again without having to send staff to the site to investigate. For ESCOs that have signed performance contracts, this approach enables them to fix the problems faster and earn the returns on their investment faster.

LIGHT EMITTING DIODES (LEDS)

LED technology evolved rapidly in recent years. LEDs are highly coveted for their extended lifetime (as much as 50,000 hours in some applications), and their low energy consumption (up to 80 percent lower than incandescent bulbs).[41] One of the most important advances is in light quality; early products produced poor quality light that was uncomfortable and distracting for consumers. Newer products produce high-quality light and consistently perform close to their ratings.

Many niche applications and technologies are advancing ahead of the curve. Four such areas include the following: (1) exit signs, (2) bi-level parking area lamps, (3) street/area lighting, (4) refrigerated display cases, and (5) channel letter signage. Figure 2.15 shows some of these applications.

[41] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. "Lighting Choices." Available: http://www.energysavers.gov/your_home/lighting_daylighting/index.cfm/mytopic=11975

Figure 2.15. Examples of Niche LED Applications

From Left (with Sources): Exit Signs (The Exit Store), Bi-Level parking lot lighting (California Emerging Technology Coordinating Council), Street/Area applications (Sacramento Municipal Utility District), Refrigerated Display Cases (Pacific Gas and Electric)

Of these, exit signs are the most common application today. Many utilities across the country provide incentives for LED channel-letter signage, typical on commercial storefronts.[42] High-use lighting applications, such as streetlights and parking lighting are other prime opportunities for LEDs. Because of the extended hours of use in these applications, owners will have shorter payback periods. For building owners with large quantities of fixtures, the significant reduction in maintenance costs due to infrequent replacement needs may be a major driver in selecting LED products.

Costs continue to decrease, but first-cost barriers continue to be the single largest challenge for LED lighting. For example, a typical commercial T8 LED lamp (17W-22W depending on the product) now costs $60 or more, whereas a conventional T8 lamp (28W) costs approximately $2.[43] These costs often force facility owners to evaluate other lighting options that may bring down the initial investment in exchange for less reduction in operation costs. At current prices, the lifetime cost savings do no outweigh the first cost barrier without financial incentives.

Many market actors expressed concern about the quality of LEDs in the marketplace over the past few years. The market was still immature, leading to an abundance of inexperienced or "fly-by-night" manufacturers of LEDs that produced products with questionable quality. Several service providers interviewed were reticent to sell unproven products to their customers due to concerns about their own credibility.

Many of these concerns have abated, however. LEDs are now available from credible vendors with long track records of producing reliable products (e.g., GE, Philips, Osram Sylvania). Most market actors interviewed for this project indicated that they are willing to suggest these products to their customers. One service provider specifically mentioned the adoption of an ENERGY STAR measurement for LEDs, and utilities' subsequent endorsement of that standard, as indicators that the technology has gained market acceptance.

[42] Utilities with channel-letter signage rebates include SMUD, CPS Energy, Rocky Mountain Power, ComEd, PG&E, and others.

[43] Richman, et. al., "Laboratory Evaluation of LED T8 Replacement Lamp Products." Pacific Northwest National Laboratory. May 2011. Available: http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/gateway_t8-replacement.pdf

OTHER TECHNOLOGIES THAT CAN IMPACT EE IN THE C&I SECTORS

A broader suite of technologies have the potential to achieve deeper energy efficiency gains in the next two to five years. While these technologies did not receive as much widespread recognition from contractors as building automation systems and LEDs did, Navigant expects they will mature and expand as widely available, cost-effective technologies within two to five years. The following tables present brief descriptions of the top technologies in each priority measure category. Appendix D includes additional detail on the top two technologies in each measure category.

Table 2-5. Promising Technologies: Lighting

Technology	Description
LEDs	LED technology reduces energy consumption by up to 75% over equivalent incandescent bulbs.[44] First costs remain a barrier, but the technology continues to mature rapidly, and with maturity comes lower prices.
Controls	Lighting controls save energy by reducing lighting load based on occupancy, lighting levels, and/or time of day. Integration of individual components into comprehensive controls and automation systems provide the highest levels of savings.
Advanced skylights, including solar tracking	Advanced skylights introduce greater amounts of sunlight into interior building spaces using the same skylight surface area, thereby reducing artificial lighting needs.
Street light network controls	Street light networking and remote monitoring provides savings by using dimming capabilities to set appropriate lighting levels, and by ensuring that lights are not lit inadvertently during daylight hours.
T5 Fluorescent adapters	T5 adapters allow existing ballasts (for T-12 (40W) or T-8 (32W)) to drive new low-profile T-5 (28-W) lamps without expensive retrofit installations. Some, like Retrolux, also provide wireless-driven dimming capabilities.

Source: Navigant analysis 2011.

[44] ENERGY STAR: Why Choose ENERGY STAR Qualified LED Lighting? Available: http://www.energystar.gov/index.cfm?c=ssl.pr_why_es_com

Table 2-6. Promising Technologies: HVAC

Technology	Description
Heat pumps	Ground-coupled heat pump systems consist of a hydronic loop for exchanging thermal energy between the ground and one or more end uses, including space heating/cooling, or water heating. The earth is an infinite heat sink/source that enables higher operating efficiencies than typical air-source heat pumps.
Fault detection and diagnosis systems (FDD)	FDD systems monitor equipment operation and notify users of faults or performance degradation. Such operational transparency helps avoid catastrophic failures by enabling corrections as soon as issues arise.
Demand controlled ventilation	Occupancy-based ventilation reduces space conditioning loads by reducing the amount of outdoor air that the system entrains (while maintaining minimum requirements).
Electrostatic anti-scaling	Electrostatic anti-scaling uses an electromagnetic process to mitigate fouling of chiller condensing tubes. This process increases energy efficiency, reduces water consumption and eliminates expensive chemical treatments that contaminate the water.
Electrochromic window glazing	Electrochromic glazing uses small electrical currents to dynamically change a window's thermal, solar and visible transmittances. Such adjustments alter heat gain in the building and therefore reduce heating and cooling loads.
Other technologies mentioned by market actors: ice storage systems for cooling[45] and digital screw compressors.	

Source: Navigant analysis 2011.

[45] Such systems use off-peak electricity (typically at night) to produce ice, which is subsequently used in lieu of conventional (and more energy intensive) air cooling methods during peak usage hours (e.g., late afternoon).

Table 2-7. Promising Technologies: Refrigeration

Technology	Description
High efficiency, refrigerated glass door display cases	New glass door display cases reduce refrigeration load in supermarkets and convenience stores. As a retrofit option for open cases, these units also reduce space conditioning loads.
Variable speed refrigeration compressors	Variable speed drive (VSD) used in industrial, high-load applications has proven the energy savings potential by allowing for load matching modulation. VSDs have significant room for increased penetration in refrigeration applications.
Ground-coupled supermarket refrigeration	Much like geothermal (ground-source) heat pumps, ground-coupled supermarket refrigeration uses the ground as an efficient heat sink for the vapor compression system, thereby improving system efficiency, especially on hot days.
External heat rejection for walk-in coolers and freezers	Many small commercial refrigeration systems reject heat within the conditioned space of the building, resulting in increased cooling loads.
Efficient open display cases	New, high-efficiency display cases reduce refrigeration load by reducing warm-air infiltration and optimizing suction pressure. New cases reduce infiltration through turbulence reductions in return air grills, and with advanced air curtains, which are precisely directed air currents that create a barrier across the case's open side.

Source: Navigant analysis 2011.

Table 2-8. Promising Technologies: Process

Technology	Description
Food drying – infrared and high efficiency gas system	Electric infrared (IR), or newer flameless catalytic IR dryers use IR radiation to dry food. IR drying eliminates the inefficiency of transferring heat to air and from the air to the wet material. New gas-driven steam dryers also provide significant savings over conventional units.
Natural gas heat pumps for process heating and cooling	Thermally driven heat pumps use natural gas to either (1) power a natural gas engine-compressor in a vapor-compression cycle, or (2) run an absorption process. Since heat pumps inherently provide simultaneous heating and cooling, they are uniquely positioned to fill this need in many industrial processes.
Compressed air system management	Compressed air management systems monitor and improve compressor performance by balancing compressor network loads, optimizing cycling, and regulating output pressure. The technology is also applicable to other HVAC-R compressors.

Source: Navigant analysis 2011.

Table 2-9. Promising Technologies: Heat Recovery

Technology	Description
Organic Rankine Cycle	Organic Rankine Cycle systems generate electricity from low-grade waste heat streams. These systems benefit where heat sources are insufficient to drive superheated steam turbines.
Commercial desuperheaters for vapor compression systems	Desuperheaters use rejected heat in a vapor compression cooling/refrigeration system to heat water. They displace water heating loads and also improve cooling system efficiency.
Dimpled tube heat exchanger	Dimpled tube technology improves the thermal efficiency in a variety of industrial heat exchangers by introducing a vortex within each dimple to intensify convective heat transfer. Additionally, this technology mitigates heat exchanger fouling.
Transport membrane condenser	Transport membrane condensers enhance the capture of waste heat and water vapor from exhaust/flue gas for reuse. This technology can be applied to a wide variety of industrial, commercial, and residential equipment.
Industrial water recycling	Industrial water recycling typically uses microfiltration to remove dissolved and suspended solids so that water can be reused. The water maintains its temperature, saving water heating energy. Applications include laundries, food processing, textiles, and any other water-intensive applications.

Source: Navigant analysis 2011.

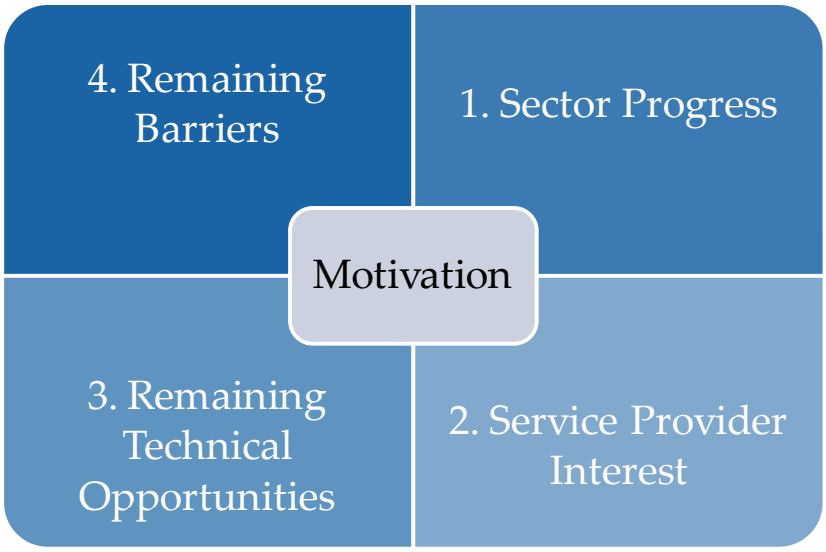
2.2.3 Recent Developments in Key Market Sectors

This section provides an overview of the current status of each of the four key market sectors. Sections 2.2.1 and 2.2.2 outlined the market conditions that affect all of these market sectors, but each sector is unique in some way. Whether it is the split incentives in the office sector or the seasonal nature of food processors' operations, program managers and staff can incorporate these sector-specific nuances into their approach to the sector.

As shown in Figure 2.16, each of the following four subsections describes the factors that influences customer to act in each of the target sectors; each section also outlines the factors that prevent the customer from taking further action. Each of these sections follows the same structure:

- Motivation to Pursue Energy Efficiency: the unique factors that lead the sector to incorporate energy efficiency into their operations
- Sector Progress towards Energy Efficiency: developments in the sector that have prepared the sector for PSE's engagement and incentives
- Service Provider Interest in the Sector: the extent to which companies have identified these sectors as prime candidates for energy efficiency investments
- Remaining Technical Opportunities: measure categories that have not yet been exhausted, according to market actors interviewed
- Remaining Barriers: the challenges that prevent the sector from fully embracing energy efficiency

Figure 2.16. Structure of Sector-Specific Sub-Sections



Source: Navigant analysis of market actor interviews 2011.

These discussions rely on market actor input rather than on facility-specific data. Additional detail on the baseline equipment typical of these sectors regionally is available in NEEA's 2009 *Northwest Commercial Building Stock Assessment*.[46]

2.2.3.1 Offices

PSE's DSM potential study identified office facilities as the single largest targeted opportunity for achievable energy savings potential for both electricity and gas. Only the "Other" buildings category had larger potential in the gas study. Similarly, NEEA's 2009 *Northwest Commercial Building Stock Assessment* reveals that office buildings account for the single greatest share of floor space (19 percent) in the Northwest.[47] This section outlines the findings for the office sector.

KEY CHARACTERISTICS OF OFFICE SECTOR FACILITIES IN PSE SERVICE TERRITORY

The project team surveyed representatives of 22 office sector facilities in PSE service territory. A list of participants in PSE's G205 and E250 programs during the past two years served as the starting point for selecting facilities for the sample frame. Navigant eliminated all records that had "Business Type" different than Office, Office and Warehouse, and Office and Manufacturing. The remaining list of facilities represented facilities that were not included in the Process or Impact Evaluation samples that are part of this project. Figure 2.17 includes all of the facilities that were included in the population of potential survey respondents after the data cleaning was completed (black) as well as all of the facilities that responded to the survey (green).

[46] Cadmus Group. December 2009. *Northwest Commercial Building Stock Assessment.* Northwest Energy Efficiency Alliance.
[47] Cadmus Group. December 2009. *Northwest Commercial Building Stock Assessment.* Northwest Energy Efficiency Alliance.

- As shown in Figure 2.17 you will see Office Sector Population and Survey Respondents.
- As shown in Figure 2.18 through Figure 2.21, several characteristics of the food processing market segment indicate that it is a promising market for energy efficiency:
- The majority of the office sector facilities (73 percent) reported that they own and occupy their facilities, as shown in Figure 2.21. As in the case of food processing, these owner-occupied facilities have alignment between the financial goals of the party investing in energy efficiency and those of the party realizing the financial benefits.
- As shown in Figure 2.20, only half of the office sector facilities that were part of the survey indicated they plan to invest capital in their facilities in the next two years. Near-term energy efficiency investment opportunities are higher in the office sector than in the public sector but generally not that favorable.
- Office sector facilities vary in scale in terms of both facility size (Figure 2.18) and number of employees (Figure 2.19). Most of the facilities fall in the medium category in terms of facility size (10,001 – 50,000 sq. ft.). The majority of the facilities have a small number of employees (between 1 and 50 employees).
- Most of the largest office facilities that have previously participated in PSE programs are located in and around Bellevue in PSE's combined service territory as shown in Figure 2.22. The largest facilities in Seattle do not appear to have been reached by PSE's programs.

Figure 2.17. Office Sector Population and Survey Respondents

Source: Navigant analysis of E&W survey of PSE Customers 2011.

Figure 2.21. Owner-Occupancy Rate – Office Sector (n=22)

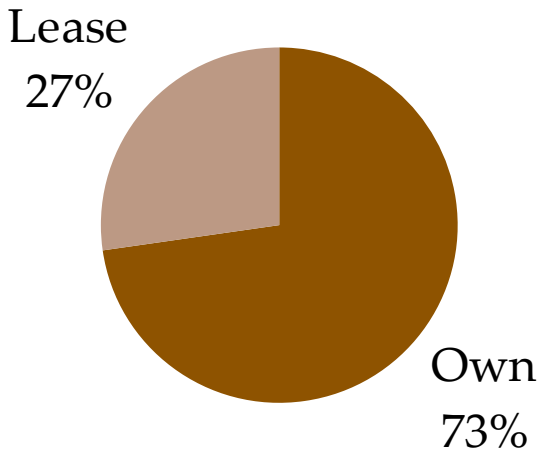


Figure 2.18. Facility Size – Office Sector (n=22)

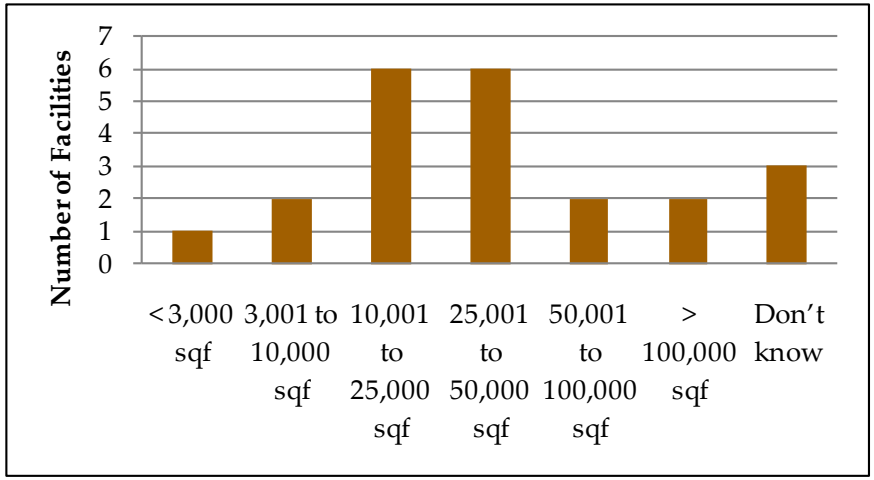


Figure 2.20. Planned Capital Spending in Next Two Years – Office Sector (n=22)

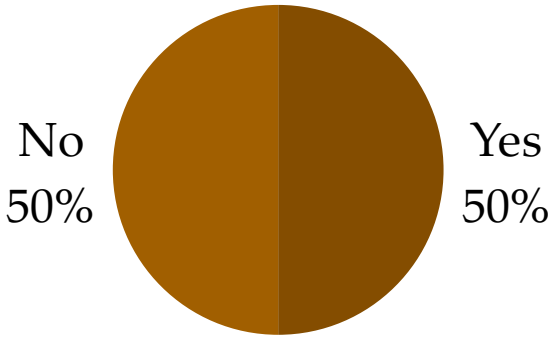
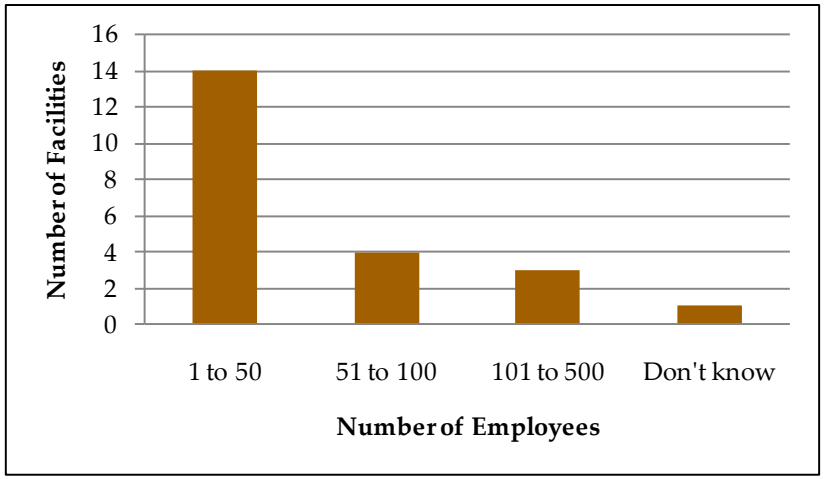
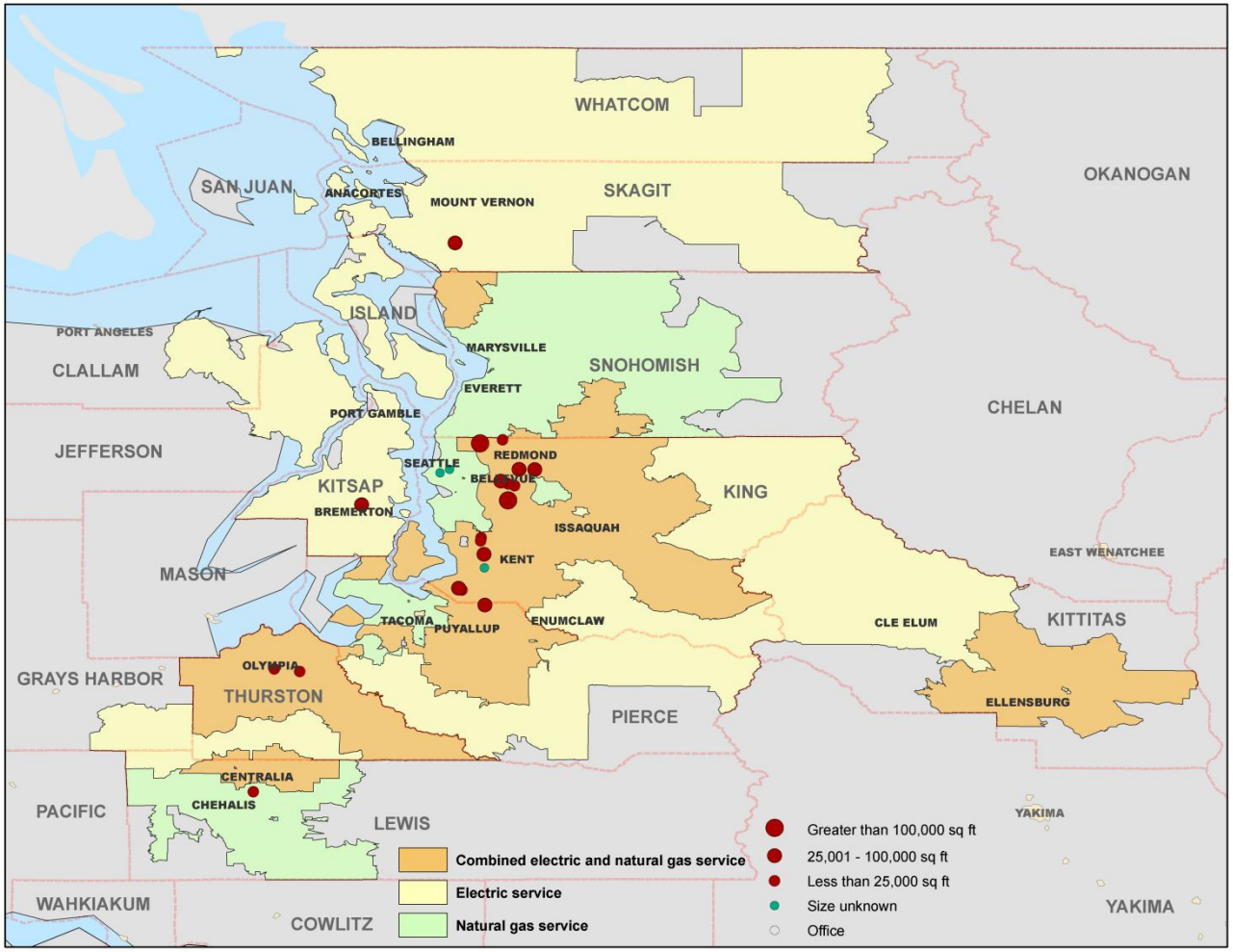


Figure 2.19. Number of Employees Per Facility – Office Sector (n=22)



Source for all figures on this page: Navigant and E&W Survey of Offices, 2011.

Figure 2.22. Office Sector Facility Size by Location



Source: Navigant analysis of E&W Survey of PSE Customers 2011.

MOTIVATION TO PURSUE ENERGY EFFICIENCY

The value proposition for office building owners to pursue energy efficiency has changed since the onset of the economic downturn. Office building owners have sought opportunities to increase the value of their properties amidst increasing vacancy rates and falling property values. Vacancy rates increased from 8 percent in late 2007[48] to over 20 percent in mid-2010.[49] As revenue from rent declined, office real estate values plunged by 46 percent in the Seattle area between the market's peak in the third quarter of 2008 and the end of 2010.[50] These trends created a very competitive market amongst property owners and managers as they sought to secure a limited pool of tenants.

In this very competitive environment, "green" office properties became a competitive advantage. Other competitive advantages typically sought after by property managers and owners (e.g., price, status, proximity to amenities, etc.) were ineffective since so many properties were available. Instead, buildings that could claim some type of "green" status in progressive Seattle saw an opportunity worth pursuing. Energy efficiency became part of that "green" package.

Energy efficiency improvements also helped increase property values by decreasing costs. Real estate properties are valued, in part, based on discounted values of the property's future net operating income.[51] By decreasing the costs associated with a particular property, the amount of positive cash flow to an owner (or potential owner) increases. This, in turn, increases the calculated value of the property. Since revenue growth was limited during the economic downturn, cost decreases became an important part of maintaining property values.

SECTOR PROGRESS TOWARDS ENERGY EFFICIENCY

NEEA helped support the office real estate market's interest in energy efficiency both before and during the economic downturn. Most recently, the BetterBricks program has focused on the office real estate market since 2006, including both new construction and building operations. NEEA has pursued a market transformation effort aimed at real estate managers by promoting the competitive advantages and increased profitability associated with high-performance building energy management. The program's key accomplishments include the following:

- Forming key partnerships and initiatives with regional industry market actors, particularly the Building Owners and Managers Association (BOMA) and the Urban Land Institute (ULI)
- Working with the energy efficiency services sector to identify and foster best practices in building operations and maintenance
- Developing tools and resources to assist building owners and facility managers in achieving building performance improvements (e.g., the *High Performance Portfolio Framework*)

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[48] Shevory, K. October 21, 2008. "Even in Resilient Seattle, Office Vacancy Rate Is Rising." *New York Times.* Available: http://www.nytimes.com/2008/10/22/business/22seattle.html?_r=1&8au&emc=au&oref=slogin

[49] Pryne, E. July 8, 2010. "Seattle Sees Increase in Occupied Office Space." *The Seattle Times.* Available: http://seattletimes.nwsource.com/html/businesstechnology/2012312547_office09.html

[50] Navigant Capital Advisors. 2010. *Quarterly Dialogue: Fourth Quarter 2010: Distressed Real Estate.* Available: http://www.navigant.com/~/media/Site/Insights/Corporate%20Finance/Distressed%20Real%20Estate%20Quarterly%20Dialogue%204Q10.ashx

[51] Jaffe, D. and R. Stanton and N. Wallace. November 30, 2010. *Energy Factors, Leasing Structure, and the Market Price for Office Buildings in the U.S.* Fischer Center for Real Estate and Urban Economics: University of California, Berkeley. Available: http://faculty.haas.berkeley.edu/ldavis/Enviro@Haas_files/JSW2010%5B1%5D.pdf

» Raising awareness of the links among energy efficiency, sustainability, and building owners' bottom line profitability[52]

NEEA has worked with market actors (including building owners, property managers, and industry associations) to begin reducing the primary barriers to energy efficiency in this sector. These collaborative efforts grew from NEEA's identification of the specific barriers to implementing energy efficiency projects in the office real estate sector (e.g., split incentives, renovation cycles). These efforts have focused largely on the transactional nature of commercial real estate (e.g., leases, underwriting) and the efficiency opportunities presented by best practices in building energy management and operations.

NEEA also helped established the state's Building Operator Certification (BOC) training initiative to achieve lasting improvement in the energy-efficient operation and maintenance (O&M) of commercial buildings.[53] Today, the Northwest Energy Efficiency Council (NEEC) and the International Building Operators Association (IBOA) continue to offer the training. BOMA promotes the training to its members. Participation remained steady or increased during the economic downturn, with more than 800 building operators earning the certification each year.[54] The training efforts have contributed to a workforce of building operators who are more aware of the implications of their decisions on the energy efficiency of their buildings.[55]

SERVICE PROVIDER INTEREST IN THE SECTOR

A subset of service providers remain interested in the office sector although several report that the economic downturn affected this sector most adversely. Some service providers focus exclusively on offices; some of those have an even narrower specialty, such as one service provider that reports focusing on mid-size office buildings (three to ten stories). Those service providers that do focus on the office sector understand how to work with the variety of stakeholders in the process, including property management firms, property owners, and tenants.

REMAINING TECHNICAL OPPORTUNITIES

Market actors report conflicting trends about the opportunities that remain in the office sector. Some market actors see continuing opportunities in the office sector. They identify task lighting, LEDs, HVAC, and boilers as primary opportunities from a measure category standpoint. They anticipate that the "green" competitive advantage will continue, though they recognize the challenges that this sector faces from a financial standpoint.

Some of the more prominent market actors indicate that the low-hanging fruit is gone. That is, the more sophisticated firms that saw the benefits of energy efficiency have already completed the projects that they saw were possible. The majority of the remaining potential will require deeper outreach among smaller property firms or will depend on larger property firms loosening their financial metrics for project approval.

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[52] Peters, Jane S., et al. 2009. "2008 BetterBricks Overall Market Progress Evaluation Report." Northwest Energy Efficiency Alliance.

[53] Navigant Consulting. 2010. *Long-Term Monitoring and Tracking: Report on 2009 Activities.* Prepared for NEEA.

[54] Navigant Consulting. 2010. *Long-Term Monitoring and Tracking: Report on 2009 Activities.* Prepared for NEEA.

[55] NEEA's 2011 Long-Term Monitoring and Tracking effort will include surveys of building operators to assess the extent to which the initiative has contributed to facility-level energy savings.

Additional opportunities may be created by a resolution adopted in 2010 by the City of Seattle that requires energy disclosure for non-residential buildings. Non-residential buildings over 50,000 square feet must benchmark and report their facilities' energy performance to potential buyers, lenders, lessees, and the City by April 2011; buildings over 10,000 square feet must start reporting by April 2012.[56] While the mandate may have a limited direct effect on PSE customers' electric usage, the utility does provide gas service to Seattle City Light's customers. In addition, a similar benchmarking requirement passed in New York City suggests that spillover effects of such mandates (e.g., improved access to and interest in energy benchmarking resources and tools) may drive additional energy savings in the region as a whole.[57]

REMAINING BARRIERS

Some of the barriers to achieving deeper penetration in the office sector are cyclical in nature, while others are structural. Several service providers singled out the commercial real estate sector as particularly hard hit by the economic recession. The key cyclical barrier is the limited access that this sector has to capital. As building values decreased, so did the owners' equity. The related weakening of balance sheets prevents building owners from securing financing at reasonable rates to support the implementation of energy efficiency projects. The projects that have been completed have had the shortest payback periods and highest ROIs. Investment in projects that meet the next tier of financial metrics will likely wait until after this sector's access to capital has expanded.

From a structural standpoint, the most visible barrier is the issue of split incentives. The vast majority of commercial leases are triple net leases, which require the tenant to pay the utility bills to the provider directly.[58] The tenant would realize the benefits of reducing its energy usage in these cases, but the tenant typically does not have the ability to make capital improvements at the facility. The facility owner or property management firm retains that right but would not realize any direct financial benefits from the project. The property owner could realize benefits from energy efficiency improvements if it could charge higher rents, but that is not always possible with an existing tenant.

Further, requirements to update certain equipment or entire facilities to code also hinder the completion of energy efficiency projects. Some upgrades trigger a requirement to upgrade specific equipment to code; sometimes it relates directly to the equipment being replaced, and sometimes it does not. In these cases, the capital required to upgrade auxiliary equipment is taken from the same "pool" of funds required to complete the energy efficiency retrofit, essentially decreasing the amount of capital available to complete the energy efficiency retrofit. In some cases, this results in a smaller-scale energy efficiency upgrade; in other cases, it may cause the project to fail the firm's financial metrics and result in project cancelation or delay.

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[56] City of Seattle Department of Planning and Development. 2011. "Our Program: Energy Benchmarking and Reporting." http://www.seattle.gov/dpd/GreenBuilding/OurProgram/PublicPolicyInitiatives/DPDP018682.asp

[57] Lowenberger, A., et al. 2010. "What Drives Energy Performance Scores: Benchmarking NYC High Rise Building Stock." 2010 ACEEE Summer Study on Energy Efficiency in Buildings.

[58] Jaffe, D. and R. Stanton and N. Wallace. November 30, 2010. *Energy Factors, Leasing Structure, and the Market Price for Office Buildings in the U.S.* Fischer Center for Real Estate and Urban Economics: University of California, Berkeley. Available: http://faculty.haas.berkeley.edu/ldavis/Enviro@Haas_files/JSW2010%5B1%5D.pdf

2.2.3.2 Public Sector

For the purposes of this report, the public sector analysis focused on state and local government office buildings. This concentration on a distinct set of building types and agency types enabled the evaluation team to probe deeper on the dynamics that affect these markets. Schools have received significant attention due to the availability of state funds to support projects. Wastewater treatment plants fit better into the category of industrial facilities than office facilities. The focus on office buildings also provided the opportunity to determine the extent to which state and local governments are subject to different forces than the private sector.

KEY CHARACTERISTICS OF PUBLIC SECTOR FACILITIES IN PSE SERVICE TERRITORY

The project team surveyed representatives of 49 public sector facilities in PSE service territory. For the Public Sector, Navigant examined two strata: State Government and Local Government. The project team sought to achieve 90/15 at the sector level (Public Sector) and 80/20 at the stratum level (State Government and Local Government). The sample included agencies' headquarters, branch locations, and single locations because decisions about energy efficiency projects are most often made at this level.

Figure 2.23 and Figure 2.24 include all of the facilities that were included in the population of potential survey respondents after the data cleaning was completed (black) as well as all of the facilities that responded to the survey (green) for the local government and state government segments, respectively. These two segments are shown on their own maps due to the large number of facilities in each population; the separate maps enabled a clearer representation of the respective populations.

As shown in Figure 2.25 through Figure 2.28, several characteristics of the public sector segment indicate that it is a promising market for energy efficiency:

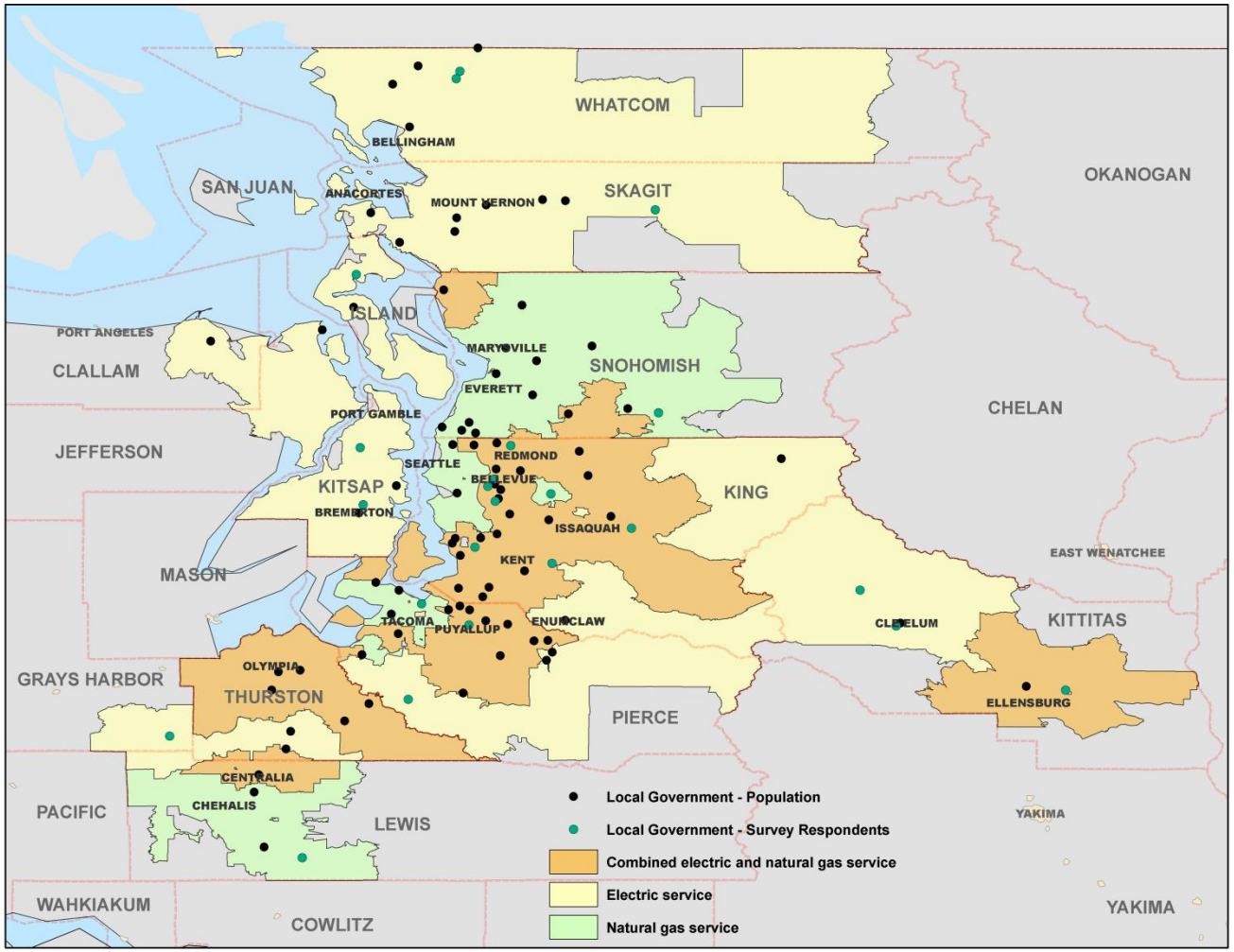
- The majority of the public sector facilities (92 percent) reported that they own and occupy their facilities, as shown in Figure 2.25.[59] These owner-occupied facilities ensure alignment between the financial goals of the party investing in energy efficiency and those of the party realizing the financial benefits.
- As shown in Figure 2.28, only 39 percent of public sector facilities indicate that they plan to invest capital in their facilities in the next two years; 53 percent of the facilities reported they don't have plans to invest. These results indicate that the opportunities to increase energy efficiency investments in the near term are somewhat limited in this sector.
- Public sector facilities vary in scale in terms of both facility size (Figure 2.27) and number of employees (Figure 2.26). Most of the facilities fall in the small and medium category in terms of facility size (10,001 – 100,000 sq. ft.). The majority of the facilities have a small to medium

[59] During the screening process for the surveys, 53 potential respondents in the State Government sector declined to continue the survey because they leased space in a building owned by a third party; no respondents in the Local Government sector indicated that this was an issue. When considering these records, only 44 percent of respondents to the survey or to the screening questions indicate that they own and occupy their own facilities. This is an area of stark contrast between local and state government facilities; 96 percent of local government facilities that responded to the survey or completed the screening questions reported owning and occupying their space while only 29 percent of state government facilities that responded to the survey or completed the screening question indicated that they own and occupy their space.

workforce size (between 1 and 500 employees). As in the case of the food processing sector, outreach efforts in the public sector likely need to include a larger number of facilities in order to achieve the same level of energy savings.

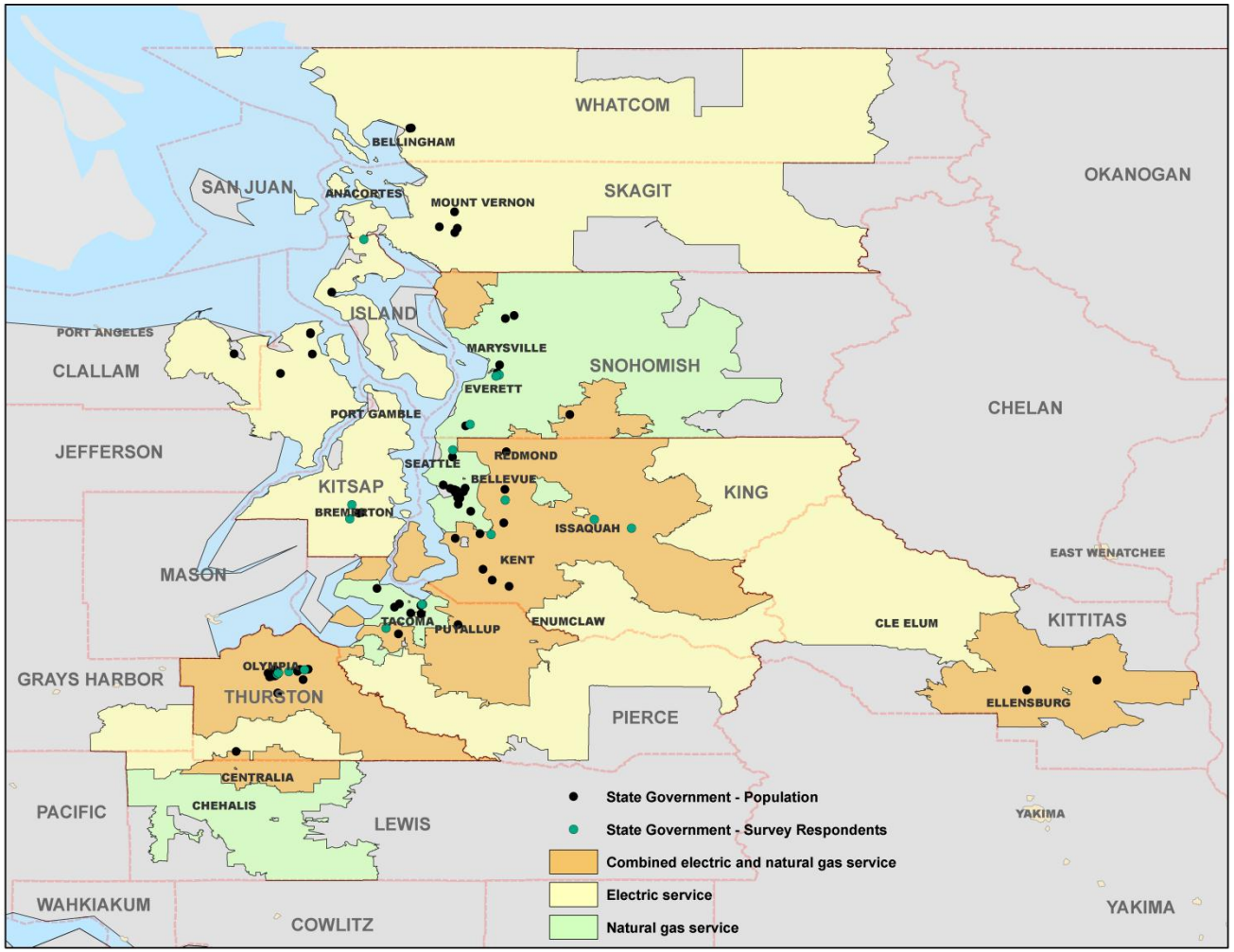
» As shown in Figure 2.29, the largest public sector facilities are located along the I-5 corridor and extend into Olympia. Facilities in the outlying areas tend to be smaller and are also more likely to be local government than state government facilities.

Figure 2.23. Local Government Sector Population and Survey Respondents



Source: Navigant analysis of E&W survey of PSE customers 2011.

Figure 2.24. State Government Sector Population and Survey Respondents



Source: Navigant analysis of E&W survey of PSE customers 2011.

Figure 2.25. Owner-Occupancy Rate – Public Sector (n=49)

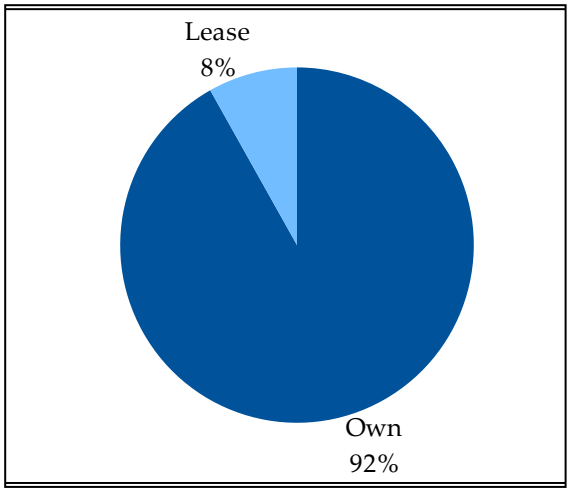


Figure 2.27. Facility Size – Public Sector (n=49)

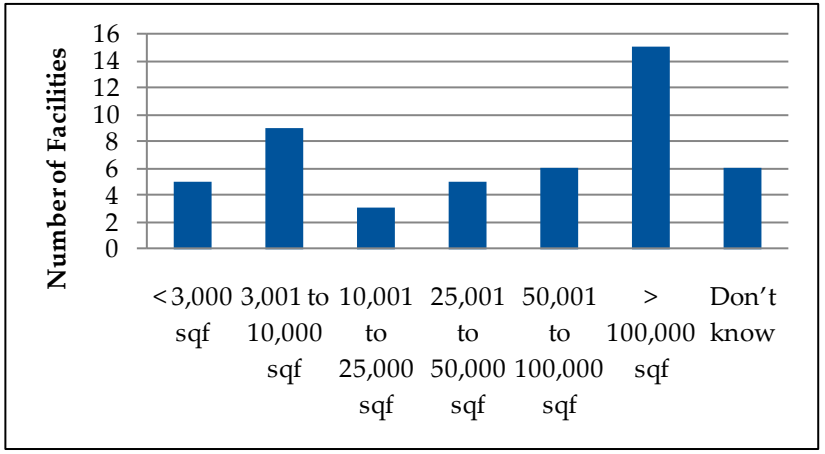


Figure 2.28. Planned Capital Spending in Next Two Years – Public Sector (n=49)

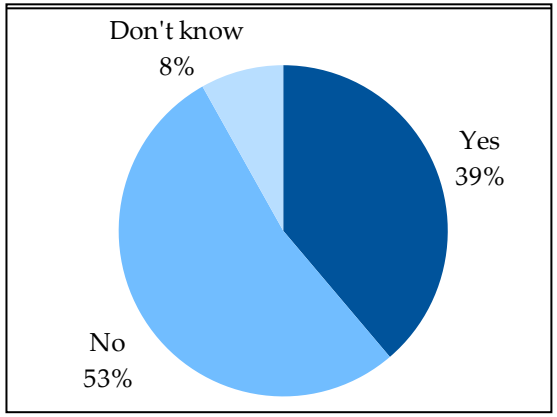
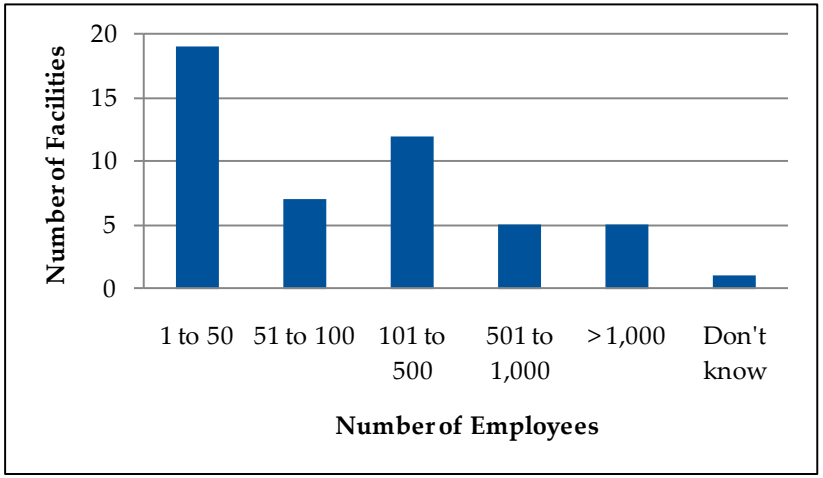
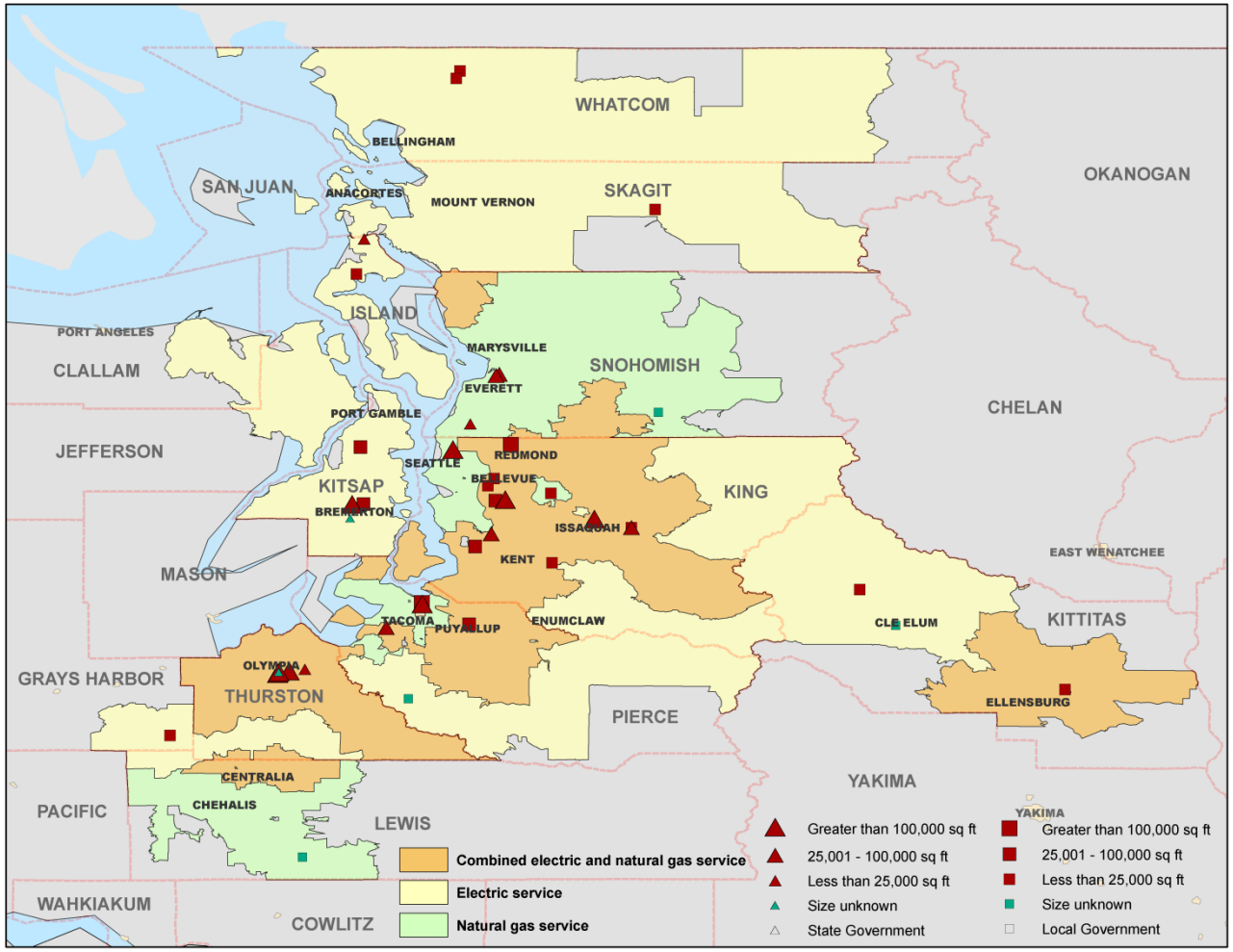


Figure 2.26. Number of Employees Per Facility – Public Sector (n=49)



Source for all figures on this page: Navigant and E&W Survey of Public Sector, 2011.

Figure 2.29. Public Sector Facility Size by Location



Source: Navigant analysis of E&W survey of PSE customers 2011.

MOTIVATION TO PURSUE ENERGY EFFICIENCY

Energy costs can account for up to 10 percent of a local government's annual operating budget. This creates potential for energy efficiency efforts to provide cost-cutting opportunities for cash-strapped municipalities.[60] Given the fiscal challenges faced by governments in the past few years, this cost reduction is a powerful driver.

As discussed in Section 2.2.2.1, the budget shortfalls have slowly created additional opportunities for energy efficiency through deferred maintenance decisions. Even prior to the economic downturn, government agencies opted to postpone regular maintenance on their facilities rather than cut staff or services.[61] It is such a significant issue in Washington State that local governments indicated that the implications of these decisions were the second-most important issue for future performance audits.[62] The result is a stock of equipment that is either running inefficiently or has failed, creating opportunities to make energy-efficient choices.

Further, the availability of federal funds to assist state and local governments with infrastructure improvement projects has added interest in this market since 2009. As discussed in Section 2.2.2.1, the EECBG funds have provided additional motivation and funding for energy efficiency projects at state and local government facilities. The ability to leverage these funds enabled many more projects than would have otherwise reached completion.

SECTOR PROGRESS TOWARDS ENERGY EFFICIENCY

Washington's Department of General Administration (GA) works with public facilities throughout the state to pursue energy efficiency upgrades, among other priorities. The GA's scope includes all public facilities, including schools, community colleges, and state and local government agencies.

The GA acts as a catalyst to initiate projects through its Energy Savings Performance Contracting (ESPC) Program. The ESPC provides assistance to publicly owned facilities in selecting and working with a pre-qualified ESCO to implement energy conservation measures without any capital outlay.[63] The GA releases a request for qualifications for ESCOs every other year and prepares a list of ESCOs that meet the agency's criteria. The GA sees this as an opportunity to create a list of trusted partners in deploying energy efficiency throughout the state. The GA does not work directly with BetterBricks, but it does use the information that BetterBricks provides.

In addition, the state adopted legislation in 2009 that establishes protocols for reviewing the energy performance of buildings in which Washington state agencies house operations.[64] Specifically, SB 5854 as adopted into law required state agencies to benchmark their facilities that are larger than

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[60] ACEEE. 2010. "Local Technical Assistance Toolkit: Lead by Example."

[61] Hood, J. 2011. "The States in Crisis." *National Affairs.* Available: http://www.nationalaffairs.com/publications/detail/the-states-in-crisis

[62] Washington State Auditor's Office. February 2011. *Local Government Performance Audit Survey Results.* Available: http://www.sao.wa.gov/EN/Audits/PerformanceAudit/Documents/Local_govt_outreach_results_PA_2011.pdf

[63] State of Washington: General Administration. June 2010. "Washington's Program." http://www.ga.wa.gov/eas/epc/municipal.htm

[64] The discussion about SB 5854 is based on the legislation: State of Washington 61st Legislature. 2009 Regular Session. "Climate Pollution Reduction – Energy Efficiency." Effective date July 26, 2009. Section 8. Available: http://apps.leg.wa.gov/documents/billdocs/2009-10/Pdf/Bills/Session%20Law%202009/5854-S2.SL.pdf

10,000 square feet by July 1, 2010; the GA would make those results public. Any facility with an ENERGY STAR rating less than 50 would receive a preliminary energy audit; the law requires more formal and detailed audits by July 1, 2013, if the initial audit identified cost-effective upgrade opportunities. The law requires that any cost-effective conservation measures identified in the more detailed audit be implemented by July 1, 2016. In addition, the law prohibits agencies from signing new leases with buildings that have ENERGY STAR ratings lower than 75 unless the property owner agrees to meet certain conditions.

One important caveat to the SB 5854 requirements is that they only apply to the extent that "specific appropriations are provided to those agencies" to support these specific requirements. These requirements are a step towards a greater commitment to energy efficiency, but the real commitment cannot be made until the funding is provided.

SERVICE PROVIDER INTEREST IN THE SECTOR

The public sector is one of the primary targets of the ESCO industry. Because of annual budgeting cycles and limits, local and state governments benefit greatly from the payment structure enabled by performance contracting. The market actors interviewed for this report agreed that the public sector uses performance contracting more than any other sector; local governments have used it more in the past than state governments. In part, this may be due to the fact that the GA makes energy efficiency investment decisions for many state agencies. The GA's Resource Conservation Manager can provide the expertise on technologies, related financial commitments, and investment structures. Few local governments have access to these types of resources, making ESCOs an attractive alternative.

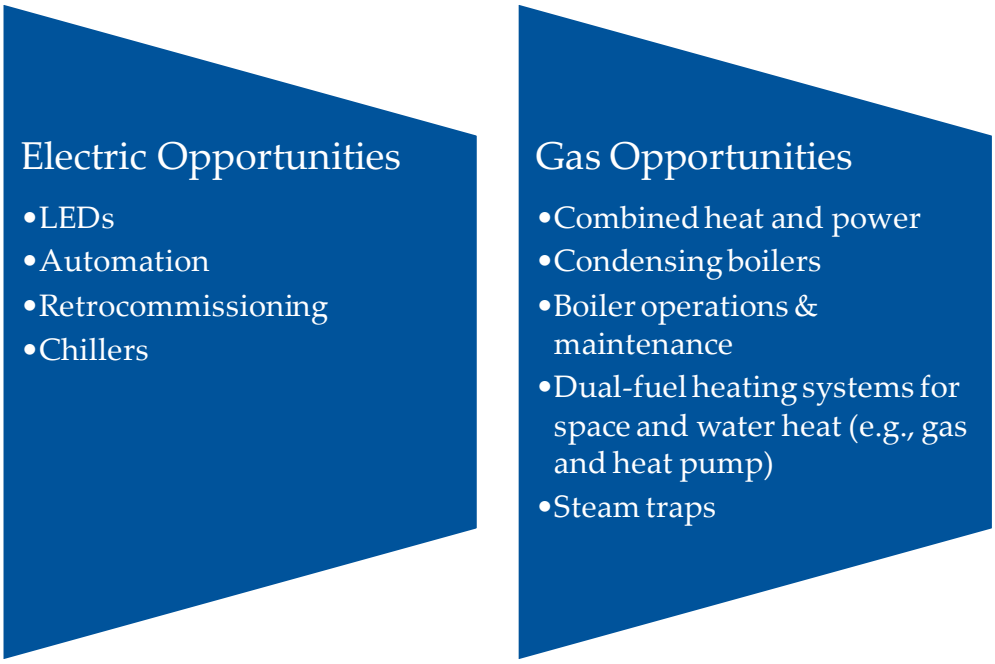
One service provider indicated that the best opportunities for the public sector are found among municipalities with populations ranging from 50,000 to 70,000 people. This service provider indicated that many of these municipalities have established redevelopment objectives in addition to greenhouse gas reduction targets. Together, these mandates create a solid platform for initiating energy efficiency projects.

REMAINING TECHNICAL OPPORTUNITIES

Service providers recognize a wide variety of remaining opportunities for public sector office buildings. Like the rest of the market, automation provides significant opportunity for future energy efficiency projects. Such automation has added benefits for government agencies, which often pay separate utility bills for multiple facilities. The GA believes that automation could enable centralized utility billing, which would reduce the cost of administering those accounts; further, it would provide additional insight into which facilities have sub-par energy performance.

As identified in Figure 2.30, service providers identified several other energy efficiency project opportunities for public sector buildings. At this point, none of the remaining opportunities stood out as game-changers. The completed surveys with end users should reveal additional project opportunities.

Figure 2.30. Additional Project Opportunities for Public Sector Office Buildings



Source: Navigant analysis of market actor interviews 2011.

REMAINING BARRIERS

The primary barrier to energy efficiency investments in state facilities is access to capital. State projects rely on the state's capital budget for funding. During the 2009-11 budget cycle, Washington diverted funds from the capital budget to the operating budget.[65] As a result, state facilities did not have access to the capital needed to undertake most energy efficiency projects.

Market actor interviews support the findings of other utility and state agency programs regarding barriers to energy efficiency at the local government level. These barriers include the following:

- Lack of staff resources and in-house energy expertise
- Lack of information and familiarity with energy efficiency technologies and performance contracting mechanisms
- High first costs and unavailability of financing for energy projects[66]

PSE staff has previously confirmed these barriers for the PNW market. In a 2009 paper, PSE staff state that tight municipal budgets and staff resources rarely allow for replacing energy-using equipment until failures occurs; even then, these limitations may affect the selection of higher efficiency replacements.[67]

[65] Warnick, Judy. May 3, 2011. "Washington state House should approve the Debt Reduction Act." The Seattle Times. (http://seattletimes.nwsource.com/html/opinion/2014949416_guest04warnick.html?syndication=rss).
[66] Chamberlain, B., et al. 2008. "Leading by Example: Streamlining EE in the Local Government Sector." 2008 ACEEE Summer Study on Energy Efficiency in Buildings.
[67] Feinstein, L. and B. Rupert. 2009. "Prioritizing Energy Efficiency in Municipalities." 2009 ACEEE Summer Study on Energy Efficiency in Industry.

2.2.3.3 Hospitals

Energy efficiency provides an important opportunity for hospitals to reduce costs and increase profits while improving the patient experience. Hospitals are under continuing pressure to increase profits at the same time that payments to hospitals from insurance companies are decreasing. Yet, convincing decision makers to invest in energy efficiency when their business is driven by the capability to provide treatment is difficult. NEEA's work with this sector has provided a strong lead for future involvement by PSE.

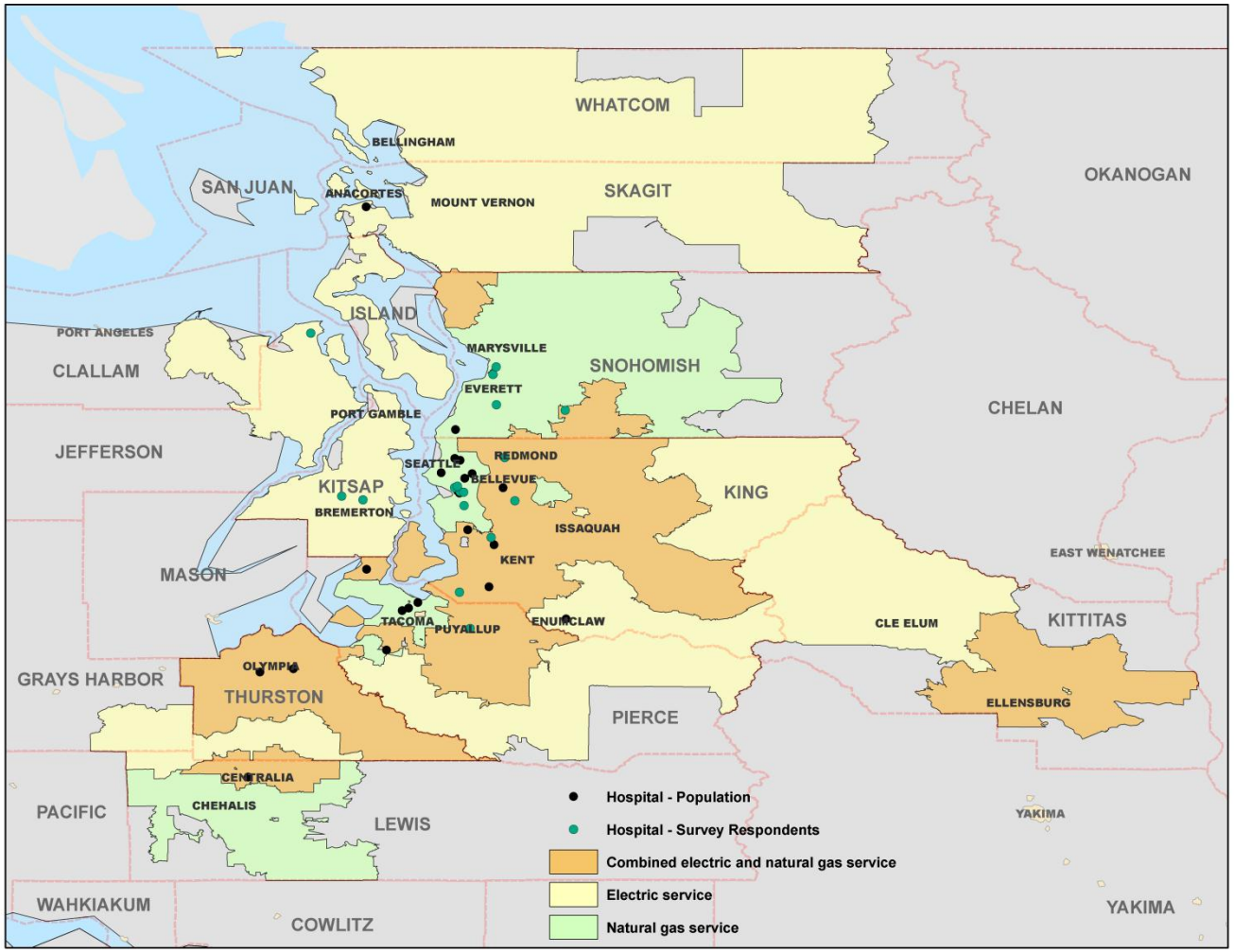
KEY CHARACTERISTICS OF HOSPITAL FACILITIES IN PSE SERVICE TERRITORY

Navigant interviewed representatives of 18 hospitals in PSE service territory. The hospitals were selected based on membership in the Washington State Hospital Association (WSHA) in conjunction with their appearance in either of the lists of PSE's Top 1,600 customers for gas or electric service. This approach targeted the largest hospitals in the PSE service territory. Figure 2.31 includes all of the facilities that were included in the population of potential survey respondents after the data cleaning was completed (black) as well as all of the facilities that responded to the survey (green).

As shown in Figure 2.32 through Figure 2.35, several characteristics of the hospitals in market segment indicate that it is a promising market for energy efficiency:

- All of the respondents reported that they own and occupy their facilities, as shown in Figure 2.33. This eliminates the challenge of split incentives and ensures alignment between the party investing in energy efficiency and the party realizing the financial benefits.
- As shown in Figure 2.35, the vast majority of hospitals (89 percent) indicate that they plan to invest capital in their facilities in the next two years. The willingness to commit capital resources to their facilities during the time of economic uncertainty creates opportunities for energy efficiency investment during the near term.
- Hospital facilities are of considerable scale in terms of both facility size (Figure 2.32) and number of employees (Figure 2.34). With more than half of facilities falling in the largest category of both facility size (100,000 sq. ft.) and number of employees (greater than 1,000), outreach to a few facilities should lead to a larger number of energy efficiency project opportunities.
- The largest hospitals in PSE's service territory tend to be located along the I-5 corridor south of Seattle, as shown in Figure 2.36. Mid-size facilities tend to be located in the counties surrounding King County. Very few facilities represented in the survey were located more than 50 miles from Seattle.

Figure 2.31. Hospital Sector Population and Survey Respondents



Source: Navigant analysis of E&W survey of PSE customers 2011.

Figure 2.33. Owner-Occupancy Rate – Hospitals (n=18)

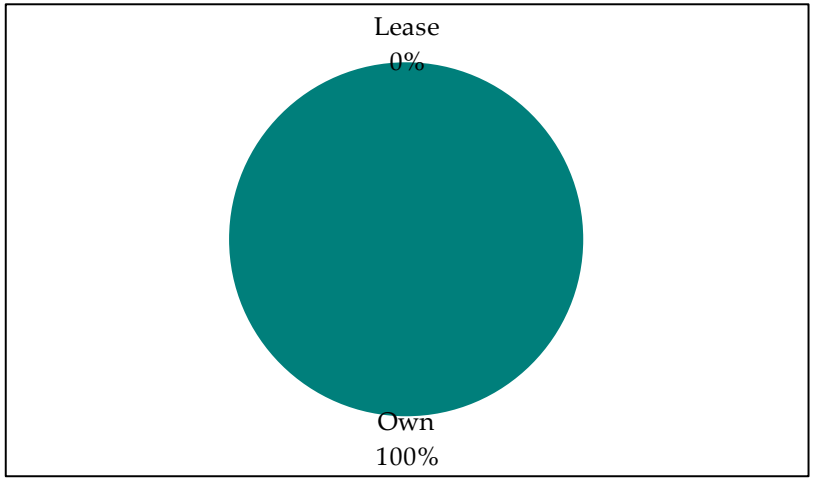


Figure 2.32. Facility Size – Hospitals (n=18)

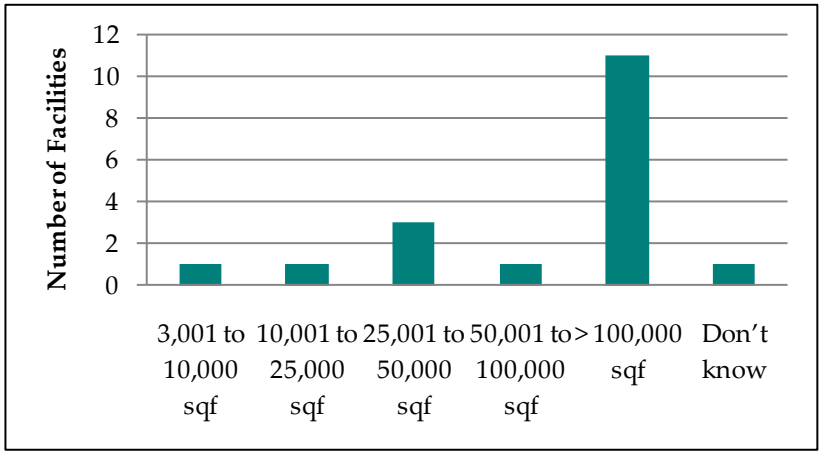


Figure 2.35. Planned Capital Spending in Next Two Years – Hospitals (n=18)

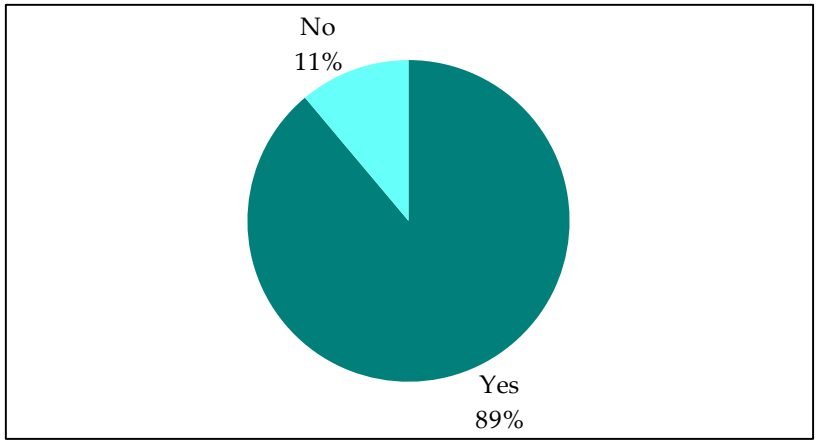
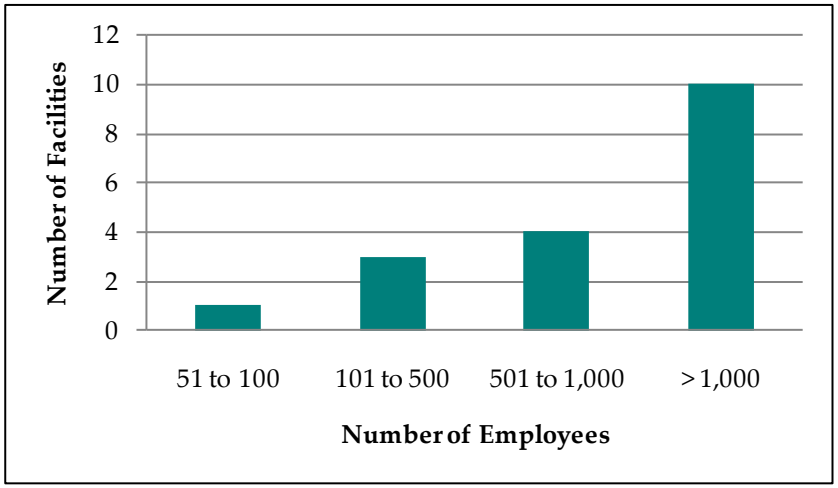
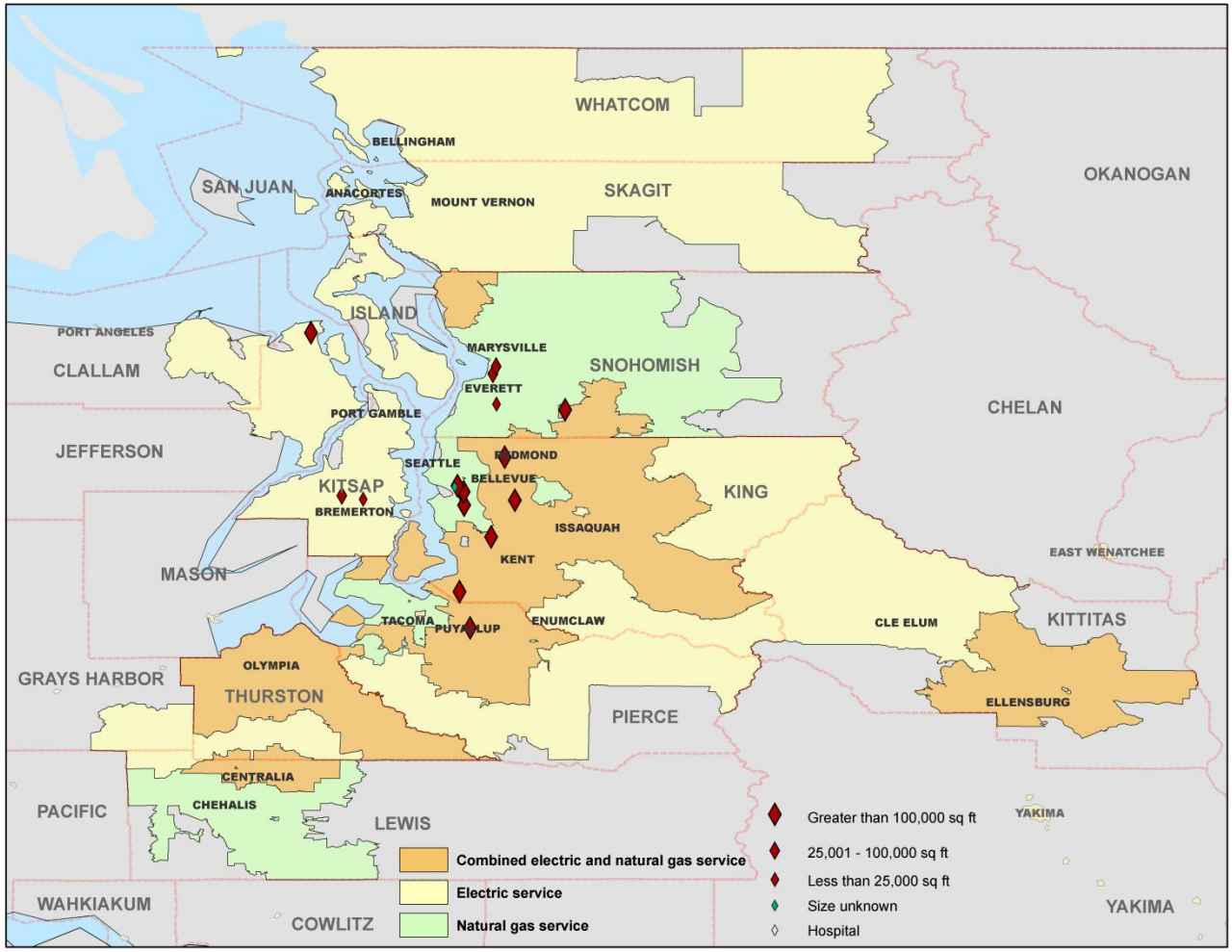


Figure 2.34. Number of Employees Per Facility – Hospitals (n=18)



Source for all figures on this page: Navigant and E&W Survey of Hospitals, 2011.

Figure 2.36. Hospital Sector Facility Size by Location



Source: Navigant analysis of E&W survey of PSE customers 2011.

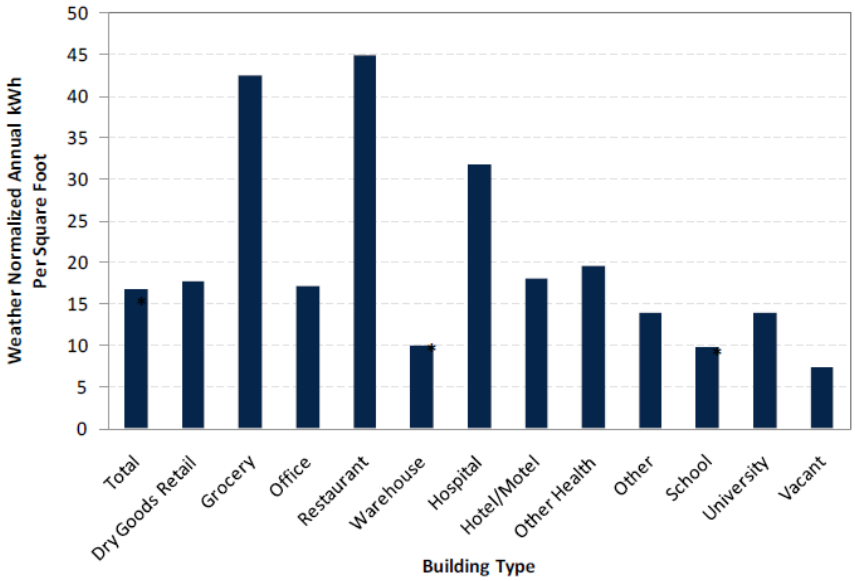
MOTIVATION TO PURSUE ENERGY EFFICIENCY

Hospitals and health care facilities present another attractive target sector for PSE's energy efficiency efforts. A combination of market characteristics, energy use patterns, and previous work in energy efficiency indicate that the hospital sector is ready to engage with utilities on energy efficiency:

- **Concentration of ownership:** Concentration of ownership among hospitals in Washington State indicates potential for economies of scale in program implementation, similar to the office sector. More than half (52 percent) of the hospital beds in Washington are in one of 38 hospitals which are part of 18 individual hospital systems.[68]
- **High energy use intensity:** Hospitals have energy use intensities that are approximately twice as high as commercial office buildings in the PNW[69], as shown in Figure 2.37.
- **High level of awareness:** Hospitals representing approximately one-third of the beds in the PNW have a high level of awareness regarding specific energy efficiency opportunities within their facilities.[70] These facilities adopted Energy Management Plans (SEMPs) as a result of NEEA's focus on this sector.
- **Motivation to increase profits.** Hospitals are willing to invest in cost-reducing energy efficiency measures to improve profits. Reducing energy costs can help hospitals to offset threats to profitability caused by insurance costs, reimbursements, and increased competition.[71]

[68] Peters, Jane S., et al. 2009. "2008 BetterBricks Overall Market Progress Evaluation Report." Northwest Energy Efficiency Alliance.
[69] Cadmus Group. December 2009. "Northwest Commercial Building Stock Assessment." Northwest Energy Efficiency Alliance.
[70] Peters, Jane S., et al. 2009. "2008 BetterBricks Overall Market Progress Evaluation Report." Northwest Energy Efficiency Alliance.
[71] Peters, Jane S., et al. 2009. "2008 BetterBricks Overall Market Progress Evaluation Report." Northwest Energy Efficiency Alliance.

Figure 2.37 Annual Electric Energy Use Intensity by Building Type



Source: Cadmus Group 2009.

SECTOR PROGRESS TOWARDS ENERGY EFFICIENCY

Through its partnerships with healthcare industry organizations, NEEA's BetterBricks initiative has laid the foundation for energy efficiency in the hospital sector in the Northwest. NEEA worked to solidify key market actor partnerships with the Washington State Society for Healthcare Engineering (WSSHE), the national chapter of the American Society of Healthcare Engineers (ASHE), and ENERGY STAR. With ASHE and the U.S. Environmental Protection Agency (EPA), NEEA helped drive the development of the Energy Efficiency Commitment (E2C) Campaign. E2C seeks to generate energy efficiency savings through both operational changes and capital investments[72] with participating health care facilities, including 18 hospitals in PSE's service territory.[73]

These partnerships have helped NEEA secure widespread adoption of strategic energy management plans. The plans include the key to achieving energy savings at each facility. SEMPs include best practices for guiding financing decisions, capital updates, and monitoring and tracking. Early-stage efforts focused on identifying efficiency opportunities, calculating project paybacks, and creating actions plans to address such projects over time. In the 2008 evaluation, all surveyed hospital contacts indicated that developing such plans was not something that they could have done without assistance from BetterBricks.[74]

In addition, NEEA and others have collaborated to develop information and tools to support hospitals in their efforts to learn about and invest in energy efficiency. For example, the *Guide to Optimizing Hospital*

[72] BetterBricks. May 17, 2010. "Energy-Intensive Healthcare Facilities Work Together to Reduce Energy Use by 10 Percent." Press release. Available: http://www.betterbricks.com/news-room/energy-intensive-healthcare-facilities-work-together-reduce-energy-use-10-percent

[73] PSE. 2010. "Energy Efficiency Services 2010 Annual Report of Energy Conservation Accomplishments."

[74] McRae, M., et al. Research Into Action, Inc. 2008. "Market Progress Evaluation Report #3; BetterBricks Hospital and Healthcare Initiative." Northwest Energy Efficiency Alliance.

Facility Investments provides the basic information necessary to compare infrastructure investments (including life cycle cost analysis) and information about financing options to support those investments.[75] Step-by-step guides to developing strategic energy management plans support the development of these important plans.[76]

SERVICE PROVIDER INTEREST IN THE SECTOR

Service providers have recognized the sector's interest in energy efficiency and are serving this sector. ESCOs, consultants, and contractors indicate that hospitals are a strong market for energy efficiency. Several firms that participated in interviews for this project indicated that hospitals were a specific sector focus for their organization.

REMAINING TECHNICAL OPPORTUNITIES

Research indicates that a variety of technical opportunities exist in the hospitals sector:

- According to research co-sponsored by the University of Washington's Integrated Design Lab, approximately 50 percent of that energy provides water and space heating. This results in high potential for no- and low-cost energy efficiency improvements, including 10-20 percent savings from tune-ups and improved operations alone.[77] On a related note, service providers indicate that heat recovery systems present a good opportunity for the hospital sector.
- As in the other sectors, building automation could be expanded in the hospitals sector.
- Reducing the energy intensity of lighting is also an area of opportunity. Hospitals have expressed specific interest in LEDs, and service providers see additional potential for daylighting. Given the implications for patient health[78], daylighting may achieve multiple goals for hospitals.
- Service providers also indicate that additional opportunities exist for high-efficiency motors and VSDs in addition to refrigeration (e.g., for blood components).

As shown in Table 2-10, around half of respondents to the hospital survey indicate that food service equipment, laundry equipment, operating room equipment, dryers and new lab equipment, and surgical lighting are applications where some progress has already been done to achieve greater energy efficiency savings These same respondents identified technology applications specific to the hospital setting that pose additional opportunity for energy efficiency savings. These applications include food service equipment, operating room equipment, and boiler/HVAC systems.

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[75] ECONorthwest. Undated. *Guide to Optimizing Hospital Facility Investments.* Northwest Energy Efficiency Alliance. Available: http://www.betterbricks.com/graphics/assets/documents/FinanceGuideFinal.pdf

[76] BetterBricks. Undated. "SEMP Tools & Resources." Northwest Energy Efficiency Alliance. Available: http://www.betterbricks.com/healthcare/tools/semp-tools-resources

[77] Loveland, J., et al. 2006. "Target 100: Re-Envisioning Today's Hospital Prototype for Greatly Improved Energy Efficiency, Human Well-Being and Performance." 2010 ACEEE Summer Study on Energy Efficiency in Buildings.

[78] See, for example, Lee, J. and K. Song. 2007. "The Daylighting Effects in Hospital for Healing Patients." Rotterdam (Netherlands) in-house publishing, p. 869-874. Fraunhofer, IRB. Available: http://www.irbdirekt.de/daten/iconda/CIB8201.pdf

Table 2-10. Hospital-Specific Equipment: Progress and Remaining Opportunities

Technology	Replaced Already?	Opportunities Remain?
Food Service Equipment	17%	22%
Laundry Equipment	6%	0%
Exam/Diagnostic & Laboratory Equipment	0%	0%
Operating Room Equipment	11%	11%
Office Equipment	0%	0%
Dryers, New Lab Equipment	6%	0%
Surgical Lighting	6%	0%
Boiler / HVAC System	0%	6%
# of respondents to the survey in this sector	**18**	**18**
Number of responses provided	8	7
# of respondents to the question	8	9
Source: Navigant and E&W survey with Hospital sector 2011.		

REMAINING BARRIERS

Despite these favorable trends, hospitals often lack the capital necessary to complete the projects that will lower energy costs. In other regions, a survey by the Ontario Hospital Association indicated that 55 percent of hospitals cited a lack of internal funding for efficiency as a reason that they did not implement more energy efficiency measures; in a separate question, 45 percent cited a lack of incentive funding as a primary barriers.[79] Service providers in PSE's service territory indicate that performance contracting is common in this sector, though not as widespread as in the public sector.

As with many other sectors, the efficiency of the building is not part of hospitals' core competencies. Hospitals have historically focused on capital investment in medical devices before investing in their buildings; hospital executives have viewed the medical devices as competitive advantages to growing top-line revenue. Accordingly, staff expertise has focused on those medical devices; few staff have deep expertise in the energy aspects of the facility or equipment.

2.2.3.4 Food Processing

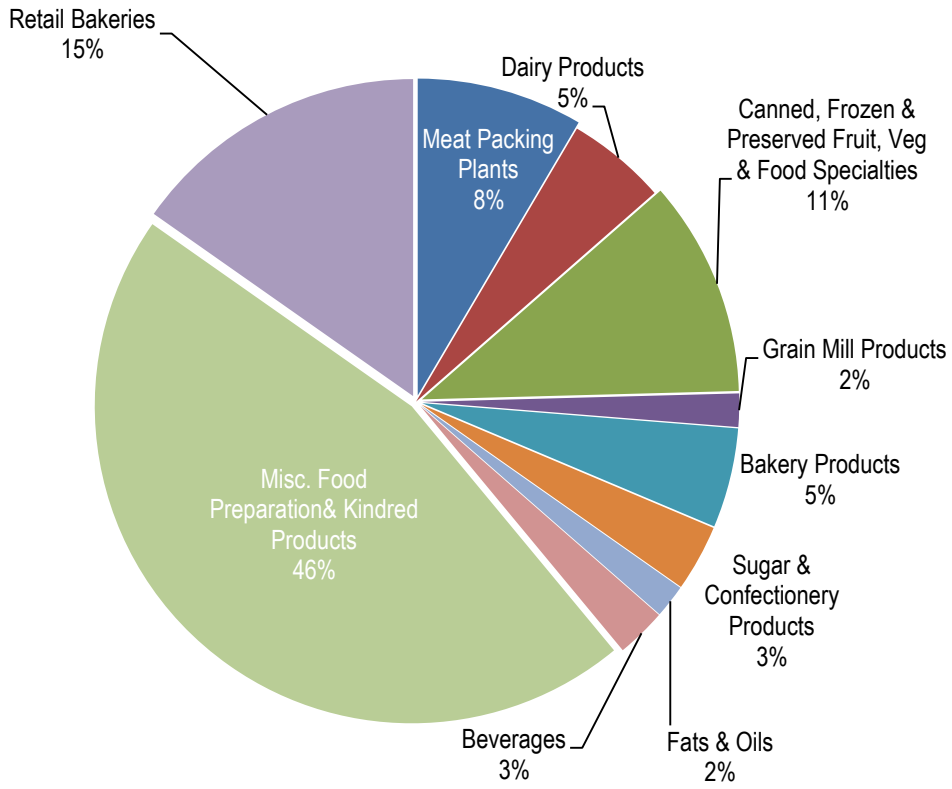
The Northwest food manufacturing sector comprises a wide range of sub-segments and company sizes. According to NEEA's latest Industrial Initiative Market Progress Evaluation Report, the PNW region includes approximately 440 individual food processing companies with 524 individual facilities. More than one-quarter of those facilities are members of the Northwest Food Processors Association (NWFPA).[80]

[79] Jefferson, J. 2006. "Energy Efficiency Opportunities in Ontario Hospitals." Ontario Hospital Association.
[80] The Cadmus Group. 2011. "NEEA Market Progress Evaluation Report #6: Evaluation of NEEA's Industrial Initiative." Northwest Energy Efficiency Alliance.

KEY CHARACTERISTICS OF FOOD PROCESSING FACILITIES IN PSE SERVICE TERRITORY

The food processing sector in PSE's service territory represents a diverse mix of specialties, workforce size, and sales volume. Figure 2.38 shows the distribution of the food processing sector by industry title. The food processing sector in PSE's territory used for the sampling includes a total of 118 facilities ranging from dairy products to miscellaneous food preparations and kindred products. These facilities have annual sales of at least $10 million or have at least 20 employees.

Figure 2.38. Distribution of Food Processing Sample by Industry Title



Source: Navigant analysis of InfoGroup list 2011.

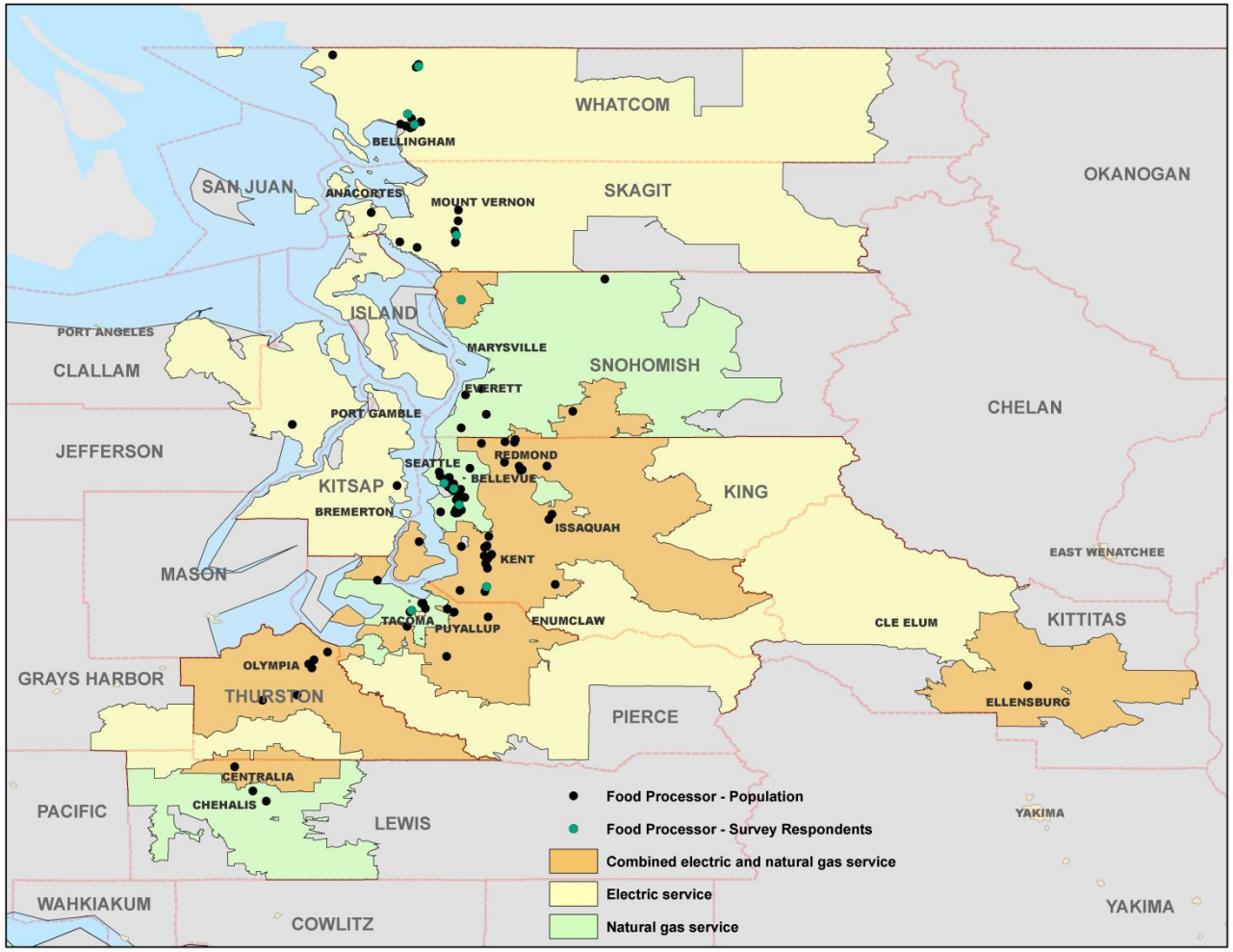
The project team surveyed representatives of 11 food processing facilities in PSE service territory. A list of facilities with an NAICS code that begins with 311 served as the starting point for selecting facilities for the sample frame. Facilities with fewer than 20 employees or less than $10 million in revenue were excluded from the sample frame. The remaining list of facilities represented facilities with enough resources, either staff or financial, to make a significant commitment to energy efficiency.

Figure 2.39 includes all of the facilities that were included in the population of potential survey respondents after the data cleaning was completed (black) as well as all of the facilities that responded to the survey (green).

As shown in Figure 2.40 through Figure 2.43, several characteristics of the food processing market segment indicate that it is a promising market for energy efficiency:

- The majority of the food processing facilities (73 percent) reported that they own and occupy their facilities, as shown in Figure 2.41. These owner-occupied facilities have alignment between the financial goals of the party investing in energy efficiency and those of the party realizing the financial benefits.
- As shown in Figure 2.43, a significant number of food processing facilities (73 percent) indicate that they plan to invest capital in their facilities in the next two years; nine percent of the facilities reported that they are unsure of their investment plans. Most facilities are willing to commit capital resources to expand their business in the near term, which creates opportunities for energy efficiency investment.
- Food processing facilities vary in scale in terms of both facility size (Figure 2.40) and number of employees (Figure 2.42). Most of the facilities fall in the small and medium category in terms of facility size (10,001 – 100,000 sq. ft.). The majority of the facilities have a small number of employees (between 1 and 50 employees). Outreach efforts in this sector likely need to include a larger number of facilities than the hospital sector, for example, in order to achieve the same level of energy savings.
- Unlike the other focus sectors, the food processing sector's largest facilities are geographically distributed throughout the PSE service territory, as shown in Figure 2.44. Although the only facility larger than 100,000 square feet is located in Seattle, half of the remaining facilities larger than 25,000 square feet are located north of King County. This reflects the food processing sector's connection to the fishery industry, some of which is tied to the northern regions of PSE's service territory.

Figure 2.39. Food Processor Sector Population and Survey Respondents



Source: Navigant analysis of E&W survey of PSE customers 2011.

Figure 2.41. Owner-Occupancy Rate – Food Processing (n=11)

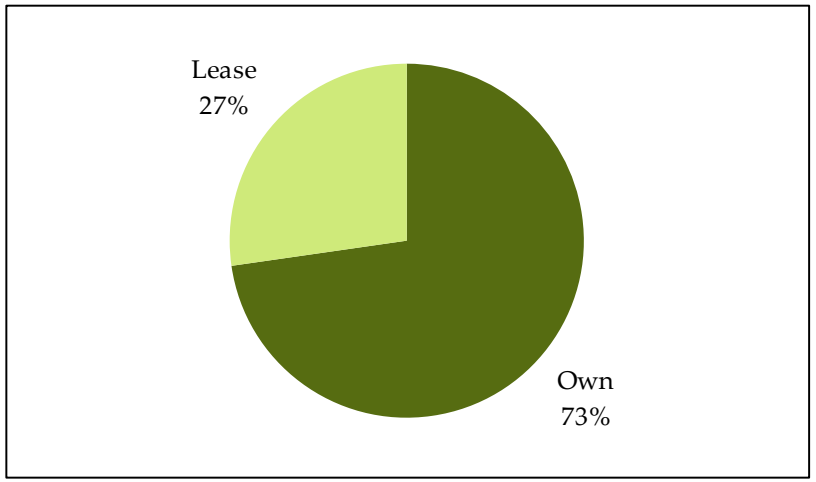


Figure 2.40. Facility Size – Food Processing (n=11)

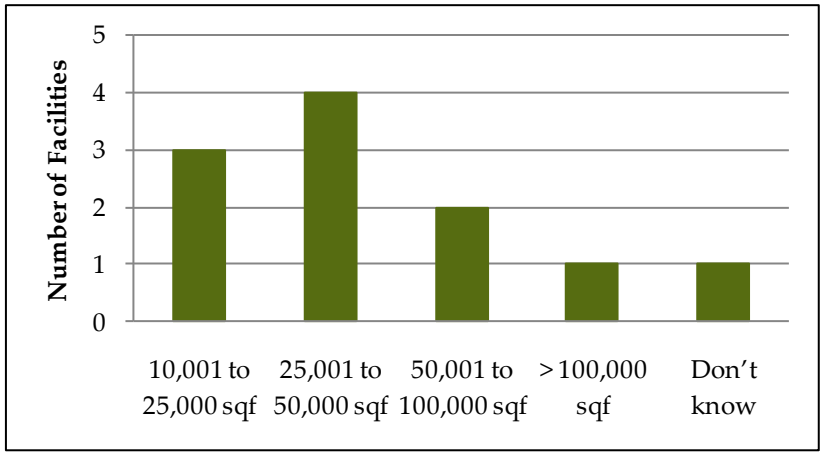


Figure 2.43. Planned Capital Spending in Next Two Years – Food Processing (n=11)

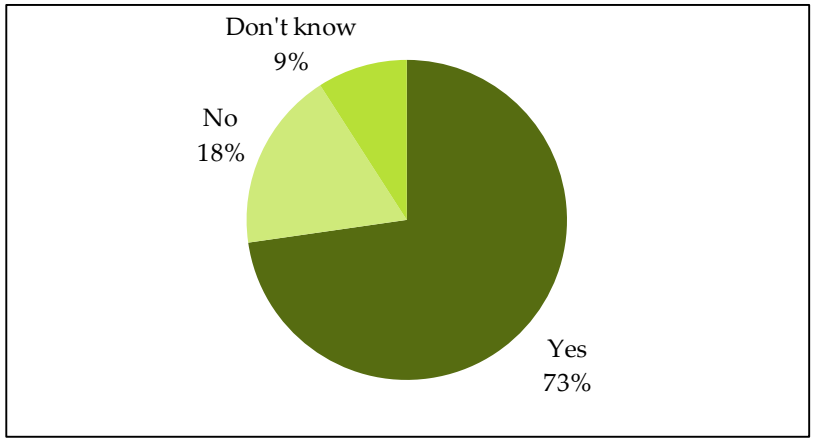


Figure 2.42. Number of Employees Per Facility – Food Processing (n=11)

Source for all figures on this page: Navigant and E&W Survey of Food Processors, 2011.

Figure 2.44. Food Processing Sector Facility Size by Location

Source: Navigant analysis of E&W survey of PSE customers 2011.

MOTIVATION TO PURSUE ENERGY EFFICIENCY

The food processing sector in the Northwest is motivated to decrease its energy usage. Members of the NWFPA established a goal to reduce energy intensity by 25 percent in 10 years and by 50 percent in 20 years.[81] In part, this goal reflects increasing levels of competition in the industry, especially related to price. As the industry anticipates increasing costs of key inputs, the increase in competition results in a focus on cost reductions.[82] NWFPA has worked with its members to identify energy as a controllable input to production, which has increased members' focus on energy-saving opportunities.

SECTOR PROGRESS TOWARDS ENERGY EFFICIENCY

To achieve its goal, the food processing industry has already taken steps to reduce energy usage. In large part, NWFPA has led these efforts through its partnership with NEEA, which PSE has leveraged in the past.[83] NWFPA's Director of Energy works closely with NEEA to increase members' participation in the Continuous Energy Improvement (CEI) program. The CEI program focuses on encouraging manufacturers' adoption of Strategic Energy Management efforts. As of 2009, NEEA had secured such CEI efforts from 36 percent of the overall PNW industrial and manufacturing sector. The food processing industry represents the largest share of these CEI activities, accounting for nearly 72 percent of electric savings and 100 percent of gas savings from the program.[84]

NWFPA's partnership with NEEA has led to **three pilot projects in the Northwest.**[85] These projects have optimized operational procedures for different types of industrial equipments and processes such as boilers and steam systems, refrigeration controls, and heat recovery equipment. The projects achieved annual savings from energy efficiency ranging from $9,000 to $150,000. This focus on energy savings has resulted in improved productivity and enhanced product quality as well as enhancements to inter-facility and corporate communication. Although none of these projects took place in PSE's territory, NWFPA's efforts to raise industry awareness about the results and the related opportunities make these efforts relevant to PSE.

Independent of NEEA, NWFPA's energy efforts focus on **raising awareness and providing tools** to its members to achieve their energy intensity reduction targets. NWFPA is developing two roadmaps to guide efforts to achieve the energy intensity reduction goals: a roadmap to guide efforts at the facility level and an industry-level roadmap to direct industry- and association-level efforts.[86] To facilitate efforts at the facility level, NWFPA hosts periodic workshops for its membership to increase awareness and familiarity with energy efficiency opportunities. NWFPA membership recently established an Energy Committee, comprised entirely of members, to provide input on NWFPA's programmatic efforts and policy priorities.

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[81] Barrow, P. June 2, 2010. "Energy Roadmap Projects Put NWFPA Membership on the Road." Northwest Food Processors Association. http://www.nwfpa.org/nwfpa.info/component/content/article/37-boiler/55--energy-roadma
[82] The Cadmus Group. 2011. "NEEA Market Progress Evaluation Report #6: Evaluation of NEEA's Industrial Initiative." Northwest Energy Efficiency Alliance.
[83] PSE. 2010. "Energy Efficiency Services 2010 Annual Report of Energy Conservation Accomplishments."
[84] The Cadmus Group. 2011. "NEEA Market Progress Evaluation Report #6: Evaluation of NEEA's Industrial Initiative." Northwest Energy Efficiency Alliance.
[85] Peterson, S. and P. Barrow. 2010. "Maximizing Energy Efficiency: Collaborative Goal Setting for Energy Intensity Reduction." Prepared for Behavior, Energy, and Climate Change Conference 2010.
[86] Northwest Food Processors Association. 2011. "Energy." Available: http://www.nwfpa.org/advocacy/energy

The EPA's **ENERGY STAR Program** serves as a complement to these regional efforts. EPA published the 2008 *ENERGY STAR Guide for Energy and Plant Managers* that specifically targeted the fruit and vegetable processing industry. The guide provides an extensive characterization of the associated energy-using processes in such facilities, and includes a diverse list of potential energy conservation measures.[87]

SERVICE PROVIDER INTEREST IN THE SECTOR

Service providers have begun to focus on this sector in response to the food processing sector's attention to energy efficiency. Several firms indicated in interviews that food processors are already part of their customer list. One of the major ESCOs interviewed for this project indicated that it had just conducted an analysis of the food processing sector, indicating that it is at least being considered as a new market. NWFPA has encouraged these efforts by enabling service providers to join the association as Supplier Members, giving them access to NWFPA member events and contact information.

REMAINING TECHNICAL OPPORTUNITIES

Solid opportunities remain to achieve energy efficiency in the food processing sector.[88] The food processing sector is unique because its energy use is dominated by natural gas, which accounts for an average of 60-70 percent of a facility's energy consumption.[89] Boilers are the primary consumer of natural gas and represent a significant opportunity for future energy efficiency, either through tune-up/maintenance programs or through efficient replacements. On the electricity side, NWFPA recognizes refrigeration as the primary opportunity with compressed air and HVAC as other areas with potential.

[87] Masanet, M., et al. 2008. "Energy Efficiency Improvement and Cost Saving Opportunities for the Fruit and Vegetable Processing Industry." Ernest Orlando Lawrence Berkeley National Laboratory.

[88] An additional example of "deep efficiency" food preparation facilities is Sierra Nevada Brewing Company's facilities in California. Additional information about those efforts can be found in the following reference: Chastain, C. Undated. "Brewing a Successful Sustainability Program."

[89] Interviews with NWFPA, NEEA. 2011.

Figure 2.45. Remaining Technology Opportunities in the Food Processing Sector

Source: Interviews with market actors 2011.

PSE's 2007 DSM potential study further disaggregates the food manufacturing sector's energy consumption by equipment category, with most potential electricity and gas savings attributable to various types of process equipment (e.g., cooling, motors, boilers, and heating).

Table 2-11 shows that around 30 percent of respondents to the food processors survey indicate that food process refrigeration/freezing, drying/cooking/baking, mixing and emulsification, materials handling/conveyor motors, compressed air and hydraulic systems, and liquid nitrogen and spiral freezer are some technologies where progress has already been done to achieve energy efficiency savings. Most of the respondents to the survey (81 percent) report that a number of opportunities remain in the following sector-specific technologies: heat processing, cold storage, process refrigeration/freezing, materials handling/conveyor motors and water generation.

Table 2-11. Food Processing Equipment: Progress to Date and Remaining Opportunities

Technology	Replaced Already?	Opportunities Remain?
Heat Processing	0%	9%
Dehydration	0%	0%
Filtration	0%	0%
Separation and Distillation	0%	0%
Drying/Curing/Baking	9%	0%
Cold Storage	0%	9%
Process Refrigeration/Freezing	9%	27%
Mixing and Emulsification	9%	0%
Materials Handling/ conveyor Motors	18%	18%
Compressed Air & Hydraulic systems	9%	0%
Steam system	0%	0%
Liquid nitrogen, spiral freezer	9%	0%
Water Generator	0%	9%
Number of responses provided	7	8
# of respondents to the question	3	9
# of respondents to the survey in this sector	11	11

Source: Navigant and E&W survey with Food Processors 2011.

REMAINING BARRIERS

Barriers remain to achieving the remaining energy efficiency potential in the food processing sector despite all of the trends in favor of deeper penetration in this sector. Food processors note a lack of familiarity with high efficiency technologies and insufficient staff time as barriers to considering such projects[90], which is consistent with barriers to adoption of energy efficiency across the C&I sectors, as discussed in Section 2.2.2.1. Service providers in the Northwest also indicate that the availability of capital also prevents full realization of energy efficiency potential in the food processing sector.

The seasonal nature of food processing operations creates unique challenges to completing projects, according to service providers. Most significantly, market actors must capture the attention of decision makers during the down season because the decision makers are too focused on operations during the busy season. If a market actor is able to attract the attention of a decision maker during the offseason, the project cannot usually be completed until the next down season at the earliest. The cost of interrupting operations during the busy season typically overwhelms any positive cash flow generated by an energy efficiency project. By the time that the next down season arrives, other concerns may have arisen, and the

[90] Shoemaker, S. 2006. "Technology Roadmap: Energy Efficiency in California's Food Industry." California Energy Commission; Public Interest Energy Research Program.

decision makers may determine that the energy efficiency project is no longer of primary importance. In the best cases, a project is delayed; in other cases, the project may be canceled. This long sales cycle and high level of uncertainty deter some service providers from investing the time needed to sell these projects.

2.2.3.5 Schedule 257 Customers

PSE's LED Traffic Signal program is a rebate program that is designed to increase replacement of existing traffic signals with energy-efficient LED traffic lights. The program educates public-sector customers on the benefits of installing red, yellow, and green LED traffic signals. PSE provides an LED informational packet along with a rebate application by mail or in person. Customers must receive electric service from PSE to qualify for the rebates, and customers with unmetered accounts must document all connected load at the intersection. New installations are not eligible for an incentive as the LED traffic lights are required by code. The LED Traffic Signals program is funded by Schedule 257.

As part of the Market Evaluation, Navigant interviewed representatives of one local government and the Washington State Department of Transportation. Navigant discussed the factors in decisions to replace traffic lights, progress towards replacing traffic lights, and the remaining opportunities in this area with the director of the department in charge of managing traffic light projects at each organization. Navigant asked the respondents to speak about their experience as well as the trends that they have seen among similar organizations regarding replacement of traffic signals with LEDs.

Findings from the interviews indicate that transportation agencies have already replaced all the old traffic light signals that could be replaced. There are a small percentage of old traffic lights that cannot be replaced because of technological barriers; depending on the type of signal head, some systems need incandescent lights in order to program them correctly. Respondents estimated that only about 2 percent of old traffic lights are not replaced with LEDs because of this technology constraint.

The respondents indicate that the role of a utility incentive is minor or ancillary to the decision to replace traffic lights. Replacements make economic sense without the utility incentive due to cost savings in three areas: energy, operating, and maintenance cost savings. In one case, old traffic lights started being replaced before the agency knew about related utility incentives.

PSE may consider sunsetting the Schedule 257 offerings due to market saturation and free-ridership issues. Interview findings indicate this market may be transformed. Municipalities are choosing to implement old traffic lights with LEDs in the absence of PSE incentives.

2.2.3.6 Schedule 258 Customers

A set of in-depth interviews with 11 of PSE's customers that are eligible for Schedule 258 revealed that remaining opportunities for energy efficiency projects do exist among these customers. The interviewer engaged the customer to talk about potential projects at their facilities by end use. As expected, much of the most cost-effective and technically simple measures have been implemented, but some opportunities do remain.

- **Lighting:** Almost no T12 lighting remains to be retrofitted. Customers still have lighting savings opportunities, but they are more costly and save less. Many customers mentioned controls for lights as future opportunities – occupancy, dimming and daylight harvesting. Conversion of

high-bay HID lamps to fluorescent was mentioned for baseline energy savings and for the sake of integrating controls. One customer is considering HID dimming in conjunction with daylight harvesting where there are skylights. LEDs for exterior lighting are also an opportunity. Several of the sites were predominantly outdoor facilities with HID lighting.

» **HVAC:** Customers with Schedule 258 represent extremes with respect to HVAC use. Customers either have majority conditioned space or majority unconditioned space. In the former case, the customers have already invested in high-efficiency equipment and good controls. For these customers, retro-commissioning is seen as the best opportunity for savings. In the case where the HVAC load is small, it is neglected as an end-use. Machines are older and less efficient. These sites still have potential for improved HVAC equipment and controls, but this equipment is low priority and smaller.

» **Compressed air:** All industrial Schedule 258 customers recognize compressed air as a high energy user and most have taken steps to reduce costs. All perform leak surveys and most have variable speed compressors to match capacity to load with the least energy. There is interest among a couple customers to install more monitoring equipment on their compressed air systems to track air production and losses to optimize operation and preventative maintenance.

» **Drive power:** Almost all Schedule 258 customers have a policy of purchasing more efficient motors on burn-out. VFDs are used widely, but there is still considerable opportunity, especially on process equipment. Frequently motor projects require very fast turn-around for failed equipment, or they have a very long lead-time because the motors are part of a large-scale process change. Neither of these situations fit the Schedule 258 program well.

» **Refrigeration** was as significant load at very few sites interviewed. Optimum staging controls on compressors were the most often mentioned future project.

» **Server Virtualization**: Schedule 258 customers know their business. Where servers are a significant load, virtualization has been implemented, at least partially. The server equipment evolves quickly so there is an on-going turn-over of equipment to meet the customer's IT needs. Where the largest potential exists, there will also be the tendency to add additional capacity as the existing capacity is optimized; there are questions as to whether virtualization saves energy in these cases.

» **Building Shell:** Very few Schedule 258 customers felt that improvements to the building shell would be among future projects.

Navigant assesses that there is still significant, though diminishing savings potential among most end uses. The next tier of savings opportunities is more expensive, and the payback is longer. A few customers see the Schedule 258 funds as a mis-focused use of *their* capital that could be used for projects with a higher ROI than energy efficiency. Most, though, see the E258 funds as important seed money for projects with efficient alternatives and a way to leverage the installation of more efficient equipment – either in new projects or to replace burnt-out equipment – that might otherwise be only minimum efficiency.

2.2.4 Cross-Cutting Findings Regarding Progress and Opportunities at the Technology Level

This section presents results from two components of the analysis that look across all four priority sectors. By presenting the results for all priority sectors in the same section for these two pieces of analysis, higher level themes emerge in a more straightforward manner than if the data for each sector had been presented independently. These analyses include (1) the progress made to date and the remaining opportunities for specific technologies and (2) analyses that can help PSE better target its marketing activities from a geographic perspective.

2.2.4.1 Progress and Opportunities at the Technology Level

Results regarding progress to date and remaining opportunities in the priority technology categories are best examined across all sectors. The results are more meaningful when considering the relative opportunities across sectors because this approach presents PSE with the opportunity to assess the relative benefits of targeting outreach in the individual sectors. The analysis in the rest of this section presents the results to two key questions for each technology:

- What types of equipment were installed as part of previous <specific equipment> efficiency improvements?
- What <specific equipment> components do you think present the greatest efficiency improvement opportunities?

The analysis highlights the sectors in which remaining opportunities warrant additional attention by PSE.

Lighting retrofits are most broadly distributed across sectors and across specific technology types as seen in Table 2-12. All sectors report completing some type of energy-efficient lighting upgrades, and nine categories of technology-specific upgrades saw activity from at least five percent of respondents in at least one sector. The most popular lighting retrofit to date has been replacing or adding new fluorescent tubes, and this measure is also reported as having the most significant opportunity remaining. Multiple sectors report significant remaining opportunities for LEDs, CFLs, occupancy sensors, and electronic ballasts. By sector, the following findings are worth mentioning:

- Food Processors report the most significant remaining lighting retrofit opportunities in multiple areas.
- Five to eleven percent of the hospital respondents and of local government respondents indicate remaining opportunities for several technology types: occupancy sensors, CFLs, LEDs, pin-based halogen fixtures, and electronic ballasts.
- State government reports that concentrated opportunities remain for LEDs (38%), fluorescent tubes (19%), and occupancy sensors (4%).
- Offices report very limited remaining lighting opportunities with only three respondents identifying opportunities.

As shown in Table 2-13, hospitals have made the most progress on air conditioning retrofits, and they report the most significant remaining opportunities. The progress in the hospital sector is concentrated among a few types of air conditioning technologies, with hospitals reporting the most progress among central air handling equipment and central chillers; this latter category represents the greatest concentrated opportunity in any sector, with 44 percent of hospitals reporting that they know of remaining upgrades to central chillers.

All sectors report completing some type of energy-efficient upgrade on their air conditioning equipment although that progress is diffused among several technologies. Ten categories of technology-specific upgrades saw activity from at least four percent of respondents in at least one sector. Multiple sectors report significant remaining opportunities for controls, heat pumps, and variable frequency drives (VFDs). By sector, the following findings are worth mentioning:

- Hospitals report the most significant remaining retrofit opportunities in multiple areas.
- More than ten percent of state government respondents report opportunities in chilled water plants and heat pumps; eight percent report opportunities for controls.
- In the office segment, controls represent the greatest remaining opportunity, with 18 percent of respondents indicating some opportunity here.
- Local governments report very limited remaining air conditioning opportunities.

The best targets for additional data center retrofits are Hospitals and State Government. One-third of hospitals and 42 percent of State Government respondents indicated that they had data center facilities on-site. Respondents in both of these sectors indicated making previous investments in their data centers, including servers and storage devices (6 percent of hospitals and 15 percent of state government); various peripherals (11 percent/4 percent); and virtualization (6 percent/27 percent). Twelve percent of state government respondents also indicated that they had made changes to thermostat set points and other operational practices. Both hospitals and State Government report remaining opportunities across a range of technologies. Local Governments and Offices indicated that they are paying minimal attention to this end use; few opportunities remain.

Finally, gas space heating presents a strong opportunity in both the hospital and food processing sectors. About a quarter of hospitals report remaining opportunities in upgrading their boilers and/or controls. Nearly ten percent of food processors report remaining opportunities in their central furnaces, district steam systems, EMSs, or zone packaged heating units. A similar number of state government respondents (12 percent) report opportunities in upgrading their gas-fired central boilers, but this opportunity stands alone among state government agencies. Local governments and offices report a few scattered opportunities to upgrade their gas space heating equipment. Only a small portion of PSE customers report using electric space heating equipment, and a smaller fraction (14 percent) report many opportunities to upgrade this equipment further.

Table 2-12. Lighting Retrofit Progress and Remaining Opportunities

Technology	Replaced Already?					Opportunities Remain?				
	Hosp	FP	LG	SG	Offices	Hosp	FP	LG	SG	Offices
Daylighting controls/photocells	17%	0%	4%	0%	0%	6%	0%	0%	0%	0%
Energy Management System (EMS)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Occupancy sensors	22%	0%	13%	8%	0%	11%	18%	9%	4%	0%
Reflectors for delamping	0%	0%	4%	0%	0%	0%	0%	0%	0%	0%
Replaced standard incandescent bulbs with CFLs	0%	18%	4%	0%	0%	6%	27%	9%	0%	0%
Replaced standard incandescent bulbs with LEDs	11%	0%	4%	12%	0%	11%	45%	4%	38%	0%
Replaced/added new fluorescent tube fixtures	44%	27%	9%	12%	59%	33%	27%	35%	19%	9%
Replaced/added new HID fixtures	0%	0%	0%	0%	0%	0%	18%	0%	0%	0%
Replaced/added new pin-based CFL fixtures	0%	0%	0%	0%	0%	0%	18%	0%	0%	0%
Replaced/added new pin-based halogen fixtures	0%	0%	0%	0%	0%	6%	18%	4%	0%	0%
Retrofitted/added (non-dimming) electronic ballasts	6%	18%	0%	0%	5%	11%	27%	4%	0%	0%
Retrofitted/added dimming electronic ballasts	28%	9%	9%	4%	0%	11%	18%	4%	0%	0%
Selective delamping	0%	0%	4%	8%	0%	0%	0%	0%	0%	5%
Time clocks	0%	0%	9%	8%	0%	0%	0%	4%	0%	0%
Number of responses provided	**24**	**9**	**15**	**14**	**16**	**18**	**24**	**18**	**23**	**5**
# of respondents to the question	**9**	**7**	**9**	**10**	**17**	**10**	**7**	**13**	**18**	**7**
# of respondents to the survey in this sector	**18**	**11**	**23**	**26**	**22**	**18**	**11**	**23**	**26**	**22**

Key: Hosp = Hospitals; FP = Food Processors; LG = Local Government; SG = State Government.
Source: Navigant and E&W survey with the Hospital, Food Processing, Local Government, State Government, and Offices sectors 2011.

Table 2-13. Air Conditioning Retrofits and Remaining Opportunities

Technology	Already Installed?					Opportunities Remain?				
	Hosp	FP	LG	SG	Office	Hosp	FP	LG	SG	Office
Built-up central air-handling equipment (changes to fans, volume controls, cooling and heating coils)	11%		0%	0%	0%	6%		0%	4%	0%
Central chilled water plant equipment	11%		0%	4%	0%	44%		0%	15%	0%
Cool roof replacing a standard roof	0%		0%	0%	0%	0%		0%	0%	0%
District chilled water piped in from outside the building	0%		0%	0%	0%	17%		0%	0%	0%
Economizer	0%		0%	0%	0%	0%		0%	4%	0%
Energy Management System (EMS)	0%		0%	8%	0%	6%		0%	4%	0%
Individual window or wall units (all components located in same housing)	6%		0%	0%	0%	0%		4%	0%	0%
NEMA Premium motors	0%		0%	0%	0%	6%		0%	0%	0%
Occupancy sensors	6%		0%	0%	0%	6%		0%	0%	0%
Packaged air conditioners or split-system air conditioners	0%		0%	0%	5%	6%		0%	0%	5%
Programmable thermostats	0%		4%	4%	5%	0%		0%	0%	0%
Reflective or tinted window film	0%		4%	0%	0%	0%		4%	0%	0%
Standard thermostats	0%		0%	0%	0%	0%		0%	0%	0%
Time clocks	6%		4%	0%	0%	0%		0%	0%	0%
Variable-frequency drives (VFDs) on large fan motors or chilled water pumps	6%		0%	0%	0%	11%		4%	0%	5%
Heat pumps*	0%		4%	0%	0%	0%		4%	15%	5%
Controls*	0%		0%	0%	5%	0%		0%	8%	18%
Number of responses provided	10		5	5	7	20		5	15	8
# of respondents to the question	7		4	4	6	15		8	11	8
# of respondents to the survey in this sector	**18**	**11**	**23**	**26**	**22**	**18**	**11**	**23**	**26**	**22**

Key: Hosp = Hospitals; FP = Food Processors; LG = Local Government; SG = State Government.
Source: Navigant and E&W survey with the Hospital, Local Government, State Government, and Offices sectors 2011.

Table 2-14. Data Centers Retrofits and Remaining Opportunities

Technology	Replaced Already?					Opportunities Remain?				
	Hosp	FP	LG	SG	Office	Hosp	FP	LG	SG	Office
Servers & storage drives – higher efficiency	6%		4%	15%	5%	6%		0%	15%	5%
Power supplies	0%		4%	0%	0%	0%		0%	0%	0%
Peripherals (various)	11%		0%	4%	0%	0%		0%	0%	0%
Heat recovery	0%		0%	0%	0%	6%		9%	0%	0%
Virtualization	6%		0%	27%	0%	0%		0%	15%	0%
Economizer/outside air free cooling	0%		0%	0%	0%	6%		0%	0%	0%
Other air flow management	0%		0%	0%	0%	6%		0%	0%	0%
Uninterruptible Power Supply (UPS) efficiency improvement	0%		4%	0%	0%	0%		0%	0%	0%
Thermostat set points & other operational efficiencies	0%		0%	12%	0%	6%		0%	0%	0%
Number of responses provided	4		4	15	1	7		2	1	1
# of respondents to the question	6		4	11		10		2	1	1
# of respondents to the survey in this sector	**18**	**11**	**23**	**26**	**22**	18	11	23	26	22
# of respondents with DC on site (DC0)	14	0	8	17	5	14	0	8	17	5

Key: Hosp = Hospitals; FP = Food Processors; LG = Local Government; SG = State Government.
Source: Navigant and E&W survey with the Hospital, Local Government, State Government, and Offices sectors 2011.

Table 2-15. Gas Space Heating: Progress and Remaining Opportunities

	Replaced Already?					Opportunities Remain?				
Technology	**Hosp**	**FP**	**LG**	**SG**	**Offices**	**Hosp**	**FP**	**LG**	**SG**	**Offices**
Central boiler	11%	4%	8%	9%	28%	28%	0%	4%	12%	0%
Central furnace	0%	9%	0%	0%	9%	0%	9%	4%	0%	0%
Designed Solar Technology	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
District steam or hot water piped in from outside the building	0%	0%	0%	0%	0%	0%	9%	0%	0%	0%
Energy Management System (EMS)	0%	0%	0%	0%	0%	0%	9%	0%	0%	0%
Higher-performance windows	0%	0%	0%	0%	0%	0%	0%	4%	0%	0%
Individual portable propane heaters	0%	0%	0%	0%	5%	0%	0%	0%	0%	5%
Programmable thermostats	0%	0%	0%	0%	5%	0%	0%	0%	0%	0%
Terminal Reheat (fan powered boxes)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Time clocks	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Variable-frequency drives (VFDs) on large fan motors or hot water pumps	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Zone Packaged heating units, including infrared heaters	0%	0%	0%	0%	5%	0%	9%	0%	0%	0%
Other building shell measures to reduce heating requirements	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Controls	6%	0%	0%	0%	0%	28%	0%	0%	0%	5%
Number of responses provided	5	3	2	6	8	14	10	5	3	4
# of respondents to the question	5	3	1	6	6	13	8	4	4	5
# of respondents to the survey in this sector	**18**	**11**	**23**	**26**	**22**	**18**	**11**	**23**	**26**	**22**

Key: Hosp = Hospitals; FP = Food Processors; LG = Local Government; SG = State Government.

Source: Navigant and E&W survey with the Hospital, Local Government, State Government, and Offices sectors 2011.

Table 2-16. Electric Space Heating: Progress and Remaining Opportunities

	Replaced Already?					Opportunities Remain?				
Technology	**Hosp**	**FP**	**LG**	**SG**	**Offices**	**Hosp**	**FP**	**LG**	**SG**	**Offices**
Central boiler			4%	0%	0%			4%	0%	5%
Central furnace			0%	0%	0%			0%	0%	0%
Packaged heating units (other than heat pump)			0%	0%	0%			0%	0%	0%
Individual space heater			0%	0%	0%			0%	4%	0%
Split-system heat pump			0%	0%	0%			13%	0%	0%
District steam or hot water piped in from outside the building			0%	0%	0%			0%	0%	0%
Terminal Reheat (fan powered boxes)			0%	0%	0%			0%	0%	0%
Energy Management System (EMS)			0%	0%	0%			0%	0%	0%
Time clocks			0%	0%	0%			0%	0%	0%
Programmable thermostats			0%	0%	0%			0%	8%	0%
Variable-frequency drives (VFDs) on large fan motors or hot water pumps			0%	0%	0%			0%	0%	0%
Designed Solar Technology			0%	0%	0%			0%	0%	0%
Higher-performance windows			0%	0%	0%			0%	4%	0%
Other building shell measures to reduce heating requirements			0%	0%	0%			0%	0%	0%
Number of responses provided	0	0	1	1	0	0	0	6	4	2
# of respondents to the question	0	0	1	1	0	0	0	6	6	2
# of respondents to the survey in this sector	**18**	**11**	**23**	**26**	**22**	**18**	**11**	**23**	**26**	**22**

Key: Hosp = Hospitals; FP = Food Processors; LG = Local Government; SG = State Government.

Source: Navigant and E&W survey with the Hospital, Local Government, State Government, and Offices sectors 2011.

2.2.4.2 Analysis Regarding Geographic Targeting of PSE's Marketing and Outreach Efforts

PSE sought input on two specific issues related to customer location – level of customer awareness of PSE's energy efficiency programs and the capital investment plans. Understanding how these issues vary by location can help PSE determine if marketing efforts focused on specific geographic areas can increase customer engagement in the programs.

Figure 2.46 depicts the findings regarding level of customer awareness. The red symbols indicate the respondents that indicated almost no awareness of PSE programs; the green symbols represent respondents that may have indicated some or high levels of awareness of PSE programs. Each shape represents a different sector as described in the Key.

Respondents located throughout the service territory report low levels of awareness. A few areas (which represent a combination of gas, electric, and combined customers) demonstrate lower levels of awareness.

- the Lewis County-Grays Harbor County area
- in and around Tacoma
- near Bellingham (though other parts of Whatcom county report relatively higher levels of awareness)
- I-5 corridor in western King County south of Seattle
- respondents near Olympia report mixed results, with about half reporting almost no awareness.

Figure 2.47 depicts respondents' feedback regarding their plans to invest capital in their facilities in the next two years. Red symbols indicate no plans for capital investment in the next two years, while green symbols indicate plans to invest capital in the facility in the next two years. Each shape represents a different sector as described in the Key.

Plans to invest capital also vary throughout the region. Table 2-17 lists the areas in which there are higher and lower concentrations of customers that plan to make capital investments in their facilities in the next two years.

Table 2-17. Customer Plans to Invest Capital in Facilities in Next Two Years

Higher Concentration of Planned Capital Investment	Lower Concentration of Planned Capital Investment
Tacoma	Lewis County-Grays Harbor County area
Seattle	Most of Whatcom County, including Bellingham
Bellevue (generally speaking)	I-5 corridor in western King County south of Seattle
	Olympia

Source: Navigant analysis of E&W survey of PSE customers 2011.

PSE may consider targeting trade allies in the Tacoma area with additional information about PSE's energy efficiency programs. Facilities in that area report higher likelihood to invest capital in their facilities in the next two years and also indicate that they are "not at all aware" of PSE's incentive programs. Other areas with very low levels of awareness about PSE programs do not represent such strong targets as Tacoma because they have higher concentrations of facilities that do not plan to invest capital in the next two years.

Figure 2.46. Levels of Customer Awareness of PSE's Energy Efficiency Programs by Sector and Location

Source: Navigant analysis of E&W survey of PSE customers 2011.

Figure 2.47. Customer Plans for Capital Investment in Next Two Years by Sector and Location

Source: Navigant analysis of E&W survey o f PSE customers 2011.

2.3 *Opportunities for PSE Involvement*

This section outlines a set of options for PSE's involvement in the market for energy efficiency retrofits in its target C&I market sectors. It builds on the previous sections, which outlined the market framework within which these sectors operate, key trends in the market, and the recent developments in each of the priority sectors that affect decisions about energy efficiency.

At this time, this section provides a high-level discussion of recommendations based on the completed data collection activities to date. At this time, those data collection activities include interviews with market actors, end user surveys, as well as the literature review and much of the secondary research. These findings provide a starting point for discussion at the upcoming in-person meeting between the evaluation team and PSE.

This section presents two options for PSE's involvements at two levels. First, Section 2.3.1 includes a discussion of the overarching themes – those that apply to all of the sectors. Section 2.3.2 summarizes the key sector-specific themes for PSE's involvement in the priority sectors.

2.3.1 Overarching Themes

Some themes that may influence PSE's involvement in the market for energy efficiency retrofits in C&I markets cut across all sectors. The discussion below identifies some of the key considerations for customers that can improve the success of outreach to customers, suggestions for the approach to marketing the programs, and two specific technology opportunities that PSE may consider promoting in the near- to mid-term.

2.3.1.1 Key Customer Considerations

Considering the broader business issues faced by customers can help PSE design programs that reach the customers more effectively. In the current economic climate, three considerations are key:

- **Sector conditions:** Each sector faces unique challenges in today's business climate. The discussion in Section 2.2.3 provides an update on what some of those challenges are and how they affect energy efficiency decisions. PSE can leverage this initial information and its relationships with service providers to continue to monitor developments in these sectors that will affect program participation. This will enable PSE to adjust program offerings to take advantage of fluctuations in the market.
- **Capital budgeting cycles:** The capital budgeting cycle is a key factor in the timeline for approving a project. This is especially true during periods of constrained capital, as organizations struggle to stretch their dollars further and protect the assets that they already have. Understanding the timing of capital budgets and how organizations make decisions can help PSE to maximize the effectiveness of its outreach efforts. For example, targeting key outreach events before and during the preliminary phases of capital budgeting can yield greater returns because decision makers have not yet allocated their capital and are more open to new opportunities.
- **Balance sheet strength:** Balance sheet strength varies by organization, but understanding the trends at the sector level has important program design implications. Balance sheet strength has important consequences for the types of gaps that organizations need to fill in order to complete

energy efficiency projects. Those with weaker balance sheets may require a partnership with an ESCO in order to raise the capital to complete the project. Those with stronger balance sheets may require more education of key decision makers. As PSE designs its offerings, the consideration of balance sheet strength at the sector level will provide guidance for how to impact the sector most effectively. The Dow Jones Industrial Average (DJIA) provides a high-level snapshot of performance at the sector level; variation is expected to exist within each sector, but the representatives used in the DJIA serve as reasonable proxies for the sector as a whole.

The knowledge gained through the **Resource Conservation Manager (RCM) program** can supplement the information in this report and the input from service providers. RCM provides a unique opportunity because of the proximity of the interface between the organization and PSE. RCM participants in the key sectors can provide insight into these issues through a unique lens. Discussions with RCM participants from the key sectors – either in one-on-one situations or in focus groups – can help PSE adjust its offerings at the programmatic level to improve the programs' match with sector needs.

PSE may consider examining **on-bill financing** offerings in more depth in response to some of the needs at the sector level. This approach has proven useful in other service territories in bridging the gap between available capital resources and the resource needs of a given project. PSE may consider shifting the risk of the financing to a third party and simply serving as an administrator of the payment through its billing system. A variety of considerations will affect the viability of this option; Table 2-3 above includes four utilities' approaches to addressing some of the key risks associated with on-bill financing.

2.3.1.2 Marketing Considerations

Effective marketing of the programs can enhance program participation. The channels selected for outreach affect the credibility of the message and the customers' response to it in many cases. In addition, the messages used to promote the programs will affect how customers consider the program in light of their other business priorities.

PSE is already working with a strong set of service providers and internal partners to promote its programs. Building on those efforts, PSE may consider the following approaches to reach its customers more proactively:

- **Trade ally strategy development.** PSE's trade allies are some of the most important channels for outreach to PSE's customers. PSE can educate them about PSE's programs, train them on the technologies and services that are eligible for PSE incentives, and provide them with the tools necessary to market the programs to their customers. The investment of these resources is multiplied many times if the trade allies are effective as channel partners. PSE may consider reviewing its approach to working with trade allies and develop a formal strategy for leveraging them in the future. The strategy should include a high-level view of the value proposition that PSE brings to the trade allies and the value proposition that the trade allies bring to PSE; a statement of the goals of partnership; benchmarks for implementation; and an owner for each key component of the trade ally strategy.
- **Account representatives and account managers.** These individuals have direct lines of communication with PSE's largest customers. These relationships can lead to great insights into customers' needs and priorities. In many cases, these PSE representatives are considered trusted

advisors to their customers. Ensuring that all of PSE's account representatives and managers are well versed in the benefits of energy efficiency and PSE's offerings will enhance their abilities to expand participation in the program. If it is not already the case, PSE may consider creating incentives (financial, performance-related, or other) for these individuals to convince their customers to complete energy efficiency projects.

- **NEEA's partners.** NEEA has developed strong ties with market actors in the office, hospital, and food processing sectors. These include industry organizations, contractors, decision makers, and others who can (1) enhance PSE's understanding of these markets and (2) create opportunities to share PSE's program offerings with their constituencies and customers. Working with NEEA to access these partners will expand on PSE's existing relationships with key market actors.
- **New account communications.** Transitions such as relocations lead to changes in behavior that create opportunities for energy efficiency programs. Reaching out to new customers during this time of transition may enable them to see the benefits of PSE's programs from a different perspective than when they are steeped in their business-as-usual activities. Information in a mailer or a phone call to the customer during this time can form a foundation that other program activities can build on later.
- **Nearby utilities.** PSE can leverage its own marketing efforts and funds by partnering with utilities within and around its service territory. Some of these utilities focus on some of the priority sectors identified in this report. Coordinating outreach on these programs may create a more cohesive message to the sector across the region as well as to the companies that serve these sectors.

PSE may consider three key messages in its marketing efforts:

- **Energy is a variable cost reduction opportunity.** Some sectors have just recently begun to identify energy as a variable cost rather than a fixed cost. This is a powerful message in a time of tight budgets that drive the need for cost reductions. For many years, businesses considered energy a fixed cost; as such, it was not a subject of conversation when the need arose to reduce costs. This is still the case in many sectors, but it is changing slowly. Accelerating the pace of that messaging may spur broader participation in PSE's programs.
- **Energy efficiency helps to promote a "green" business image.** As more companies incorporate "green" messaging into their marketing strategies, they become more open to suggestions about how to enhance the sustainability of their business. Renewable energy, organics, and recycling often come to mind before energy efficiency. Helping decision makers to understand that energy efficiency can fit into this strategy can help to deepen market adoption. The media's coverage of best practices and case studies, whether they occur in Seattle or elsewhere around the country, can also assist in building awareness about the positive effects (energy- and non-energy related) created by these investments.

In addition, PSE may consider creating targeted marketing approaches for each of its priority sectors. These marketing approaches would rely on internal expertise regarding each sector's market structure and decision-making processes. In some sectors, this expertise may already exist within PSE; in other sectors, PSE may need to supplement its existing knowledge. PSE uses this approach with the Energy Smart Grocer program, which relies on a third party with deep experience in the sector to build

relationships, influence decision makers, and design incentives with the most impact. PSE may consider a similar approach in its other target sectors.

2.3.1.3 Technology Considerations

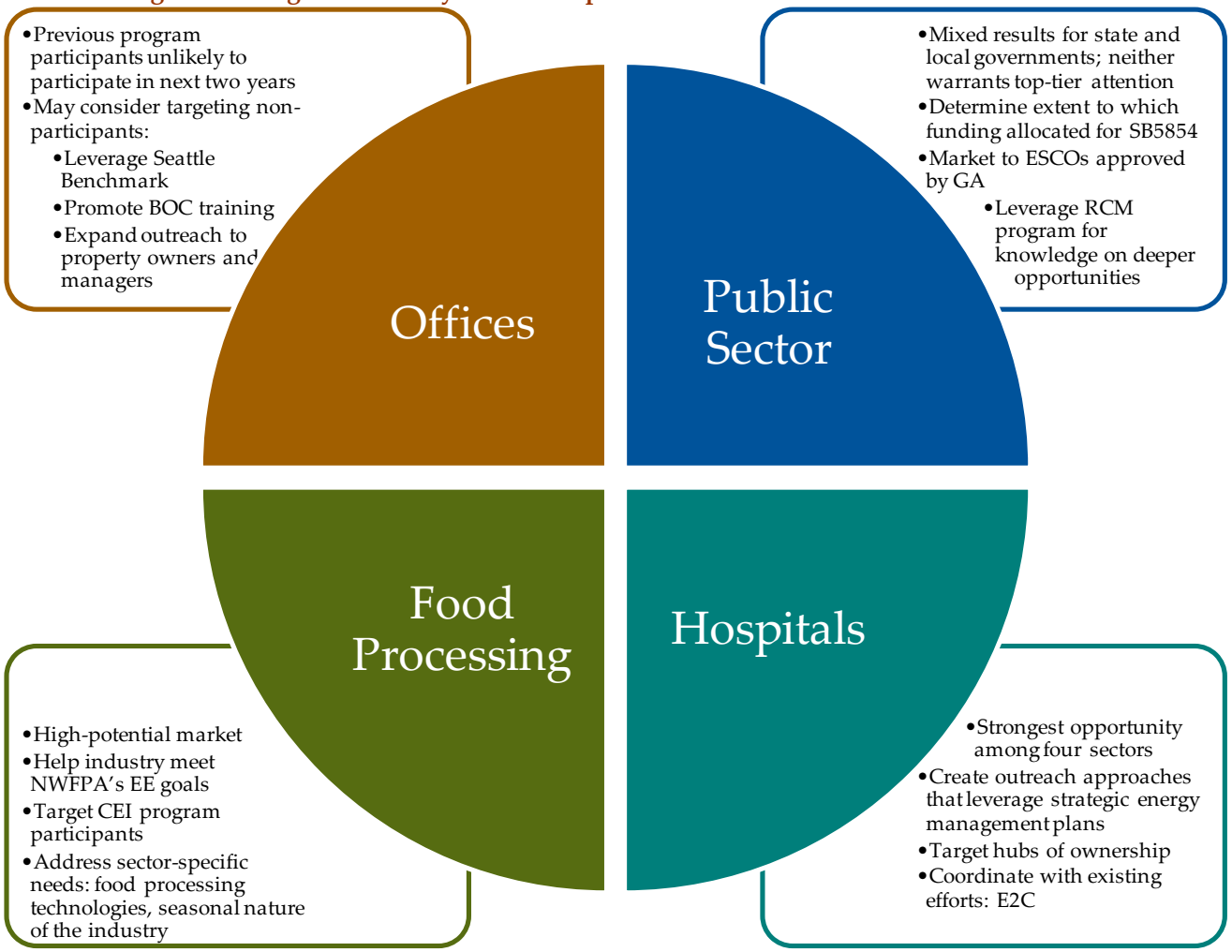
As discussed in Section 2.2.2.3, the market is moving more heavily toward LEDs and building automation systems. Specific uncertainties about these technologies still persist in the energy efficiency community, but the market has moved past these uncertainties and is implementing projects with these technologies. They pose significant opportunity for future energy savings if PSE decides to promote them. Developing a plan for vetting these technologies – both internally and in the region as needed – will open new opportunities for PSE to count energy savings in the region.

2.3.2 Sector-Specific Themes

This section outlines sector-specific opportunities for PSE to consider in the design and implementation of its programs. They address unique characteristics of each sector and take advantage of unique opportunities available in each sector. These are organized in the same order in which they were presented earlier: offices, public sector, hospitals, and food processing.

Figure 2.48 summarizes the sector-specific approaches suggested in the remainder of this section.

Figure 2.48. Figure Summary of Sector-Specific Market Evaluation Recommendations



Source: Navigant analysis 2011.

2.3.2.1 Offices

Previous participants in PSE's incentive programs from the office segment represent the weakest segment of the four investigated for additional targeting by PSE. This segment is challenged economically, with only half of the facilities planning to invest capital in the next two years. They report very narrow bands of remaining opportunity for energy efficiency, with only controls reported by more than 10 percent of respondents as a remaining opportunity. While this segment does have high levels of owner occupancy and substantial facility size, the ownership's receptivity to additional investment overshadows those favorable factors.

Offices

- Previous program participants unlikely to participate in next two years
- May consider targeting non-participants:
  - Leverage Seattle Benchmark
  - Promote BOC training
  - Expand outreach to property owners and managers

PSE may consider further investigation of the market for offices that have not previously participated in PSE programs. Although their capital investment plans may mirror their participating counterparts, more energy efficiency retrofit opportunities likely exist. This segment is challenging to define for market research opportunities, but PSE may consider developing proxy representation, such as using NAICS codes that represent sectors that frequently occupy office space (e.g., computer software, engineering, and services firms).

In the event that PSE chooses to pursue non-participating office customers, much of the market assessment work conducted for this project can be applied. PSE can leverage the efforts that other market actors have already initiated to deepen penetration of energy efficiency in the offices sector. These efforts include the City of Seattle's benchmark, building Operator Certification (BOC) training offered by NEEC and IBOA, and the development of relationships with industry associations and building owners that NEEA has fostered in the past decade.

First, the benchmarking requirement in the City of Seattle creates opportunities for gas customers directly affected by the policy and for other customers that will be indirectly affected. **For customers required to benchmark their facilities,** PSE can strengthen its promotional efforts during key reporting periods. Some buildings could improve their performance in the benchmarking by making upgrades to some equipment; they may be inclined to do so in advance of their initial report to improve the position of their property in the marketplace. PSE could run a marketing effort targeted at those facilities (and their owners) in advance of the first reporting period (October 2011 or April 2012, depending on building size). PSE may also consider increasing its incentive levels during these times to provide additional motivation to complete projects.

For facilities in cities and towns near Seattle, PSE may consider working with market actors to help identify facilities that compete with Seattle-based facilities for occupants. To the extent that prospective tenants begin to expect energy benchmarking reports when they evaluate potential facilities, PSE may consider promoting benchmarking capabilities of service providers. One way of accomplishing this

would be to certify benchmarking firms and sharing that list with building owners throughout the service territory. An alternative would be to offer a modest incentive to assist in paying for the benchmarking. Either of these efforts may help to increase the number of facilities that consider retrofits as a means for improving their performance relative to other buildings.

PSE may consider expanding its support for certification of building operators in its territory through the **BOC** program. PSE currently offers a stipend for such certifications through its Resource Conservation Manager program. The BOC training achieves approximately 119 MWh of savings per building operator per year.[91] PSE may be able to claim credit for this initial training, and it may also serve as a point of entry to the building operators. Once they have received the training, the building operators may seek incentives to support some of the improvements that they would like to make.

Finally, property owners and managers of different sizes likely present different opportunities for PSE's programs. Service providers indicate that the **largest property owners and managers** have already implemented many of the measures with the shortest payback cycles. Additional opportunities in this segment will have longer payback periods and may not meet the thresholds currently established by these firms. One option is to help make connections between ESCOs and office property managers and owners to help overcome this barrier. Alternatively, PSE may consider leveraging the benchmarking requirements (as described earlier) to make the business case for going deeper with the energy efficiency investments in this segment.

On the other hand, **mid-size office property owners and managers** likely have significant opportunities for projects remaining. Service providers did not indicate that this segment had been targeted as heavily as the largest segment of the market. In fact, one service provider indicated that it was targeting mid-size office buildings (three to ten stories) because of the opportunities in this sector. PSE could work more directly with the property owners and managers in these mid-size buildings to increase awareness of PSE's incentives and to connect them with service providers.

2.3.2.2 Public Sector

The public sector represents a possible target for additional targeting for PSE but not the strongest of those explored for this project. The dynamics differ at the state and local levels:

- More state government agencies (54 percent) report the intention to invest capital in their facilities in the next two years than local governments (28 percent).
- Local governments (96 percent) report higher levels of owner occupancy than state governments (29 percent).
- State governments represent a better market for upgrades across the three major technology categories (lighting, air conditioning, and data centers) than local governments.

[91] NEEA has used this estimate for its Long-Term Monitoring and Tracking (LTMT) efforts in the past. The 2011 LTMT effort will seek to refine this estimate through surveys with program participants and non-participants.

Public Sector
• Mixed results for state and local governments but neither warrants top-tier attention • Determine extent to which funding allocated for SB5854 • Market to ESCOs approved by GA • Leverage RCM program for knowledge on deeper opportunities

Additional targeting of the public sector should proceed with caution in regard to the availability of capital. ARRA funds drove the recent boom in energy efficiency in this sector over the past two years. The legislature passed the state's capital budget for the 2011-13 planning period, but it is not clear whether or not it directed funding at meeting the energy goals established in SB 5854. At the same time, local governments are struggling to maintain their credit ratings and may not have the bandwidth to either raise capital themselves or to take on additional long-term liabilities in the form of loans or capital (e.g., on-balance sheet) leases.[92] There is some uncertainty about the rate at which this sector will continue to adopt additional energy efficiency projects in the coming years.

In the event that these issues are resolved, PSE may consider partnering with the GA's program for approving ESCOs. PSE may consider distributing material or holding training for the approved ESCOs to familiarize them with PSE's offerings. Although many of the ESCOs currently approved already participate in PSE's programs, several mentioned that it is difficult to keep up to date with the changes in incentives. Increasing engagement even modestly may go a long way towards increasing participation in the programs.

Further, PSE may leverage the expertise developed by participants in and staff of the RCM program. The proximity in which this program works with public sector customers provides access to information and insights that are not as widely available in the other priority sectors. Hosting focus groups or leveraging personal relationships may provide deeper insight into the approaches used to target this sector.

2.3.2.3 Hospitals

Hospitals represent the strongest opportunity for energy efficiency upgrades among the four sectors identified because of the economies of scale and favorable investment conditions. They **universally own and occupy** their facilities, and their large facilities provide fertile ground for identifying bundles of measures at one facility. Nearly 90 percent of hospitals have plans to invest capital in their facilities in the next two years, which implies that funds may be available for energy efficiency.

Like the office sector, PSE can achieve deeper penetration of energy efficiency by targeting the **concentrated ownership** in the hospital sector. Ownership of hospitals is concentrated among a relatively small number of organizations, creating opportunities to reach multiple facilities with outreach to a single entity. Connecting with these few entities will require a deep understanding of decision-making processes at hospitals and the priorities that drive those decisions.

[92] U.S. EPA. October 2008. "ENERGY STAR Building Upgrade Manual." Environmental Protection Agency. (http://www.energystar.gov/ia/business/EPA_BUM_Full.pdf)

Opportunities in the hospital sector can leverage previous efforts at NEEA and existing industry partnerships. The **strategic energy management plans** that hospitals have developed through these initiatives provide a head start for working with this sector. Many of the hospitals in PSE's service territory have already completed these plans. If PSE does not already have a list of these hospitals, PSE may consider working with NEEA to obtain this list to facilitate marketing efforts. Several service providers indicated that they are already targeting this sector, but more may choose to do so if they are aware of the planning that this sector has already completed. PSE may work to raise awareness about these efforts among the service provider community; PSE may consider working on its own or in conjunction with its neighboring utilities and the E2C initiative.

Hospitals

- Strongest opportunity among four sectors
- Create outreach approaches that leverage strategic energy management plans
- Target hubs of ownership
- Coordinate with existing efforts: E2C

Further, hospitals report significant opportunities across several technology categories. **About 84 percent of respondents indicate opportunities to retrofit their air conditioning units**, with central chillers receiving the most attention. More than half (55 percent) report opportunities to retrofit lighting, with the replacement or installation of new fluorescent fixtures the most popular option. A similar number report opportunities to upgrade on-site data centers.

Since the sector is already aware of energy efficiency as an opportunity, a practical approach to overcoming common hurdles may help to create implementation opportunities; case studies that demonstrate other hospitals' approaches to overcoming those hurdles would provide one approach to doing so. Other approaches may include leveraging the expertise of trade allies or an industry veteran to communicate the success stories or to troubleshoot at the organizational level. PSE may also consider addressing the sector's low level of awareness about the role of energy costs in overall facility operating costs through education and deeper engagement on the strategic energy management plans.

2.3.2.4 Food Processing

The food processing sector is poised for further engagement with PSE. This is a high-potential market because the **industry itself is creating the demand** for additional energy efficiency investment. The sector's energy use intensity reduction goals create the point of entry for PSE, and individual firms' strategic energy management plans create key starting points for discussion. More than half of food processors report having participated in PSE programs in the past, providing a strong foundation for soliciting deeper participation in the future. PSE's outreach efforts may focus on approaches to achieving the goal at the industry level as well as those goals established by individual firms.

Further, the food processing sector **has the economic motivation and the economic resources available** to invest in energy efficiency. More than half of food processors report that **energy costs represent six percent or more of their overall operating costs**, meaning that reductions in energy efficiency translate into bottom-line benefits. Since **financial returns are the primary driver for energy efficiency investment**, this noticeable effect on the bottom line strengthens the case for energy efficiency. Since they tend to own their own facilities (nearly three-quarters do), they reap the benefits of investing in energy efficiency in their own facilities. Further, about **three-quarters of food processors indicate that they will invest capital in their facilities in the next two years**. Together, these financial motivations create an investment environment that is amenable to energy efficiency.

Food Processing
• High-potential market • Help industry meet NWFPA's EE goals • Target CEI program participants • Address sector-specific needs: food processing technologies, seasonal nature of the industry

The food processing sector has identified opportunities for additional investment in energy efficiency. Nearly 20 percent of respondents identified opportunities for future lighting retrofits across a suite of technologies, and 45 percent identified replacements of standard incandescent with LEDs as a remaining opportunity. Over **80 percent** of respondents indicated the **opportunity for retrofitting at least one food processing-specific technology**; process refrigeration/freezing and materials handling/conveyor motors were the two categories listed most frequently.

Engaging more deeply with NWFPA is a natural first step. It represents about one-quarter of the food processing facilities in the region and has the relationships and stature in the industry to create opportunities for PSE. If PSE is not already a **Supplier member** of NWFPA, PSE may consider joining in this capacity; such a membership would provide PSE with access to the membership lists, which include both facilities and service providers. These lists could help PSE further target its market efforts. The partnership with NWFPA may include efforts to **promote the pilot projects** that NEEA and its partners completed.

If PSE chooses to make the food processing sector a focus, PSE may emphasize the importance of **enhancing internal expertise** on the structure and decision making within this industry. The seasonal nature of the food processing industry creates unique challenges not faced in the other priority sectors. Developing strategies to overcome the challenges to capital allocation and to the sales cycle would support energy efficiency efforts in this sector and strengthen relationships with service providers.

3 Process Evaluation

This section discusses Navigant's process evaluation methodology, findings and recommendations regarding the efficiency and effectiveness of PSE's Schedule G205, E250, E257 and E 258 programs.

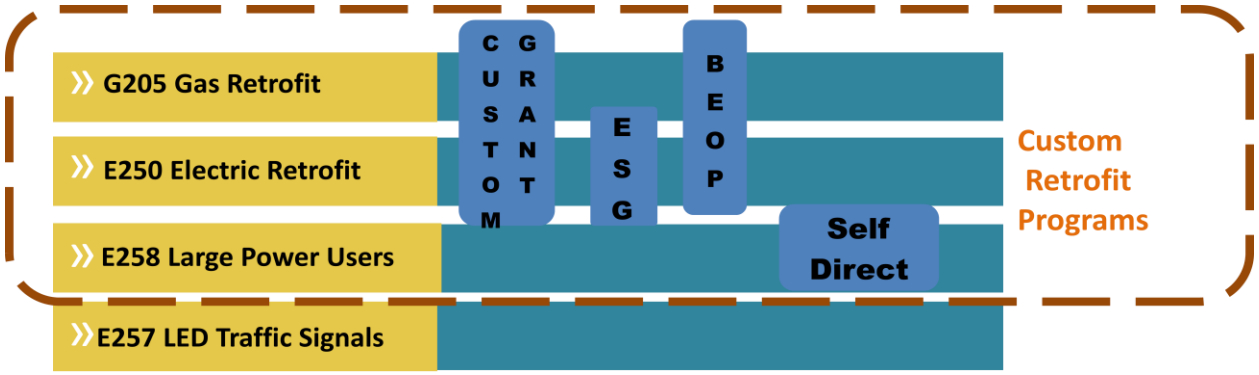
3.1 Methodology

This process evaluation is designed to provide PSE with the information that it needs to enhance its C&I EE retrofit programs' design, marketing and delivery processes and to enable PSE to increase the savings achieved through its C&I retrofit programs. This evaluation effort encompasses the four schedules – G205, E250, E257, and E258 - but is structured around how the schedule-funded programs are designed and delivered to customers. Specifically, Navigant's process evaluation assesses the following five programs, some of which match one-to-one the funding schedule and some of which overlap multiple schedules:

- Custom Grant Program
- EnergySmart Grocer (ESG) Program
- Building Energy Optimization Program (BEOP)
- Large Power User Self-Direct (Self-Direct) Program
- LED Traffic Signals Program

The overlap between the funding schedules and the customer facing programs are depicted in Figure 3.1.

Figure 3.1. PSE Custom Retrofit Programs and Funding Schedules Evaluated by Navigant

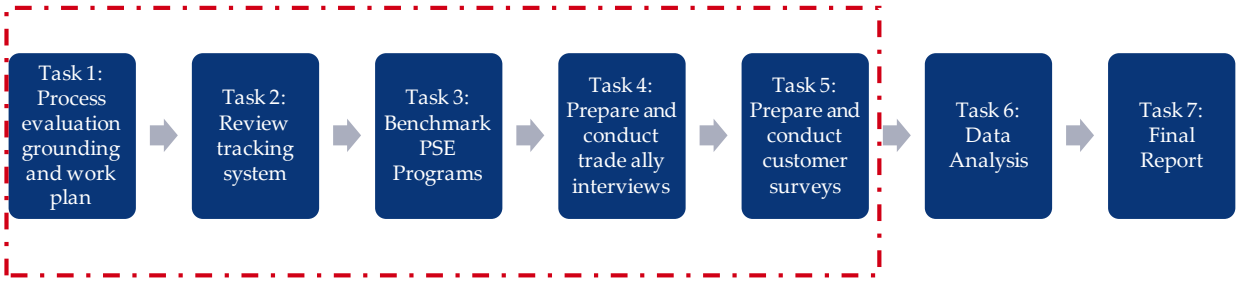


The process evaluation addressed the following key research questions regarding these programs:

- Are the programs being operated effectively and efficiently?
- How can the programs' operations and impacts be enhanced?
- How can underserved customers be better reached?
- How can deeper savings best be obtained?
- What levels of free-ridership and spillover are occurring?

The process evaluation relied on five key data collection activities, which are shown in Figure 3.2 and discussed in the balance of this section. The five data collection steps include PSE staff interviews (included in Task 1 Process evaluation grounding), logic model development (also in Task 1), participant data mining (part of tracking system review), PSE program benchmarking against peer programs, trade ally in-depth interviews and customer surveys. Navigant expanded the planned data mining beyond participant data to include some analysis relative to PSE's entire C&I customer population, although this effort was not included in the original work plan.

Figure 3.2. Process Evaluation Activities



In addition to addressing the above research questions, Navigant has strived to enumerate specific opportunities by which PSE may enhance its efforts to generate additional savings through these programs. This report details actionable recommendations for PSE staff using the Process Evaluation Team's data collection efforts and analysis to support the recommendations.

3.1.1 Program Management In-Depth Interviews and Document Review

Navigant interviewed twelve PSE staff as well as a director of PECI's EnergySmart Grocer program. PSE staff interviewed included engineering staff, program managers and four marketing and sales staff representing major account executives, business segment managers, marketing communications and Energy Advisor staff. These interviews supplemented impressions drawn from program documents and informed the logic models that Navigant developed (Appendix E). In turn, the logic models shaped

subsequent staff interviews as well as the interview and survey guides for trade allies and customers. These interviews also provided input to Navigant's tracking system review.

Perhaps most importantly, the staff interviews provided input on potential issues and opportunities related to program design and delivery, as well as the history and fundamental understanding of the programs' present status. This initial input regarding potential issues and improvement opportunities helped shape Navigant's subsequent research.

3.1.2 Mining of the Program Tracking System and Commercial and Industrial (C&I) Customer Database

Navigant obtained data extracts for the four funding schedules from PSE's program tracking systems to glean information about the programs' performance and activity. Navigant subsequently requested both an extract and an analysis (by rate schedule) of the C&I customer database to assess the two years' program participation and savings relative to PSE C&I activity as a whole. Navigant cleaned and mapped the program tracking data on participants and trade allies. Some targeted data was not available from the databases, but the quantity of missing data was limited and did not affect the quality or reliability of the findings.

Mining of the 2009/2010 program data and the C&I customer database provides a two-year snapshot of how the program is doing in attracting participation and garnering savings. This analysis drilled down to assess *premise* level participation by consumption tier (based on rate schedules) and business type (based on NAICS codes in the C&I customer database.) It also reviewed the custom retrofit activity from a range of perspectives: premise type participation, measure type and quantity implemented, average project size, incentive amount and cost per first year kWh saved, and trade ally activity. Several of these metrics were analyzed at the program level. Navigant's draft data mining results memo is attached as Appendix F.

PSE's programs in most cases have been running for a number of years consistently meeting or exceeding savings targets. . The program data analyzed for this report only covers two years and therefore does not reflect full program saturation. This analysis does, however, provide a picture of two years' activity and the approximate current annual savings rates, which have predictive value for future years if no programmatic changes are made.

3.1.3 Benchmarking of Best Practice and Regional Electric and Gas Utilities

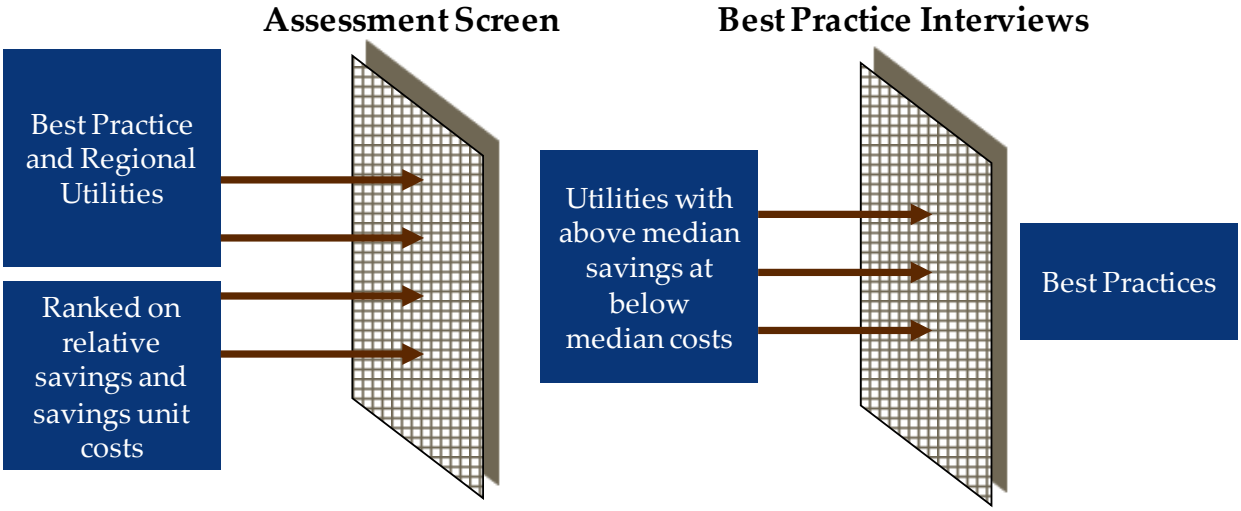
Navigant collected published 2009 data on regional electric and gas utilities' C&I EE programs as well as utility programs previously identified by Navigant as best practice utilities at the C&I EE program *portfolio* level. The team collected data on C&I DSM program spending, savings from C&I DSM programs and total utility C&I electricity and gas consumption and revenues. Savings *costs per first year kWh and Therm* were broken down by incentive and non-incentive spending where available. The team also collected data on average per kWh and Therm *retail rates* to understand the energy cost environment for the utility's customers.

The benchmarked utilities were then ranked based on a combination of their 2009 C&I program cost per first year kWh saved and percent C&I program savings relative to total C&I kWh or Therm

consumption. The top performing utilities generated above average savings at below average first year cost per kWh or Therm saved. Based on these rankings, Navigant staff then interviewed higher savings/lower cost custom retrofit, Smart Grocer and commissioning program operators to learn about their programs and about other programs they had in place to achieve the deeper savings at lower cost. (Figure 3.3).

Navigant has also drawn on its experience with other utilities to highlight other best practices that could prove useful to PSE. The draft benchmarking and best practices report is provided in Appendix G.

Figure 3.3. Navigant Utility EE Program Benchmarking and Best Practices Development Approach



The team recognizes that program comparisons are not always apples-to-apples. While Navigant's reported program savings are adjusted to reflect gross values at the generator, there are many other variables that cannot be adjusted to make the savings or costs more comparable. Energy codes vary and with them the associated savings from any measure. In addition, how utilities account for DSM program costs varies. Some programs have greater relative funding, while others have been operating longer, with the attendant benefits and challenges. *This benchmarking analysis is not designed to pick winners and losers, but rather to identify utilities and programs that may be garnering more savings with less funding and in turn may have an approach that will enable PSE to do more with their current funding and staffing.*

3.1.4 In-depth Interviews with Trade Allies

The Navigant Process Evaluation team conducted in-depth interviews with 25 trade allies as detailed in the Team's memo "Process Evaluation – Approach to Sampling Trade Allies" dated March 25, 2011. (Appendix H) Over a one-month period spanning April and May 2011, Navigant interviewed 25 trade allies as detailed in Table 3-1.

Table 3-1. Composition of C&I Custom Grant Trade Ally Interviews

Trade Allies	Stratification	Number of Interviews (25 Total)
Most Active	By type for coverage	7 participants
Moderately active	By type	6 participants
Least Active	By type	4 participants
Commissioning	Most active and inactive	3 participants/2 inactive qualified agents
EnergySmart Grocer	Most active	3 most active participants
Not active	Targeted by sector	None

Navigant attempted to identify and interview inactive trade allies but was unable to identify any credible candidates. Virtually all trade allies contacted either participated in PSE's programs or were not active in the commercial or industrial sectors. Over 500 trade allies participated in PSE's custom retrofit programs over the past two years, suggesting that the majority of those trade allies qualified to participate are already active. BEOP providers were one exception to this rule and Navigant conducted two interviews with those inactive agents. In place of the planned non-participating trade allies, Navigant interviewed additional active trade allies. PSE reviewed and commented on the Team's interview guide (Appendix I)

The *trade ally interviews* were designed to obtain the following:

- Feedback on delivery strategy, target market, eligible measures, incentive structure, grant process, spillover and other program aspects.
- Perceptions of the programs' design and delivery effectiveness and efficiency.
- Input on how they promote (or can promote) each program they are involved in and their motivation(s) for participating or not participating.
- Comments on whether/why some of their customers are not interested in participating and what can be done to increase participation levels.
- If the trade allies are not marketing PSE's programs to some of their customers, why that is the case.

Navigant analyzed the 25 trade ally interview results and key findings are conveyed in more general terms such as "many", "a few" or "most". In-depth interviews by their nature are not designed to provide statistical data but rather to investigate individual trade ally views of the program. Follow up questions in the trade ally interviews were shaped by the quantitative findings from the other research streams along with prior experience with C&I custom retrofit programs.

3.1.5 Customer Surveys

The customer survey of the Process Evaluation Team's review of PSE's custom grant programs involved obtaining feedback from program participants, partial participants (customers who started but did not complete the program process to obtain a grant) and non-participants (customers who did not participate in the two-year period evaluated, 2009 and 2010.) This customer feedback is useful primarily in addressing a particular subset of the overarching process evaluation questions, specifically in the following areas:

- Assessing participant satisfaction with the programs
- Identifying areas with opportunity for improved efficiency
- Understanding key barriers to program participation
- Highlighting potential foci for market and outreach strategies and messages

PSE program management identified light manufacturing and commercial real estate firms as potentially underserved customer segments. Where sensible, the team's findings break out responses from these two customer types. Because the sample sizes of these two customer types are quite small, their findings should be considered qualitative and additional research may be warranted.

As detailed in the evaluation team's sampling approach memo (Appendix H), feedback was qualitatively stratified to reflect different customer types, sizes, and activity levels in line with the PSE program management perceptions of underserved customer groups and underperforming programs. In addition, findings specific to different programs funded by the same schedule have been collected separately where the program processes are different, such as the EnergySmart Grocer (ESG) and Building Energy Optimization Program (BEOP).

Navigant's analysis first extracts the findings from each of the research streams and then weaves together the findings and conclusions from all of them to create a full-faceted view of PSE's custom retrofit programs' efficiency and effectiveness.

3.2 Findings

The process evaluation findings in this report are organized around both the four Schedules and five programs funded by the Schedules since *process evaluation has a number of components which are program-specific*. This report is organized to first provide findings that apply to all five programs or to the custom retrofit programs in aggregate, looking at electric and gas findings separately. Then program-specific findings are provided for the following programs and schedules:

» Custom Grant Program Without ESG and BEOP

» ESG Program

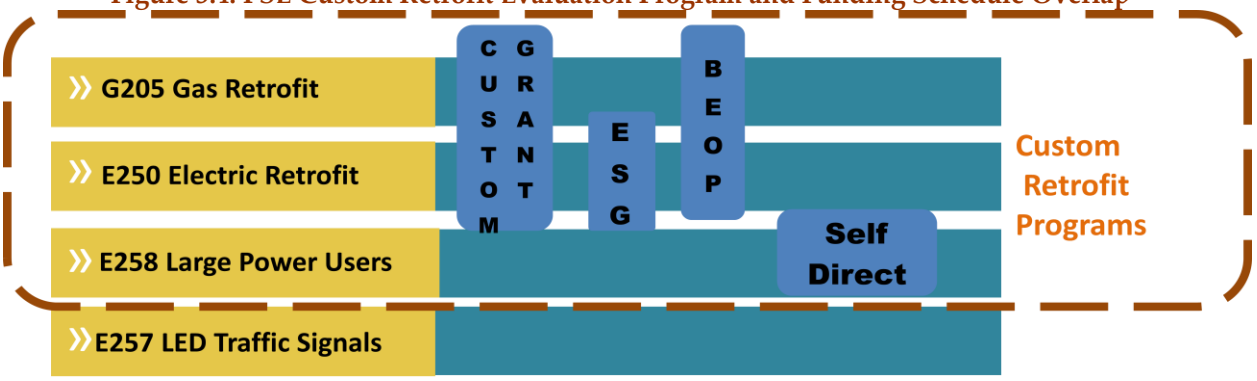
» BEOP

» Self-Direct Program/Schedule 258

» LED Traffic Signals Program/Schedule 257

Figure 3.4 presents for reference again the schematic of the overlay of programs and schedules. This schematic will also be provided to orient the reader at the beginning of each findings section.

Figure 3.4. PSE Custom Retrofit Evaluation Program and Funding Schedule Overlap



Appendices to this report include more detailed findings and conclusions from five of the process evaluation activities detailed in Figure 1 and listed below:

» Logic models

» Data-mining results memo

» Tracking system review memo

» Benchmarking and Best Practices report

» Customer feedback memo

The detailed findings and conclusions spelled out in those documents are not fully restated in this report. Instead, key findings and conclusions are extracted and integrated in a format designed to inform program-level recommendations. The documents in the Appendices provide significant additional detail.

The following sections are organized to present and integrate Navigant's findings for each program or group of programs. The specific research streams drawn upon will vary depending on the program, but will include a combination of the following seven as previously detailed:

» Custom program logic models

» Program database mining

- Program/C&I customer database mining
- Benchmarking and best practices research
- Program management and implementation staff in-depth interviews
- Trade ally in-depth interviews
- Customer surveys

3.2.1 Cross Cutting Findings

This section details findings that cut across all of PSE's gas and electric custom retrofit programs. The primary research activities that provided input to these findings include program benchmarking, tracking system review, data mining, trade ally in-depth interviews and customer surveys. The latter two activities provide input to the team's free ridership and spillover findings.

PSE's C&I Custom Grant program is designed to encourage existing C&I customers to use electric and natural gas efficiently by installing cost-effective energy efficient equipment and implementing energy efficient operations at their facilities. Through this program, PSE works with C&I customers to review energy consumption at the customer's facility and to assess cost-effective energy savings or fuel switching opportunities from equipment, building shell, industrial processes or O&M improvements. These services are provided on the customer's behalf and, where specified by the customer, are developed in conjunction with design engineers, contractors, and/or vendors.

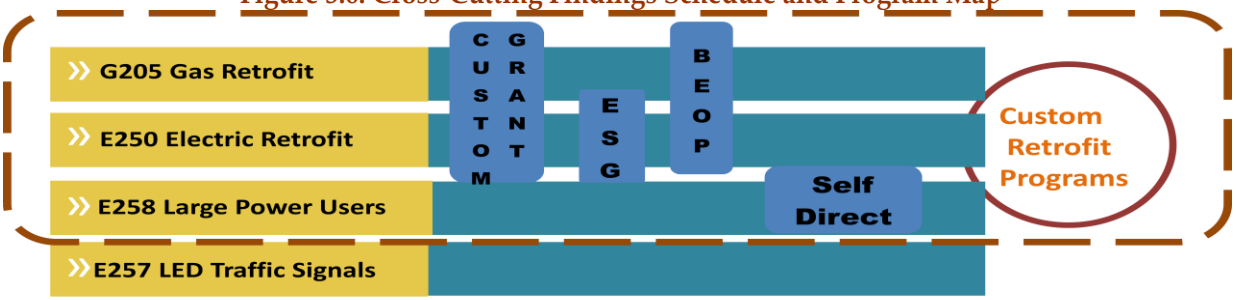
PSE's grant approval process has seven steps as show in Figure 3.5 below. PSE reviews third-party savings estimates and analyses and generates savings estimates. Where the project meets PSE cost-effectiveness funding criteria, PSE provides grants toward energy savings projects. PSE works with the customer to make sure financial decision-makers at the customer's facility are aware of the cost-savings opportunities. Upon notice of installation or implementation, PSE will verify the project as complete and operational, and issue payments to offset customer costs.

Figure 3.5. PSE Custom Grant Review Process

Findings presented here (Figure 3.6) span all of the custom retrofit programs and in some cases comprehend LED Traffic Signal program findings as well. All program data mining analyses include savings and participation from all four schedules. Some of the benchmarking findings cover just *custom retrofit program* comparisons, while others review *comparative C&I EE program portfolio* results. C&I

portfolio findings reflect combined program results from new construction, rebate, custom grant and others (like RCM). The first section, Section 4.2.1.1, covers only electric program results, while section 4.2.1.2 covers all gas results.

Figure 3.6. Cross-Cutting Findings Schedule and Program Map



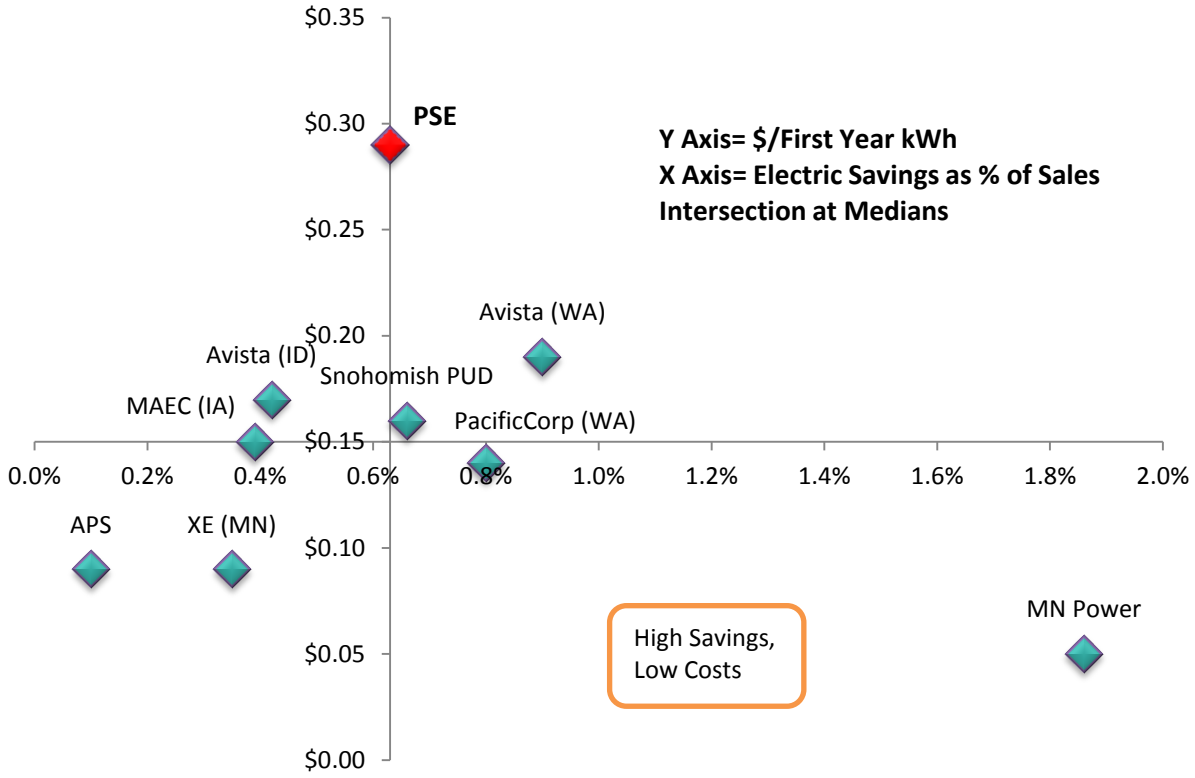
3.2.1.1 Overall Electric Custom Retrofit Program Performance

PSE clearly shows that, compared to the other benchmarked utilities, PSE is committed to supporting energy efficiency with its commercial and industrial customers. In 2009 PSE spent a higher percentage of its C&I revenue on DSM programs than all other benchmarked utilities except Seattle City Light.

In reviewing what PSE achieved with that spending, Navigant's benchmarking approach is to compare PSE's first year per kWh savings cost and first year savings volumes relative to total usage (to normalize for size) to comparable statistics for its peers. (This analysis does not incorporate any customer satisfaction ratings because they are not universally available.) Using Navigant's metrics, PSE's *electric custom retrofit programs* combined in 2009 were *relatively high cost* on a $/first year kWh saved and delivered *an average rate of savings relative to total C&I customer consumption*. Minnesota Power delivered the most savings at the lowest cost among the utilities benchmarked at the custom retrofit program level, though this comparison is somewhat apples to oranges since MN Power's "custom" program aggregates prescriptive, RCx, custom and Self-Direct components. Regionally, and more apples to apples, PacifiCorp Washington and Avista Washington delivered more savings as a percent of total consumption at lower first year cost than PSE. Seattle City Light program data are not available, while Snohomish's costs reflect only incentive.

Note that the two axes in Figure 3.7 cross at the point of average cost and average savings for the benchmarked utilities. Consequently, the lower right quadrant is the area where high savings/low cost utilities are mapped.

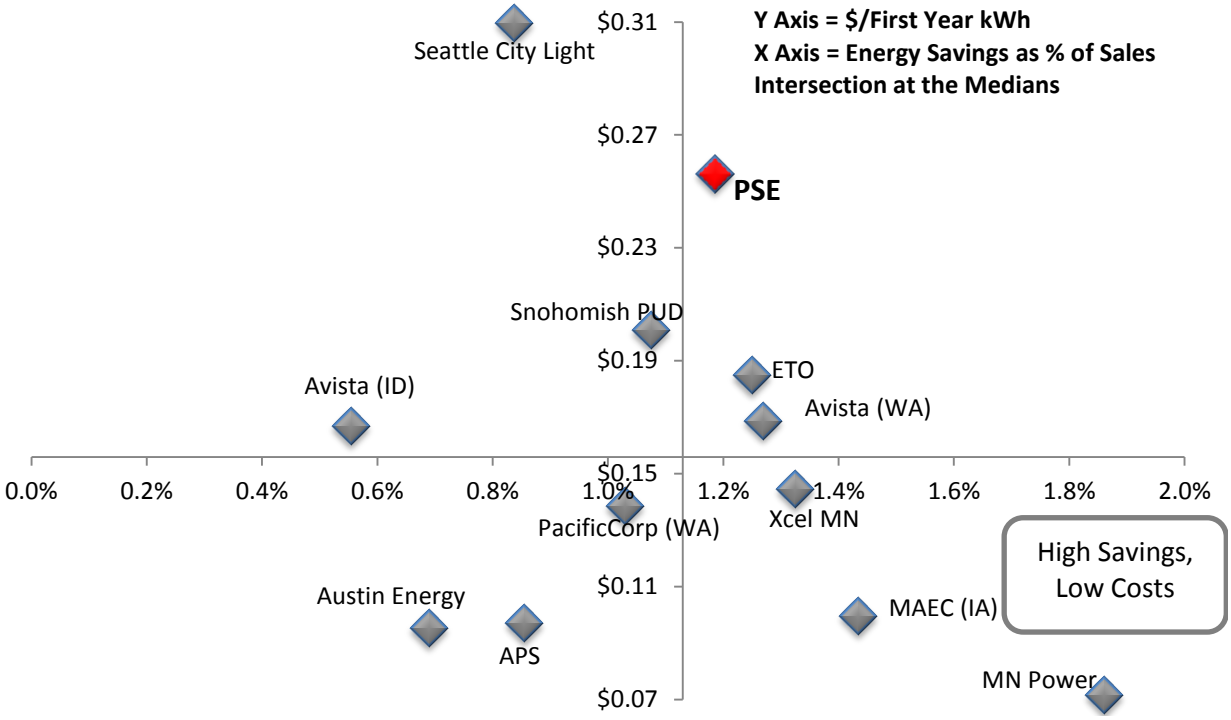
Figure 3.7. 2009 Electric Custom Retrofit Savings as % of Sales and Cost of First Year Savings, $/kWh



Note: Snohomish PUD's costs reflect only incentives. Seattle City Light detail not available.
Sources: See References at end of this report. Navigant analysis.

This pattern of relatively high cost per first year kWh and about median savings holds as well at the *overall C&I program portfolio level*. As with the custom program comparison, Minnesota Power has the highest savings at lowest cost, while both Avista Washington and PacifiCorp Washington – as well as Energy Trust of Oregon— appear to achieve higher savings at lower cost (closer to the lower right quadrant) than PSE. Again, Snohomish's data reflect only incentives. (Figure 3.8)

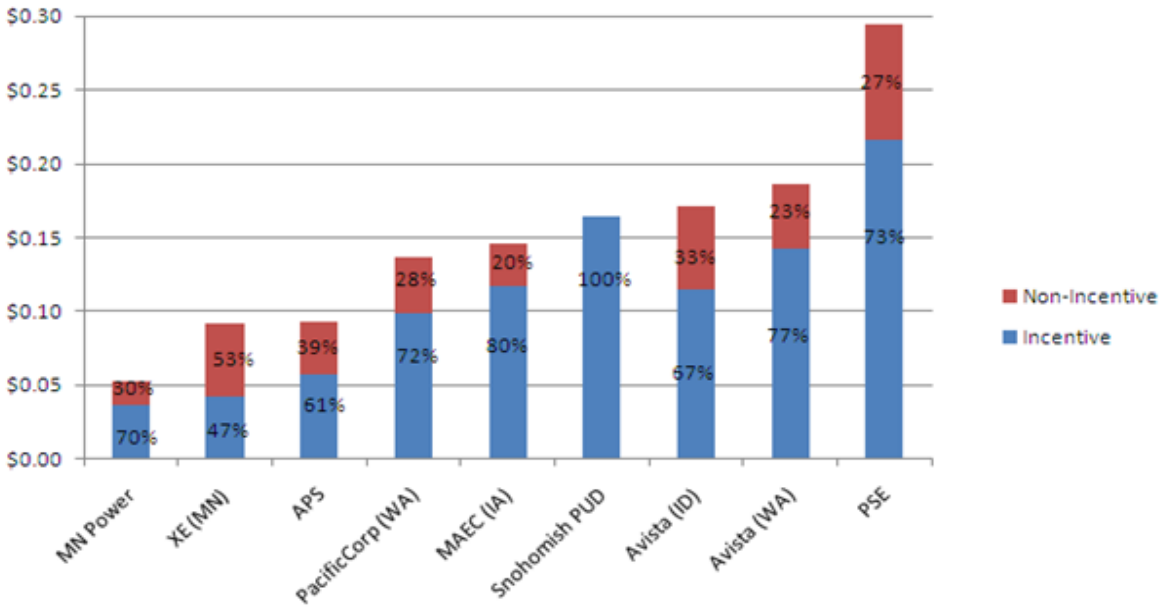
Figure 3.8. 2009 C&I Portfolio Energy Savings as % of Sales & Cost of First Year Energy Savings, $/kWh



Note: Snohomish PUD's costs reflect only incentives. Sources: See References.

PSE's per first year kWh spending is dominated by incentive costs, which are higher than all other benchmarked utilities total cost per first year kWh saved. (It should be noted that this data is not available for Seattle City Light, while Snohomish's costs only reflect incentives.) PSE's proportionate spending on administrative costs is among the lowest per first year kWh saved. (Figure 3.9).

Figure 3.9. Custom Retrofit Program Spending per First Year kWh Saved



Note: Snohomish PUD's costs reflect only incentives. Seattle City Light detail not available.
Sources: See References at end of this report.

3.2.1.2 Overall Custom Retrofit Program Electric Customer Segment Penetration

The previous sub-section's benchmarking analysis provides a view of comparative performance *across* utilities. Navigant's mining of program and customer data provides a view *within PSE and across PSE's customers by size and business type.* Specifically, Navigant used PSE's data to assess the relative rates of participation and savings as a percent of *all segment* customers and all segment kWh sold. These analyses are conducted at the **premise** level because of the complexities of defining customers. Customers and premises are used interchangeably to refer to premises.

Table 3-2 below details the custom retrofit program participants *by their rate schedule* and *compares the percentage of participants by schedule to PSE's C&I customer base as a whole.* PSE's electric custom retrofit program **participation** as a percent of total PSE C&I customers totaled about 1% of premises during 2009 and 2010. As would be expected with a custom grant program, smaller customers participated at a lower rate relative to total customer premises of comparable size. (Table 3-2) PSE's electric customer participation ranged from 0.3% of customers with demand less than 50 kW to 29% on average for customers with over 3 MW load and those on high voltage general service. Retail wheeling customers participated at a relatively low 6% rate over the two years.

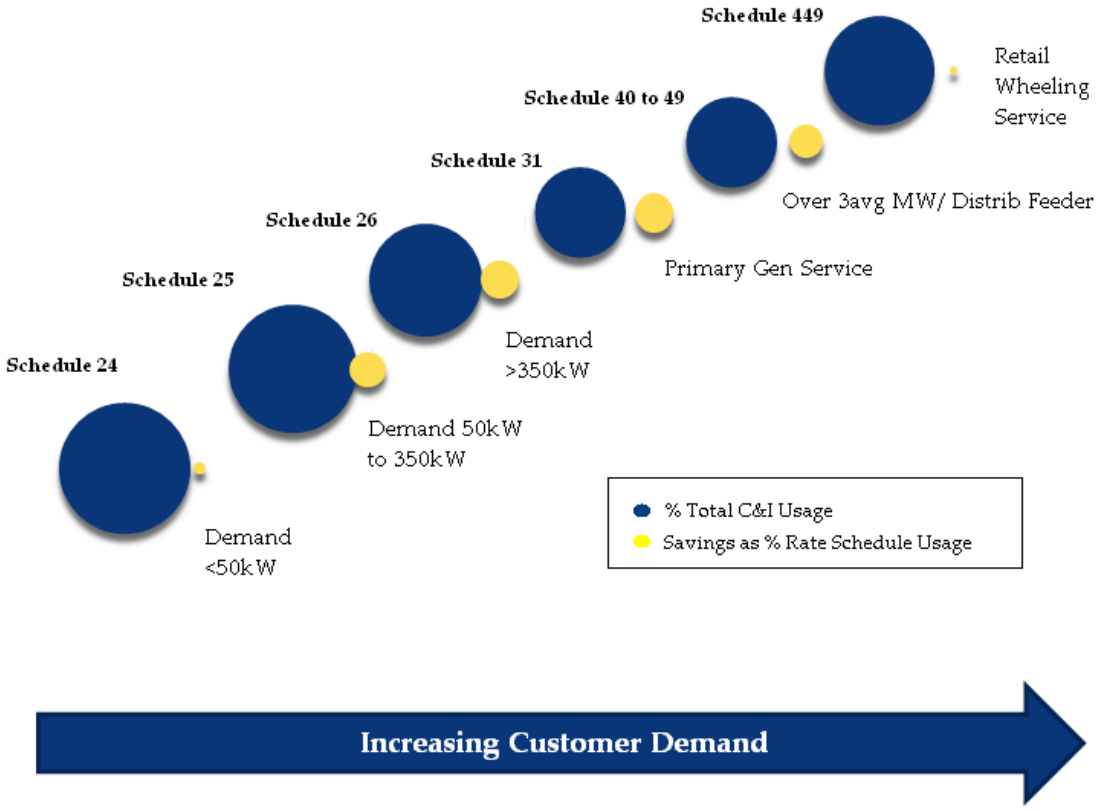
Table 3-2. C&I Electric Participation by Rate Schedule/Demand Tier (Premise level)

Rate Schedule	Service Description	Participants % Total	Premises % Total	Participants % Premises
24	**Demand < 50 kW**	24%	93%	**0.3%**
25	**50 kW < Demand < 350 kW.**	49%	5%	**9%**
26	**Demand > 350 kW**	13%	0.6%	**22%**
31	**Primary general service**	5%	0.4%	**14%**
40 to 49	**40: over 3 average MW/distribution feeder** **49: High voltage general service**	7%	0.2%	**29%**
449	**Retail Wheeling Service**	0.1%	0.01%	**6%**
Other*		1%	-*	**-**
Total		100%	100%	**1.0%**

Source: PSE program tracking system and PSE staff (Mei Cass) input; n= 1,356 participants and 131,457 customers. * Excluded from the analysis.

Electric program savings for the two years totaled 1.2% of 2010 consumption overall, or an average of 0.6% annually. (Figure 3.10) Segment specific savings levels for the custom retrofit program ranged from limited (0.1%) for retail wheeling customers to most significant (2%) for primary general service customers and customers with average monthly peak demand greater than 350 kW.

Figure 3.10. C&I Electric Savings by Rate Schedule Relative to Consumption



Source: PSE program tracking system and PSE staff ((Mei Cass) input.

Navigant then analyzed separately *large and small customer participation by business type*. As shown in Figure 3.11, PSE's custom retrofit programs have achieved overall large electric customer/premise penetration of 22% during 2009 and 2010 combined, and over 20% penetration of four customer types: retail trade (32%), information (27%), real estate/rental/leasing (23%) and other services (except public admin) (23%). As shown in Table 3-3, of PSE's large electric customers that account for more than 10% of the total large premise count, only two have below 20% participation over the two years: manufacturing (14%) and educational services (17%). While the former had been identified by PSE staff as a potential opportunity, educational services is rather a surprise given the high level of customer spending in that sector due to the availability of federal stimulus funds. This likely reflects the premise level analysis; whereas the customer may have participated, not all premises were retrofitted.

Table 3-3. Large C&I Electric Customer/Premise Participation by Type

Customer Type	Participants	Premises	Participants % Premises
	% Total		
Accommodation and Food Services	1%	2%	**8%**
Agriculture, Forestry, Fishing and Hunting	1%	2%	**8%**
Arts, Entertainment, and Recreation	1%	2%	**14%**
Construction	1%	2%	**16%**
Educational Services	12%	17%	**16%**
Health Care and Social Assistance	2%	4%	**11%**
Information	9%	7%	**27%**
Manufacturing	11%	14%	**17%**
Other Services (except Public Admin)	2%	2%	**23%**
Public Administration	3%	5%	**11%**
Real Estate and Rental and Leasing	5%	5%	**23%**
Retail Trade	18%	12%	**32%**
Transportation and Warehousing	1%	3%	**8%**
Utilities	1%	3%	**9%**
Wholesale Trade	2%	3%	**20%**
Others	14%	15%	**19%**
No match with customer database	13%	-	**-**
Total	97%	97%	**22%**

Navigant also assessed PSE's smaller customer (Schedule 24 and 25) participation in the custom retrofit program, though clearly the program is unlikely to target many of these customers other than national chains. Not unexpectedly, penetration of smaller customers/premises is a much lower 0.8% over the two year period, ranging from 0.1% to 3% (Table 3-4). PSE achieved 3% small customer participation in two segments, accommodation and food services and retail trade, both segments with significant national chain presence.

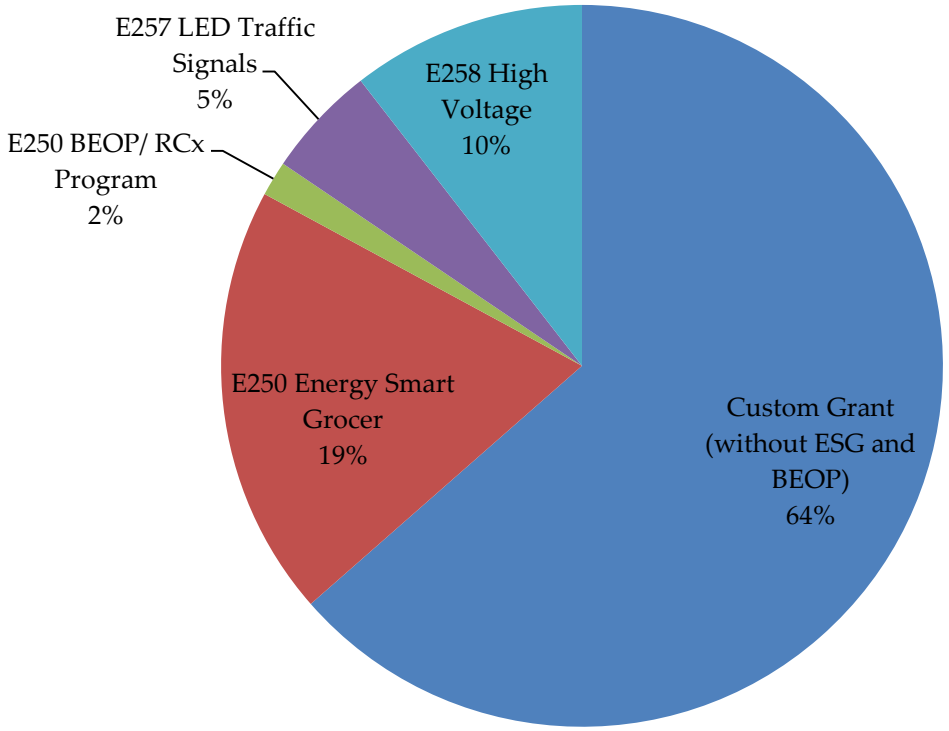
Table 3-4. Small C&I Electric Customer/Premise Participation by Type

Customer Type	Participants	Premises	Participants % Premises
	% Total		
Accommodation and Food Services	12%	4%	**3%**
Admin, Support and Waste Mgmt	1%	2%	**0.3%**
Arts, Entertainment, and Recreation	2%	2%	**1%**
Construction	1%	4%	**0.2%**
Finance and Insurance	4%	2%	**2%**
Health Care and Social Assistance	2%	4%	**0.5%**
Information	1%	3%	**0.2%**
Manufacturing	7%	4%	**1%**
Other Services (except Public Admin)	4%	12%	**0.3%**
Professional, Scientific, and Technical Services	1%	3%	**0.2%**
Public Administration	4%	4%	**1%**
Real Estate and Rental and Leasing	4%	12%	**0.3%**
Retail Trade	24%	7%	**3%**
Transportation and Warehousing	2%	2%	**1%**
Utilities	1%	4%	**0.1%**
Wholesale Trade	3%	2%	**1%**
Others	17%	27%	**1%**
No match with customer database	3%	-	**-**
Total	92%	97%	**0.8%**

Source: PSE program tracking systems and customer database. n= 995 small participants and 121,732 small customers.

The following discussion relates to analysis only of the program databases and does not include any references to C&I customers overall. Drilling down within *total custom retrofit program savings alone (the four schedules evaluated by Navigant)*, Schedule E250 accounts for 85% of total program kWh savings, with Schedule E258 accounting for an additional 10%. (Figure 3.11)

Figure 3.11. C&I Custom Retrofit Program kWh Savings: 2009 and 2010

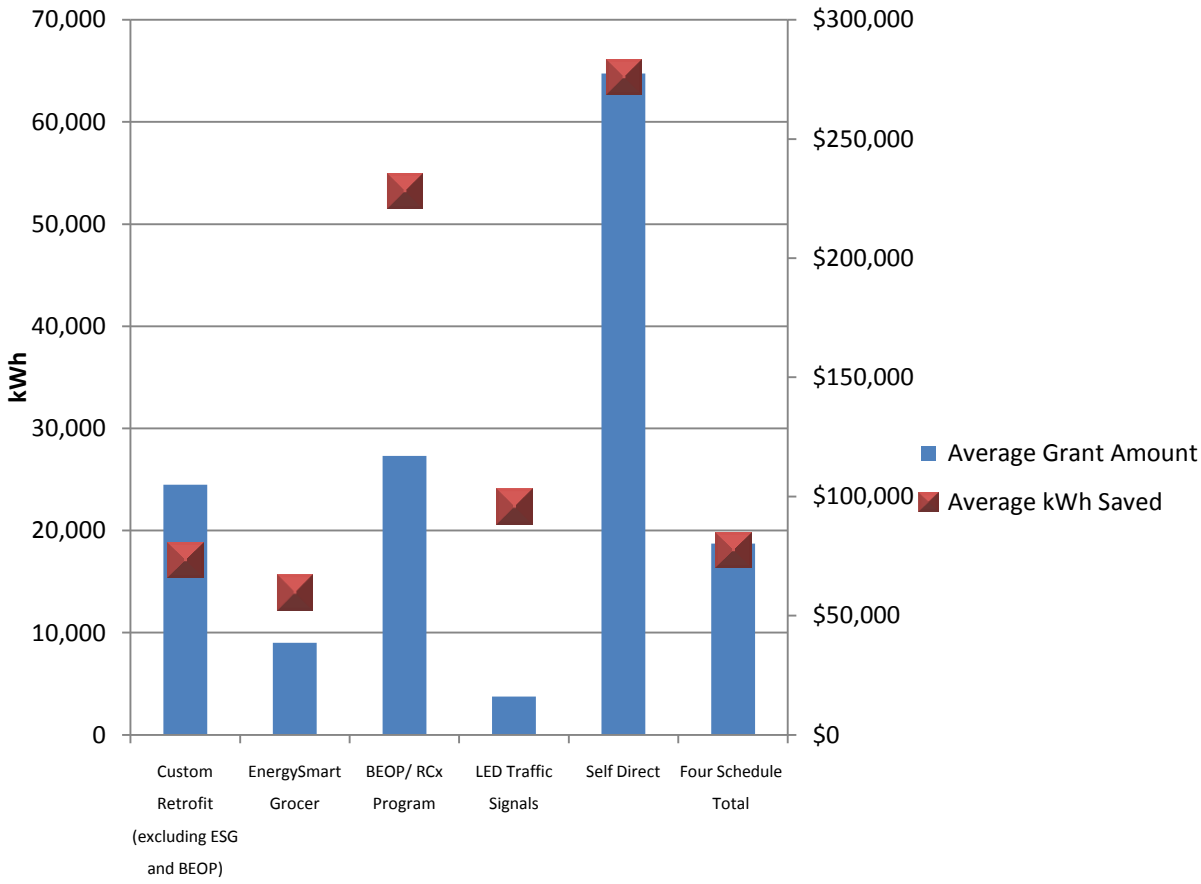


Total two-year savings for PSE DSM programs = 160.3 GWh

Source: CSY Master Database, May 18, 2011.

Schedule E258 Self Direct projects have both the highest average grant amount and the greatest average (first year) kWh saved per project, though BEOP projects are not that much smaller in terms of kWh saved. (Figure 3.12)

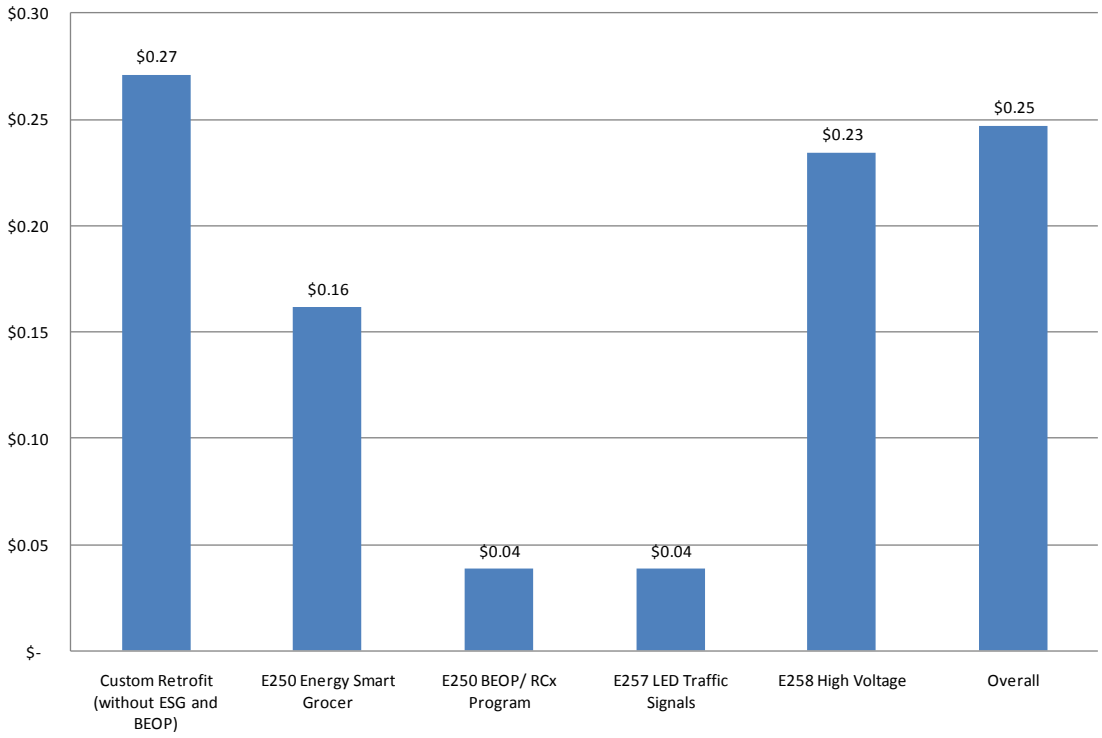
Figure 3.12. Custom Retrofit Program Average per Project Grant Amount and First Year KWh Saved



Source: CSY Master Database, May 18, 2011. Navigant analysis.

The average incentive cost per first year kWh saved in the programs evaluated was $0.25. LED Traffic Signal and BEOP incentives are the lowest cost per kWh. (Figure 3.13)

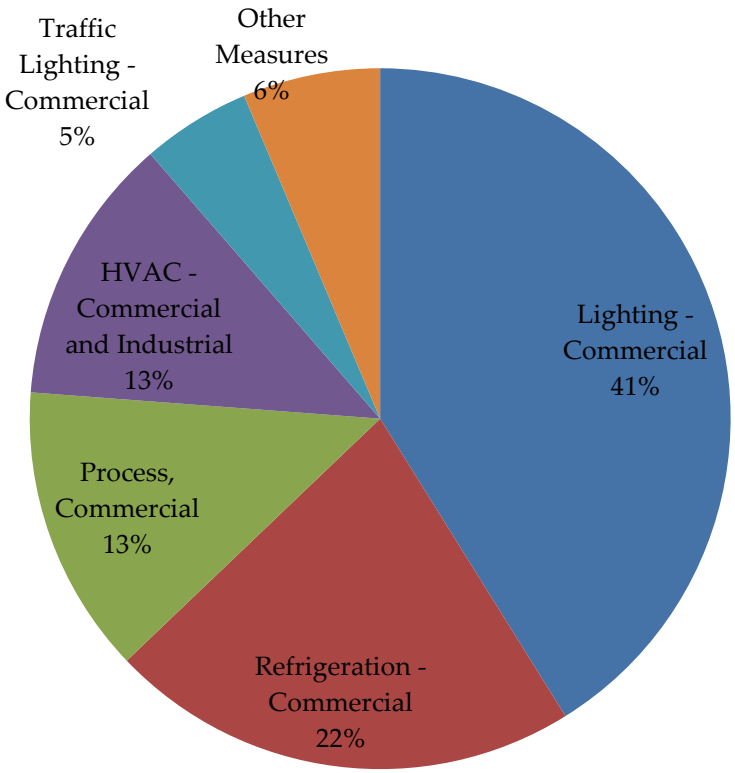
Figure 3.13. Custom Retrofit Program Average Incentive Cost per First Year kWh Saved



Source: CSY Master Database, May 18, 2011. Navigant analysis.

Approximately 80% of all measures incented by the custom retrofit programs are electric measures. Non-lighting measures accounted for 59% of total kWh savings during the two years, mostly refrigeration, followed by process and HVAC measures. (Figure 3.14)

Figure 3.14. Custom Retrofit Program kWh Savings by Measure

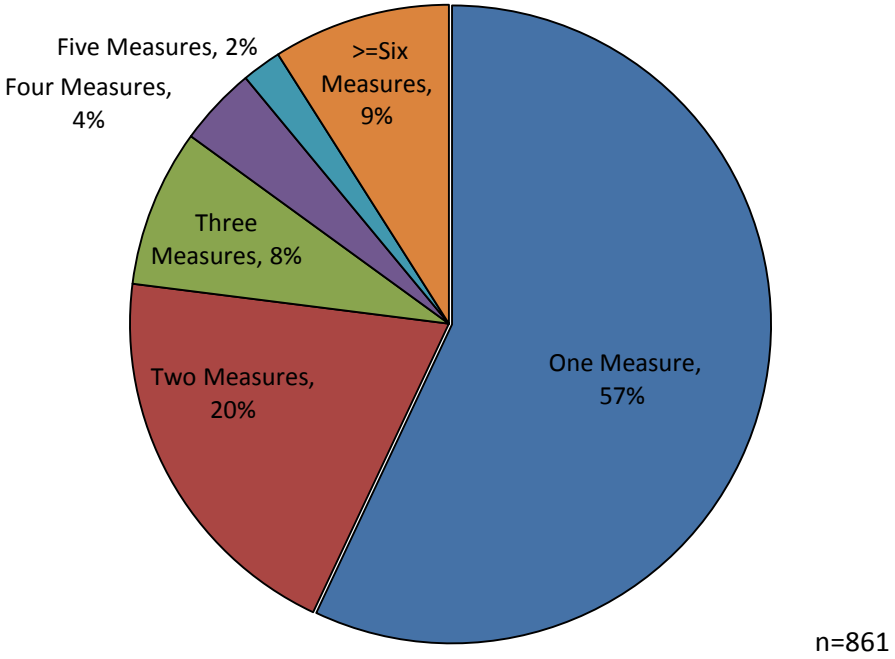


Total PSE Custom Retrofit Program Savings 2009-2010 = 160.3 GWh

Source: CSY Master Database, May 18, 2011.

For all the programs evaluated, 57% of participants implemented only one measure in the two years analyzed. At the other end of the spectrum, 9% implemented six or more measures during that period (Figure 3.15). It is highly likely that the current weak economic environment has resulted in more single-measure projects than would occur under more typical economic conditions.

Figure 3.15. Custom Retrofit Program Measure Frequency Distribution



Source: CSY Master Database, May 18, 2011. Navigant analysis.

Grocery stores, manufacturing and offices were the largest contributors to custom retrofit program savings, together accounting for 56% over the two year period. (Table 3-5) The least active sectors as measured by percent of total savings were restaurants, office/manufacturing and hospitals.

Table 3-5. Custom Retrofit Programs Participant Business Types: 2009-2010

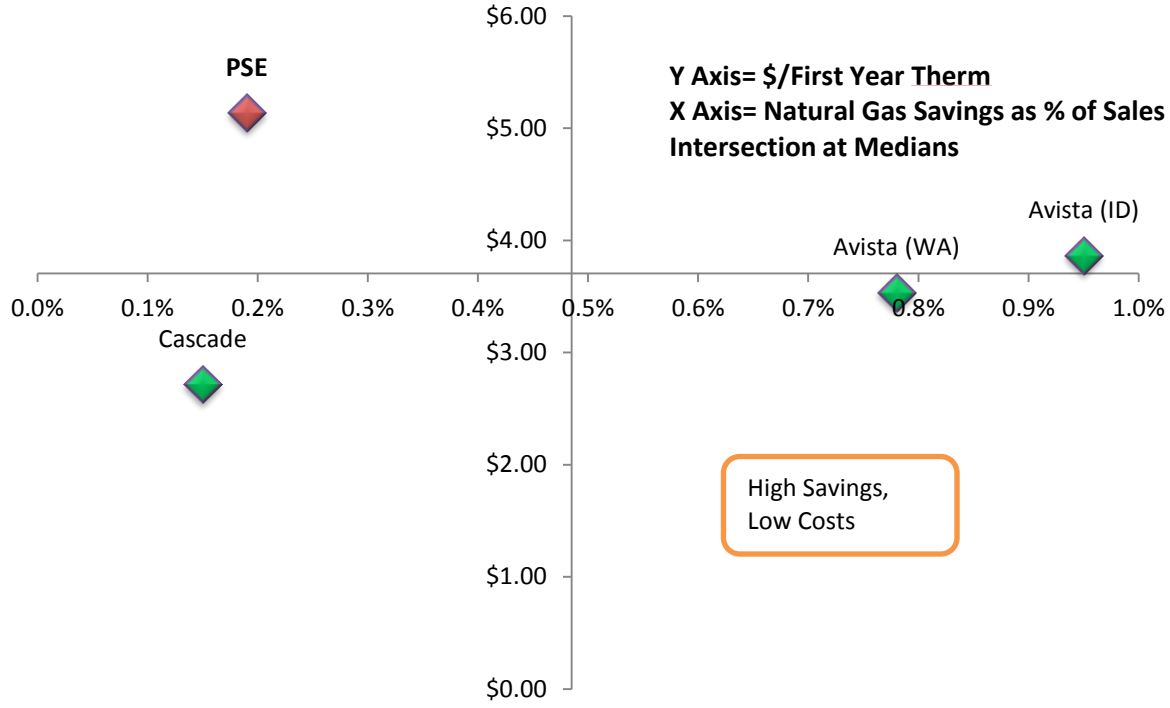
Business Type	Saved	Percentage of Total Savings
Grocery Store	38.8	24%
Industrial/Manufacturing	32.2	20%
Other	24.9	16%
Office	19.3	12%
Warehouse	11.7	7%
School	8.7	5%
Public Facility	8.2	5%
Retail	7.3	5%
Restaurant	3.5	2%
Office and Manufacturing	2.9	2%
Hospital	2.6	2%
Total	**160.3**	**100%**

PSE's top 25 (of over 500) electric trade allies accounted for 59% of electricity savings during the two years, with no trade ally implementing projects that accounted for more than 7% of savings. The three most active include two energy service companies, McKinstry (6.3% of savings) and MacDonald-Miller (3.2% of savings) and one lighting contractor, EWCO (5.7%). At the measure level, Real Win Win installed the greatest number of measures (11.7% of the total), followed by McKinstry with 6.7%.

3.2.1.3 Overall Gas Custom Retrofit Program Performance

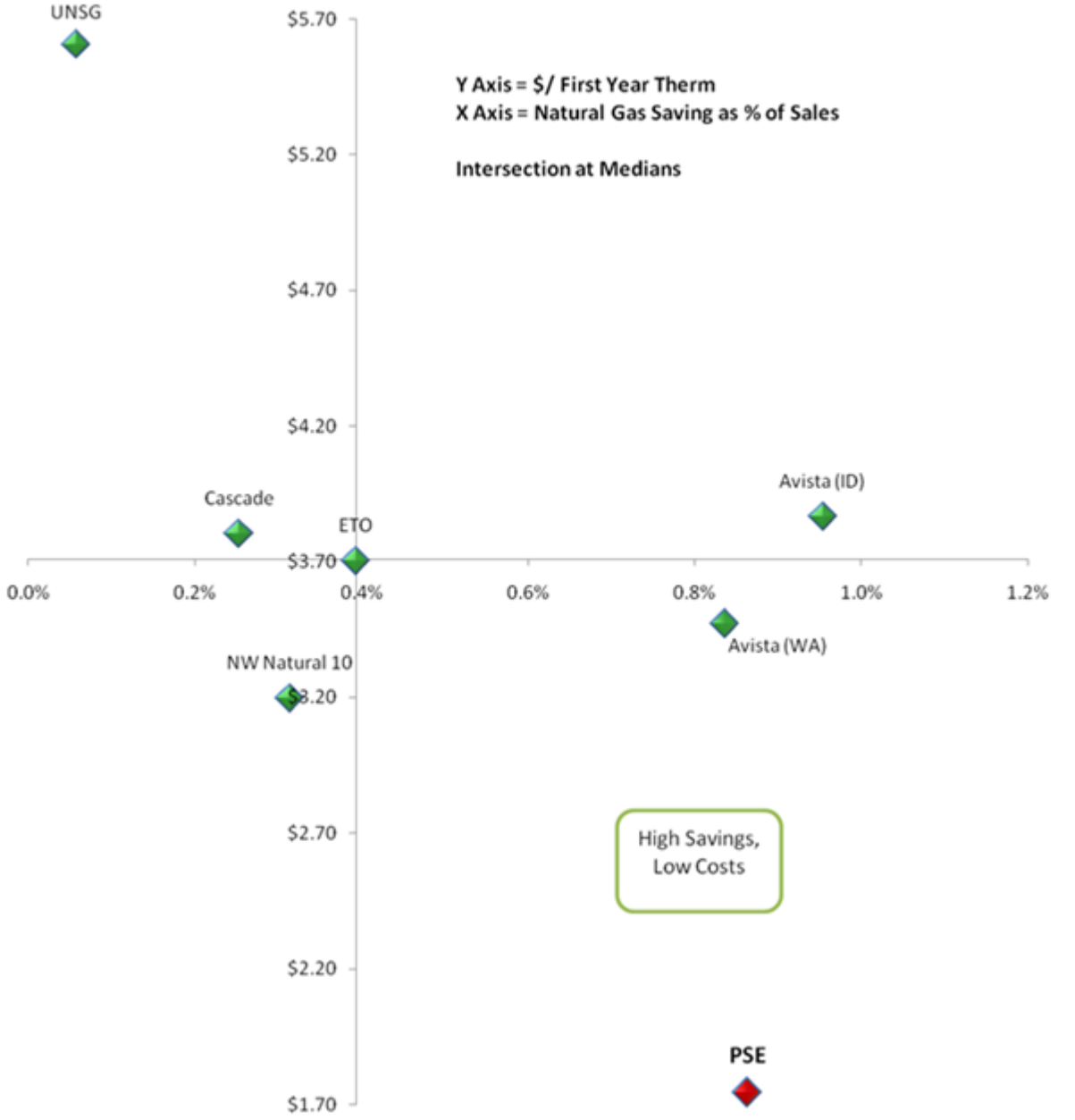
Benchmarking of PSE's custom retrofit program gas measures is more challenging than the electric side, as *limited custom-program specific data was available for the Northwestern region utilities benchmarked*. Only Cascade and Avista (Washington and Idaho) provided comparable cost and savings statistics for their custom retrofit programs. Among this panel on these metrics, Avista Washington achieved the highest savings at the lowest cost per first year Therm, while compared to Cascade PSE generated marginally higher savings at considerably higher cost per first year Therm. (Figure 3.16)

Figure 3.16. 2009 Gas Custom Grant Savings as % of Sales and Cost of First Year Savings, $/Therm



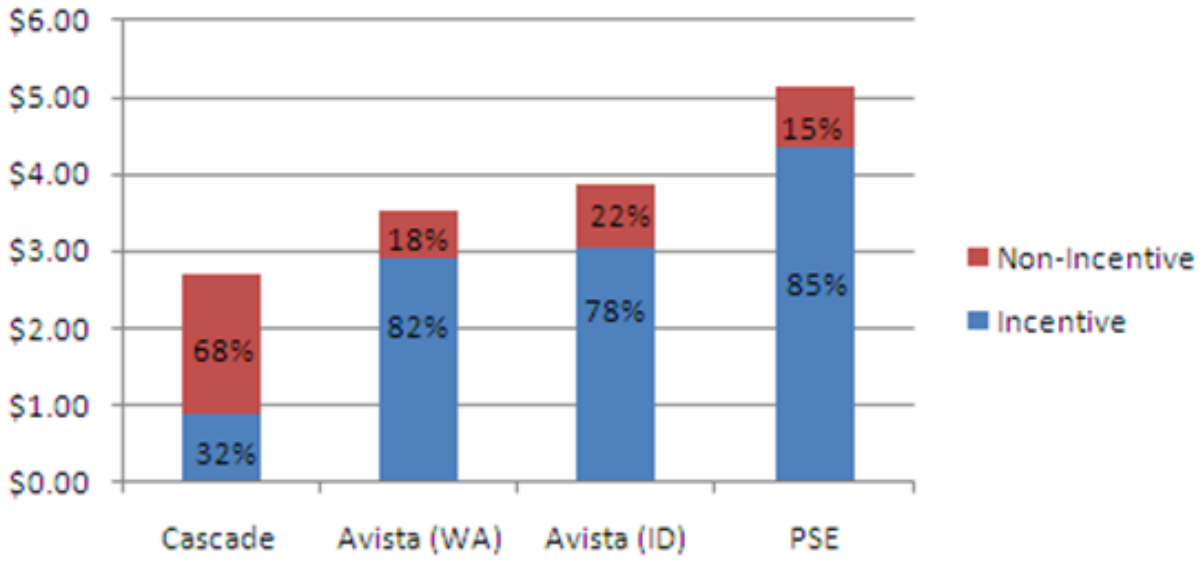
When program performance is benchmarked at *the **full C&I EE program portfolio level**, PSE's gas portfolio delivers amongst the best performance of the regional and other utilities.* Both Avista Washington and Avista Idaho spend more per Therm saved, while Avista Idaho saved more than PSE as a percent of Therms sold to C&I customers. (Figure 3.17)

Figure 3.17. 2009 C&I Gas Portfolio Savings as % of Sales and Cost of First Year Savings, $/Therm



Drilling down into *custom program* spending per first year Therm, PSE spends more overall, as well as for incentives, than the others reporting this level of detail. However, PSE's spending on non-incentive costs as a percent of the total first year cost is the lowest of the four. (Figure 3.18)

Figure 3.18. 2009 Gas Custom Programs' Incentive vs Non-Incentive Detail ($/Therm)



Turning to the data mining analysis for PSE's natural gas program participation, a similar pattern of lower participation by smaller customers/premises is evident, while overall participation in the Schedule G205 program is lower than for E250, E257 and E258. Overall participation is 0.6% of gas premises over the two year period. Only 0.4% of smaller customers participated during this period, while 7% of customers on interruptible gas service participated. **(**Table 3-6**)**

Table 3-6. C&I Gas Customer/Premise Participation by Rate Schedule

Rate Schedule	Service Description	Participants % Total	Premises % Total	Participants % Premises
31	**General Service**	63%	96%	**0.4%**
41	**Large Volume High Load factor**	19%	4%	**3%**
85 to 87	**Interruptible Gas Service**	10%	0.8%	**7%**
Other*		7%	-*	**-**
Total		100%	100%	**0.6%**

Source: PSE program tracking system and PSE staff (Mei Cass) input. n= 329 gas participants and 56,918 customers.
*Excluded from the analysis.

Gas program savings over the two years as a percent of total 2010 C&I consumption was 0.3%, while savings for the various consumption tiers ranged from 0.1% to 0.3%. (Table 3-7).

Table 3-7. C&I Gas Savings by Rate Schedule (size)

Rate Schedule	Service Description	Program Savings	Usage	Savings % Usage
		% Total		
31	**General Service**	31%	38%	**0.2%**
41	**Large Volume High Load factor**	8%	16%	**0.1%**
85 to 87	**Interruptible Gas Service**	59%	45%	**0.3%**
Other*		2%	-*	**-**
Total		100%	100%	**0.3%**

Source: PSE program tracking system and PSE staff (Mei Cass) input. * Excluded from the analysis.

Small gas customer participation was the lowest of all four segments reviewed, at 0.4%. Participation reached 1% in Educational Services alone. Manufacturing, (0.6%) Transportation and Warehousing (0.6%), Public Administration (0.5%) and Wholesale Trade (0.5%) all had above average participation. Two of the larger sectors in terms of total PSE premises, retail trade and other services (except public administration), achieved about average participation, at 0.4% each. (Table 3-8) Comparable data was not available to evaluate large gas customer participation.

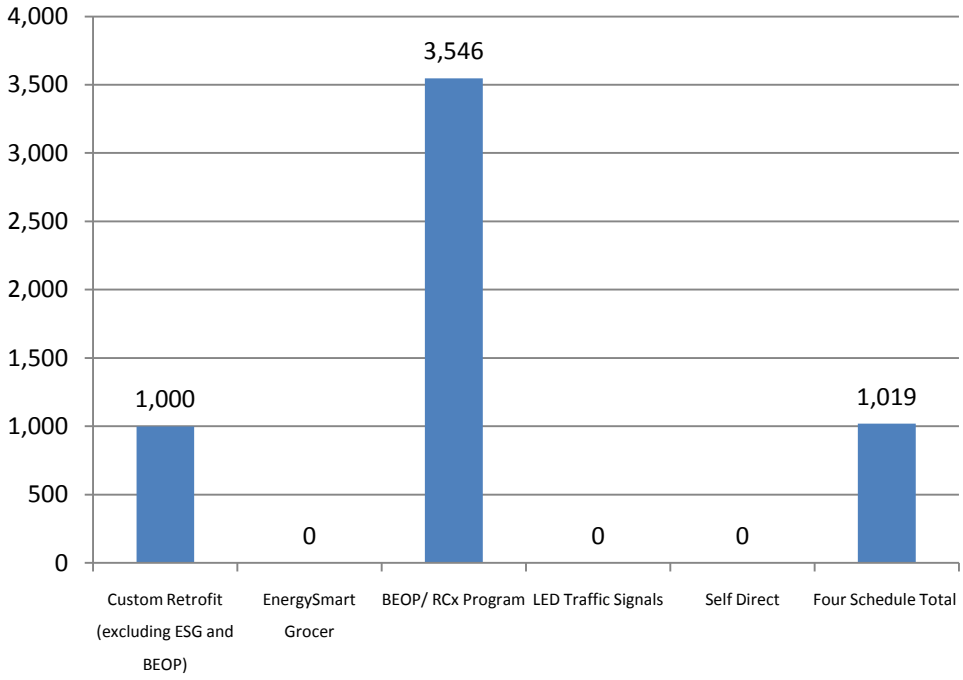
Table 3-8. Small C&I Gas Customer/Premise Participation by Type

Customer Type	Participants	Premises	Participants /Premises
	%	%	
Accommodation and Food Services	7%	8%	**0.3%**
Administrative and Waste Management	-	2%	**-**
Arts, Entertainment, and Recreation	2%	2%	**0.4%**
Construction	1%	3%	**0.1%**
Educational Services	6%	2%	**1.0%**
Finance and Insurance	1%	2%	**0.2%**
Health Care and Social Assistance	3%	4%	**0.3%**
Manufacturing	14%	7%	**0.6%**
Other Services (except Public Administration)	11%	11%	**0.4%**
Professional, Scientific, and Tech Services	1%	3%	**0.01%**
Public Administration	1%	2%	**0.5%**
Real Estate and Rental and Leasing	5%	9%	**0.2%**
Retail Trade	14%	11%	**0.4%**
Transportation and Warehousing	2%	2%	**0.6%**
Wholesale Trade	5%	4%	**0.5%**
Others	14%	27%	**0.2%**
No match	9%	-	**-**
Total	97%	99%	**0.4%**

Source: PSE program tracking systems and customer database. n= 207 small gas participants and 54,463 small gas customers.

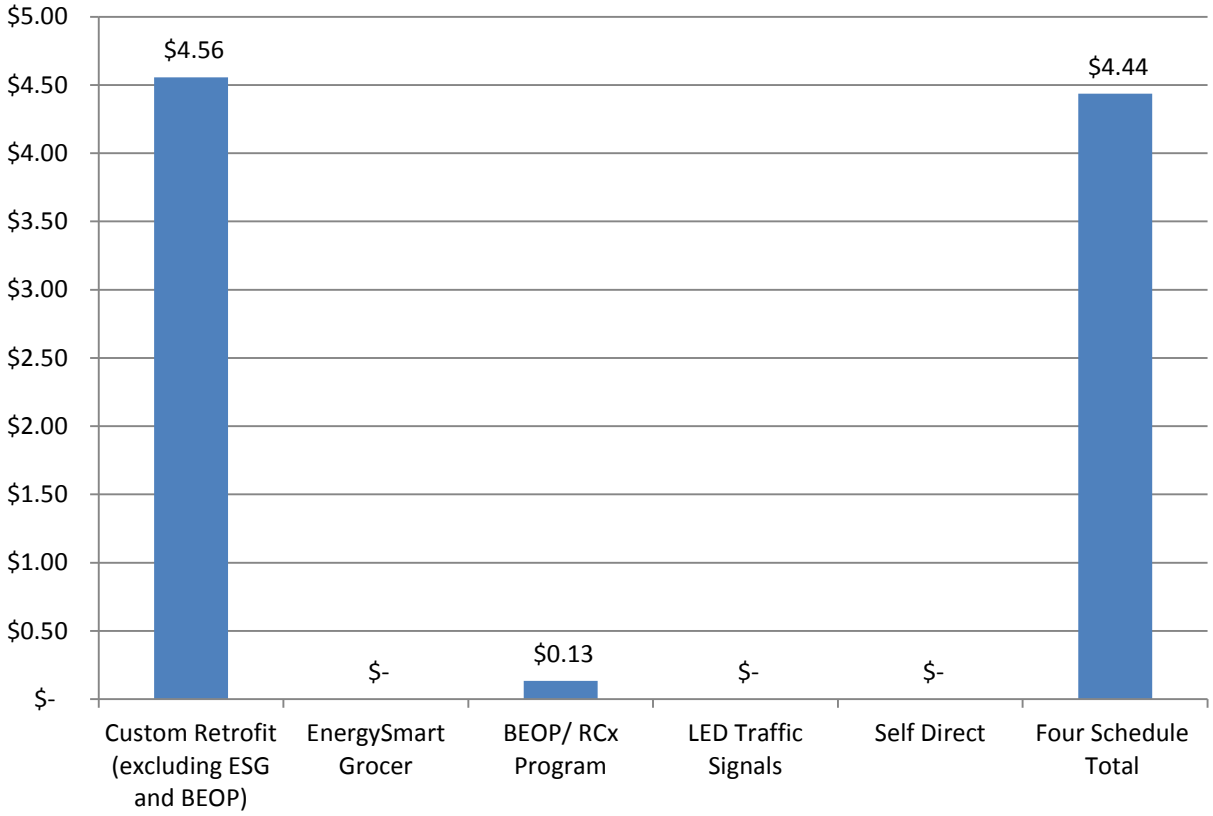
Average Therms saved for the custom retrofit projects implemented in 2009 to 2010 totaled 1,019 per project, as shown in Figure 3.19. Custom grant projects averaged 1,000 per project, while BEOP projects averaged a higher 3,546.

Figure 3.19. Average Custom Retrofit Project First Year Therms Savings



The average incentive cost per first year Therm saved in the programs evaluated was $4.44. The majority of Therm savings (97%) came from the Custom Retrofit program, which had an average cost of $4.56 per Therm. Cost per Therm was significantly lower for BEOP at $0.13 per Therm. (Figure 3.20)

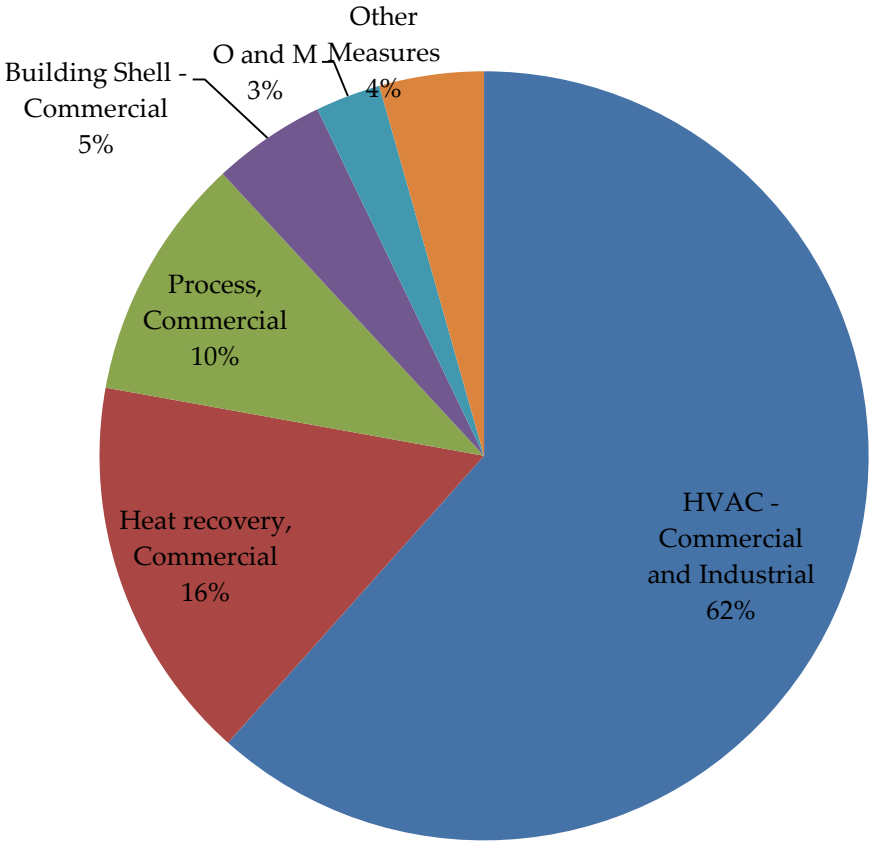
Figure 3.20. Custom Retrofit Program Average Incentive Cost per First Year Therms Saved



Source: CSY Master DAtabase, May 18, 2011. Navigant Analysis

Approximately 20% of all measures incented by the custom retrofit programs are gas measures. Gas measures are dominated by HVAC measures, which account for 62% of all gas savings (Figure 3.21). Commercial process and heat recovery measures account for a combined 26%, with shell measures contributing an additional 5%.

Figure 3.21. Custom Retrofit Program Therm Savings by Measure



Total two-year savings for PSE DSM programs = 1.4 million Therms

Source: CSY Master Database, May 18, 2011.

Gas savings were more dispersed among a variety of business types than electric savings were, with "other" accounting for 29% of the total as shown in Table 3-9. Manufacturing was a major Therm savings contributor as with kWh, accounting for 18% of the total over 2009 and 2010. Schools were another notable source of Therm savings, with 13% of the total.

Table 3-9. Gas Participant Business Types: 2009-2010

Business Type	Therms Saved	Percentage of Total Gas Savings
Other	408,659	29%
Industrial/Manufacturing	262,929	18%
School	185,810	13%
Public Facility	117,990	8%
Swimming Pool	87,039	6%
Restaurant	65,184	5%
Hospital	64,879	5%
Apartments	51,682	4%
Health, Non-Hospital	40,933	3%
Warehouse	33,654	2%
Hotel	27,049	2%
Office	25,286	2%
Church	24,290	2%
Data Center	18,813	1%
Athletic Club	10,275	1%
Total	**1,424,472**	**100%**

Source: CSY Master Database, May 18, 2011.

Activity among PSE's **gas trade allies** is more concentrated in fewer trade allies than in electric. PSE's top 10 gas trade allies accounted for 75% of all Therm savings during the two years.

3.2.1.4 Tracking System

PSE's custom retrofit program tracking system and customer data have some significant strengths as well as potential for enhanced system effectiveness. PSE's system's most notable strengths are the collection of data that enable the analysis of participating and non-participating customers – rate schedules in program databases and NAICS codes for most customer records. In addition, the simple mapping of detailed measures to types (e.g., lighting) enables a quick analysis of types of measures being undertaken while retaining the underlying detail. PSE's tracking system also has some weaknesses, many which relate primarily to program delivery metrics, features that have become more important as the PSE C&I Custom Grant team's workload has increased.

Well designed tracking systems have features that enable the following program management capabilities:

» Measurement of program efficiency and performance against time-based targets

- » Tracking of customer communications to enable effective on-going interaction and maintain easily accessible records of such
- » Tracking of trigger dates to enable follow up with customers to increase participation (e.g., signal need to contact customer as a deadline approaches)
- » Electronic file maintenance for future ease of access
- » Engineering resource management

Various PSE staff informed Navigant that a number of these needs have been identified and are targeted for implementation in a new system.

An additional potential tracking system weakness is the lack of a unique record (primary key) identified for each record in the program database. Records are measures which are now linked together by the project number, but each record and project number combination does not have its own distinct identifier. Such an identifier may not have been critical in the past, but when PSE decides to link the program tracking database to a customer relationship management system such identifiers will be necessary to be able to access individual records.

Overall, PSE's tracking system captures considerable amounts of useful data for a process evaluation. As detailed in Navigant's May 22, 2011 draft memo, PSE should consider more consistently collecting trade ally data as its goals become more challenging and it needs to work still more closely with its trade allies. Navigant also identified in its May memo attached as Appendix J other less significant opportunities to enhance its data that PSE may wish to address.

3.2.1.5 Free-ridership and Spillover

Free-ridership (FR) and spillover (SO) were assessed for PSE's custom retrofit programs by two primary means: trade ally in-depth interviews and participant and non-participant surveys. Findings are summarized in this section.

Trade Ally FR and SO Feedback

Trade allies were asked to rate the importance of incentives in their customers' decisions to invest in energy efficiency measures on a scale of one to ten, with ten being extremely important. Many trade allies in the EnergySmart Grocer and C&I Retrofit programs indicated that incentives were often a "make or break" factor in their sales of efficient equipment. Responses from BEOP trade allies suggested incentives were somewhat less important to their participants than to those of the other programs. Table 3-10.

Table 3-10. Importance of Incentive for Customers, Rated from 1 to 10 by Trade Allies

Program	Average Importance	Standard Deviation	Sample Size
Building Energy Optimization	8.33	2.06	6
EnergySmart Grocer	9.50	0.87	5
C&I Retrofit	9.08	1.61	12

These results *could be read to suggest* that free-ridership is fairly low, especially for the EnergySmart Grocer program. Free-ridership in the BEOP program may be higher based on the trade allies' assessment of the lower average importance of incentives and higher standard deviation. These conclusions are quite soft, however, given the relatively small sample of trade allies queried as well as the trade allies' natural interest in keeping the programs operating.

Trade allies stated that the majority of eligible projects they are involved with go through PSE to receive the related incentive. At the same time, some trade allies commented that they had done a few projects that would have been eligible for incentives but they did not apply for them, creating some spillover in the market:

» Commissioning agents stated that a few projects they were involved with would have been eligible but did not go through the program because the timing would not have worked out.

» For the EnergySmart Grocer Program, some eligible projects might not go through the program because of the short term timing of the project.

» For the Custom Grant Program, trade allies commented that it takes a long time to get custom grants approved or in limited cases there might be additional funding sources (federal government) so some projects that were eligible did not go through the program.

Navigant did not identify any other participant or non-participant spillover in the trade ally interviews that would be easily quantified. Typically this spillover is driven by training and changes in contractor practices that affect projects completed outside of utility programs. *PSE has clearly impacted the broader market for energy efficiency products and services,* as evidenced by trade ally comments that they have hired staff and expanded due to the program. Additionally, new contractors have entered the markets targeted by PSE's programs, thereby increasing market size and competition within them. Quantifying these market effects would require detailed studies of each market.

Participant and Non-Participant FR and SO Feedback

Free-ridership

The logic model used for Navigant's free-ridership analysis reflects four survey questions. The first three questions relate to the timing of the project, the level of equipment efficiency, and the quantity of measures the customer would have undertaken without the program. Customers' responses are

translated into a free-rider value. Then, this value is adjusted through the attribution question, the level of program importance in the customer's decision. The analysis found a 27% free-rider rate for the PSE's Custom Grant program overall excluding Schedule 258.

Free-ridership by Schedule 258 customers, in contrast, is only minor, with most customers stating that projects would have been implemented more than a year later (or never)and in fewer quantity without the incentives. Almost all participants rated the financial incentive as somewhat important or very important for installing the measures.

Participant Spillover

Participant spillover was also calculated based on customer survey responses. Specifically, respondents were asked whether they had taken any other energy efficiency actions at the facility located where the program participating measure was installed (or any other facility owned by their corporation in PSE territory) that did NOT receive incentives from PSE. They were also asked what action was taken.

The analysis evaluated two types of spillover:

- *Inside Facility Spillover:* EE measures similar to program measures, and other EE actions (including behavioral changes), were installed by the customer in the *same* facility without receiving a program incentive.

- *Outside Facility Spillover*: Measures similar to program measures, and other EE actions (including behavioral changes), were installed by the customer in *another* facility (in PSE territory) owned by the participant without receiving an incentive.

Because the survey did not ask for spillover project savings details, the analysis assumed, for any spillover identified, an average spillover project savings comparable to that of the incented project average. According to the program database, the average project savings during 2009 and 2010 were 60,433 kWh and 5,248 Therms, specifically reflecting the average measure savings shown in Table 3-11. For spillover measures which were not in the database, a 5,000 kWh assumption was used. These measures included: gas range, de-watering device, timers for compressors, metering devices, occupancy sensors, turning off lights, and the like.

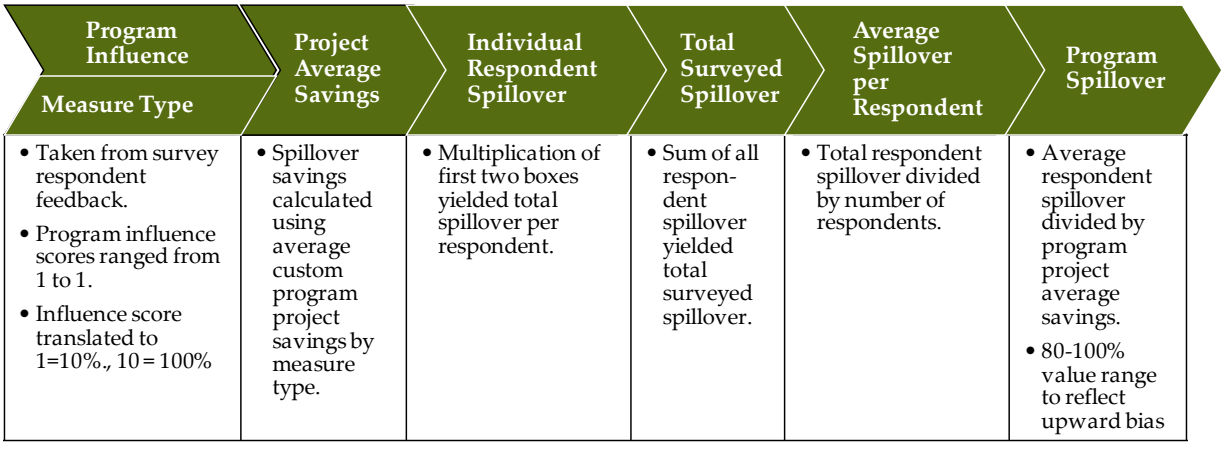
Table 3-11. Program Measure-Type Average Gross Savings Per Project

Program	Measure	kWh	Therms
ESG	Refrigeration	38,226	
C&I	Lighting Prescriptive*	20,571	
C&I	Lighting Commercial	71,455	
C&I	Motors	64,673	6,678
C&I	Refrigeration	75,015	
C&I	HVAC	100,157	4,957
C&I	Process	172,565	3,147
C&I	Water heating	3,040	1,748
C&I	Heat Recovery	27,670	33,050

Source: Master Database - 060911.xlsx.
* Due to uncertainty with whether the measure would qualify for the program, the more conservative Prescriptive Lighting savings value was used for all lighting measure spillover (participant as well as non-participant).

To identify spillover specific to each participant, the question inquiring about the influence of the program was translated into an influence percentage for each respondent. A score of no influence, 1, was translated into 10% and a score of high influence, 10, was translated into 100%. Then, the estimated savings per measure were multiplied by this influence percentage for both inside facility and outside facility spillover. All responses were added together to obtain total spillover for all survey respondents (44), and the average was calculated. This average was then divided by the average savings per project from the database to obtain the percentage of spillover that occurred due to the program. (Figure 3.22)

Figure 3.22. Spillover Development Methodology



For each spillover type a range is shown that represents 80% to 100% of the calculated value due to uncertainty involving savings arising from spillover projects relative to average savings for program

projects. Results for Custom Grant program participants excluding Schedule E258 customers are presented in Table 3-12.

Table 3-12. Custom Grant Program (Excluding Schedule E258) Participant Spillover

N=44	Inside Facility Spillover		Outside Facility Spillover	
	kWh	*Therms*	*kWh*	*Therms*
Total for all respondents	504,000-630,000	16,000-20,000	288,000-360,000	10,000-13,000
Average for all respondents	11,500-14,500	370-460	6,500-8,000	230-2800
PARTICIPANT SPILLOVER	**19-24%**	**7-9%**	**11-14%**	**4-5%**

Source: Navigant analysis of surveys and in-depth responses for the Custom Grant Programs.
Note: Range is due to the uncertainty involving project savings and respondent overestimation of project activity.

The Process Evaluation Team found substantial spillover energy savings among Custom Grant participants (again excluding Schedule 258 participants.) An additional 30-38% kWh (gross savings) and 11-14% Therms are estimated to be saved due to program spillover. There is considerable uncertainty around these findings, however, because specific project details were not collected from respondents and these estimates were developed based on participant project savings.

In contrast, interviews with Schedule E258 Large Power User customers identified more limited spillover. While most sites reported installing efficiency measures without incentives, only a few attributed the Large Power Users Program with the motivation for those projects.

3.3 Non-participant Spillover

Non-participant spillover was also calculated using the participant spillover methodology. These savings reflect energy-efficient projects which customers undertook due to the program's influence, but for which they did not receive PSE incentives. Of primary importance in this analysis, respondents were asked how much their knowledge of the Custom Grant Business program influenced their decision to install high-efficiency equipment on their own. The answer to this question then drove the weighting of any potential savings from non-participant energy efficiency projects.

The Process Evaluation Team found substantial non-participant spillover savings occurring, presumably due in part to the program's maturity and long-term market presence. Even so, these levels appear to be quite significant for a Custom program, raising questions as to whether some of the non-participant spillover is due to other PSE programs. This is highly likely since many non-participants do not have the program familiarity to distinguish between PSE programs and a number of those surveyed were small businesses; however, this possibility was not explored further in this analysis.

Survey results indicate the average non-participant saves 30-37% and 18-23% of the participant project average kWh and Therm savings, respectively, influenced by PSE's C&I programs. This total would be multiplied by the number of non-participants, making the amount quite significant. Again, since specific project detail was not requested of respondents, it is highly likely that some if not most of the spillover relates to other PSE EE programs as well, not just the custom grant program. Since it is likely that these spillover projects include simpler and smaller projects covered under the Rebate program, Navigant adjusted the spillover savings range downward.

Total and average savings for respondents per measure as well as summary results are presented in Table 3-13. A range reflecting 80% to 100% of the estimated value is shown due to uncertainty involving savings arising from spillover projects relative to average savings for program projects. The foregoing percentages provide only an indication of potential non-participant turnover, and further research should be undertaken if it is necessary to determine specifically that component that relates to PSE's custom grant program distinct from others like the rebate and small business programs.

Table 3-13. Non-Participant Spillover: By Measure and Total

N=49	kWh				Therms		Total	
	Lighting	Cooling	Refrig-eration	Motors	Cooling	Motors	kWh	Therms
Total for all respondents	153,048-191,310	280,440-350,550	133,061-166,326	320,778-400,973	13,880-17,350	33,123-41,404	887,327-1,109,159	47,003-58,753
Average for all respondents	3,123-3,904	5,723-7,154	2,716-3,394	6,546-8,183	283-354	676-845	18,109-22,636	959-1,199
NON-PARTICIPANT SPILLOVER							30-37% kWh	18-23% Therms

Source: Navigant analysis of surveys and in-depth responses for the Custom Grant Programs.
Note: Range is due to the uncertainty involving respondent project activity estimates.

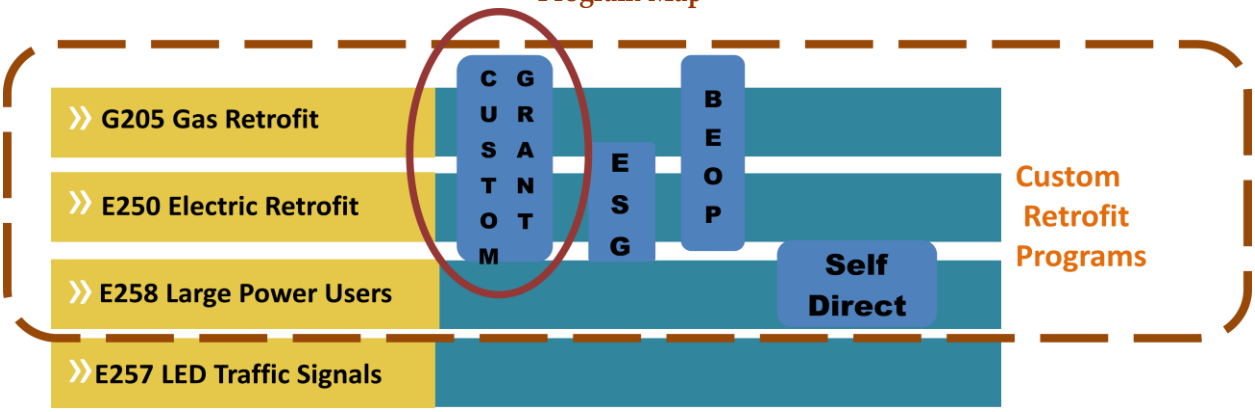
3.3.1 C&I Electric and Gas Custom Grant Program (excluding ESG and BEOP)

Navigant's process evaluation for the custom retrofit program (excluding ESG and BEOP) draws upon the following sources for these findings:

- Draft custom program logic model
- Program database mining
- Program management and implementation in-depth interviews
- Trade ally in-depth interviews
- Customer surveys

This section reviews results from the schedules indicated below, excluding ESG and BEOP (Figure 3.23).

Figure 3.23. Gas and Electric Custom Grant (excluding ESG and BEOP) Findings Schedule and Program Map



3.3.1.1 Overall Custom Grant Program (excluding ESG and BEOP) Performance

PSE's Custom Grant program (excluding ESG and BEOP) accounted for 64% of all kWh savings and 97% of all Therm savings for the schedules evaluated by Navigant. It accounts for 81% of all C&I participants in the programs evaluated and has the highest average incentive cost per first year kWh savings, at $0.27. Average incentive cost per first year Therm is $4.56. (Table 3-14).

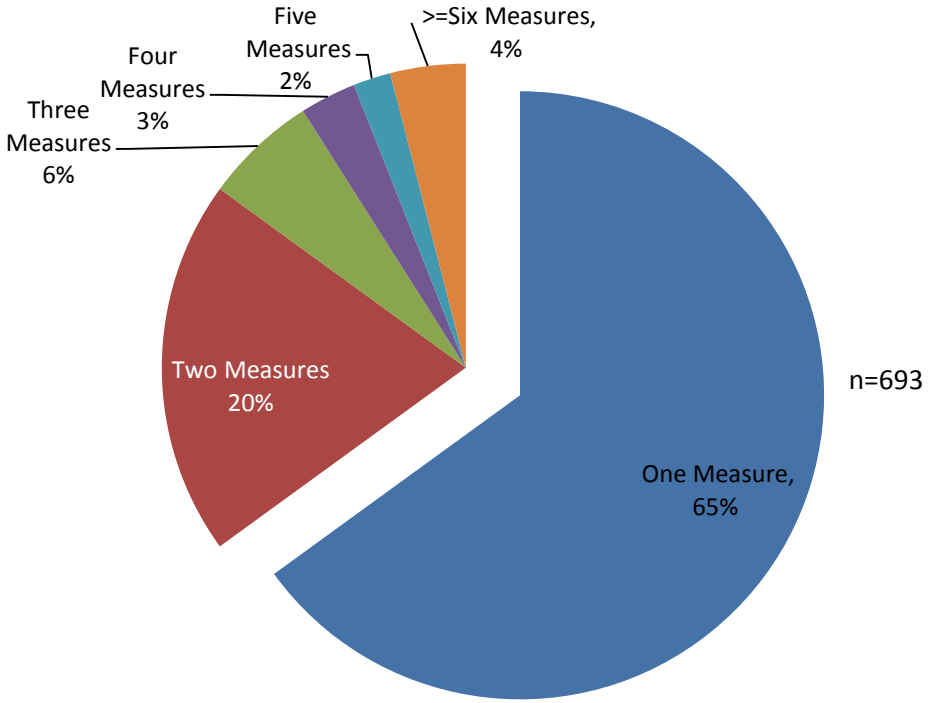
Table 3-14. Custom Grant (excluding ESG and BEOP) Program Overview

Program	Total					
	GWh Savings	% Electric Savings	Therm Savings (MDth)	% Gas Savings	# Participants	% Participants
Custom Retrofit (excluding ESG and BEOP)	101.85	64%	138.5	97%	693	81%

Program	Number of Projects	Average Per Project			Overall Average	
		Grant Amount	kWh Savings	Therm Savings	$/kWh	$/Therm
Custom Retrofit (excluding ESG and BEOP)	1,386	$24,479	73,486	1,000	$0.27	$4.56
Four Schedule Total	**2,060**	**$18,715**	**77,822**	**1,019**	**$0.25**	**$4.44**

During 2009 and 2010, in the Custom Grant program (excluding BEOP and ESG) the majority of participants implemented only one measure, with 85% implementing one or two measures in this period. (Figure 3.24) In contrast, 4% implemented six or more measures.

Figure 3.24. Custom Grant Program (excluding BEOP and ESG) Measure Frequency Distribution



Source: CSY Master Database, May 18, 2011. Navigant analysis.

3.3.1.2 Benchmarking Best Practices

Navigant's benchmarking of custom programs identified Avista Washington's custom program as a strong performer in the Northwest and Xcel Minnesota as a top performer nationwide. Avista Washington believes that its custom grant program has been successful at least in part because it directly involves Avista Account Executives (AEs) in program delivery and tracks AE performance against savings goals. AEs are given DSM targets that are part of their performance review. AEs generally target medium and large customers but will also cold call throughout a neighborhood to reach small customers. They are responsible for overseeing the projects and receive credit for both custom and prescriptive measure savings, but not behavioral, which has become an issue.

Avista Washington's program is run in-house, with audits provided by either an Avista engineer or, for industrial processes, an outside engineer. If savings are demonstrable and simple payback is greater than one year then they execute a contract and the customer completes the projects, the AE collects the receipts and post-verifies the install and the DSM group cuts the check. Avista reported they had been able to lower their incentives and add more in-house engineering and tech support. Seven full-time engineers now support Washington and Idaho custom programs.

Xcel MN is one of a number of utilities that are running segment-specific programs to achieve broader and deeper savings in targeted sectors. Its most successful program has been the Industrial Process program which uses the Envinta Assessment tool as a linchpin. (Avista does not have a Self-Direct

program which typically targets many of the same customers.) The Industrial Process program was offered by Xcel MN beginning in 2002 and delivered 42 GWhs and 113 Dekatherms savings in 2010. The program is staffed by 1.5 program managers at Xcel.

Xcel's Industrial Process program is delivered by a third party which is responsible for setting up initial meetings, developing and delivering the assessment and managing the customer through the process over the multiple year effort. A relationship with a new participant starts with a three-hour meeting at the customer site with Finance, Facilities, Property Management and other related staff involved in energy policies, planning and decision making, followed by a facility walk-through in the afternoon. The consultant provides a three star rating at the end of the day based both on the information gathered that day and previously collected facility data and usage data. The third-party keeps working with customers who sign a memorandum of understanding MOU at each stage.

Xcel MN retains the administrative/regulatory role and processes the rebates - only because they could not find someone less expensive to whom to outsource the back office functions. Prescriptive and custom incentives in the Industrial Process program are rolled into a bundle enabling measure with longer paybacks to be subsidized by shorter payback projects. Bonus rebates are offered based on three year signed agreements – up to 20% incremental rebate in each year if target savings are achieved.

Xcel MN ran a similar program targeting the commercial real estate sector but it did not perform well during the three-year period of their program filing. Xcel MN believes it is because they chose the wrong provider, and their sister company, Xcel CO, is now running a similar program in its service territory. Navigant did not fully benchmark Xcel CO for this evaluation, but because PSE staff had identified the commercial real estate market as a potential under-performer, Navigant contacted Xcel CO to discuss their program.

In Xcel CO's commercial real estate program, the customer relationship begins with an ASHRAE Level 2 audit, good for two years, that identifies all savings opportunities and how they match up with Xcel CO's DSM programs. The utility limits studies to 50,000 square foot buildings or two smaller buildings. Xcel Colorado presently has one study provider authorized to provide the initial ASHRAE Level 2 audits, but they are looking to open the program to other providers. The program, which launched in 2010, did five studies in 2010 identifying 2 GWh in savings and six studies by May 2011. Implementation is underway for some customers.

Xcel CO pays the current study provider to market the program and has found that the third party is more effective than the Account Managers at bringing in customers. The utility offers a 30% bonus on top of the regular incentives (up to 75% of incremental cost) and covers half of the study cost ($2,500). In their experience, this program costs 15-20% more and is still cost effective. To generate a sense of urgency, they file for a three year program life. They have found that owner occupied buildings are the best target and that it is key is to get decision makers involved at the study presentation meeting, that is, the meeting where the ASHRAE level 2 audit findings are presented to the client. Overall, they believe this general approach is very effective and have filed to expand this program into the hospitality sector.

Navigant has noticed the deployment of sector-specific studies at other utilities that similarly appear to deliver superior savings. AEP Oklahoma has had success with a K to 12 and upper education targeted

program run by a third party. A similar program targeting cities has gotten off to a slower start. Both of these programs include some benchmarking of participant facilities against DOE Portfolio Manager data.

National Grid is also taking two interesting tacks to increase participation of its smaller customers, though in National Grid's case the tactics are being applied in their direct install program. National Grid pays a $10 incentive to their call center reps who sign up a customer for an audit. They also involve their government affairs and community relations staff in scheduling a series of audits in a particular community over a narrow window of time. They have found that this approach enables them to obtain broader savings at lower cost.

3.3.1.3 Trade Ally Feedback: Program Efficiency

In this report, the in-depth trade ally interview findings for each of the C&I Retrofit programs are organized into three sections: Program Efficiency, Marketing and Outreach, and Enhancement Opportunities. Twelve trade allies (TAs) with varying levels of participation provided feedback on the Custom Grant program explicitly. These findings are presented in the following three subsections.

Overall, these twelve trade allies reported high satisfaction (1.5 out of 4, with a score of 1 being the highest possible) with the Custom Grant program, and most trade allies reported needing to add staff to meet program-driven growth. Trade allies nonetheless identified a number of program features that they felt discouraged program participation and that led them to prefer the faster and more predictable prescriptive program. *According to most trade allies contacted, the time required by the pre-qualification process, inspections, and payment process adds up and discourages many customers from participating*. In addition, many trade allies have difficulty predicting how large incentives will be unless they have had extensive experience with the program and relevant equipment, introducing an element of uncertainty that can be too high for many customers. Many potential projects do not have short enough payback periods to qualify. (It should be noted that any reference to payment process in this report is from the *participant's* perspective, that is, the time it took to get paid after implementing the measure. As this period includes verification, then from *PSE's* perspective, the issue is either in the length of time required until verification or from verification to payment.)

Table 3-15 details responses regarding specific program characteristics impacting efficiency.

Table 3-15. Trade Ally Feedback on C&I Retrofit Program Efficiency

C&I Retrofit: Program Efficiency	
Application Process	Many TAs commented that it can be hard to get some customers on board because it takes a while to pre-qualify and determine incentives. Many also find that program requirements are not always clear.
Effectiveness of Inspections	Most report that multiple inspections (specifically pre-and post) can take a long time, in part due to scheduling issues.
Paperwork Issues	Many TAs commented that PSE needs to keep them better updated on requirement changes and ensure that documentation requirements are clear.
Payment process	Most report at least some delays in grant payments, with some more understanding than others. For many, the lengthy time from installation to payment is a major program weakness.
Impact on contractor	Almost all report increased business. Many report additional hires; few changes in stocking practices.

3.3.1.4 Trade Ally Feedback: Marketing and Outreach

Many trade allies expressed a desire for increased outreach by PSE, both to them and their customers. Allies feel they have been given the task of bringing customers to the program, and resent lack of PSE presence in their projects. Trade allies recognize PSE as a powerful support in their efforts to market their products and PSE's program, and would like PSE to be more of a partner in the sales cycle. Increased technical training, direct communication with trade allies and customer education are strongly recommended.

Table 3-16 details responses on program training, marketing, and outreach.

Table 3-16. Trade Ally Feedback on C&I Retrofit Program Marketing and Outreach

C&I Retrofit: Marketing and Outreach Effectiveness	
Training availability and usefulness	About half reported receiving at least some training, which garnered mixed comments on how useful additional training would be. Some requested marketing training or a "plug and play" spreadsheet or other tool to make predicting savings easier.
Availability and quality of marketing materials	Those who had received marketing materials found them adequate (about half of interviewees). Some used their own material. Some found PSE's website helpful.
T`A Outreach Desired	Many TAs with moderate program activity would like to have more direct contact and a better relationship with PSE; more active TAs with such relationships are often more satisfied with and better informed about PSE's programs. Some TAs suggested that PSE should have a larger presence in projects and be more of a partner to TAs. Some also desired increased education of customers.

3.3.1.5 Trade Ally Feedback: Enhancement Opportunities

The most commonly identified need was to have a stronger relationship with PSE. Strengthening contractor relationships through increases in direct communication with trade allies about programs and both process and technical training can also help improve program transparency, another weak point in the program. Customer education and outreach is another area where PSE can develop the program further.

Table 3-17 highlights the main areas where PSE can improve the program.

Table 3-17. Enhancement Opportunities Based on Trade Ally Feedback

TA Feedback: C&I Retrofit Program Enhancement Opportunities	
Problem or Obstacle Identified	*Opportunity*
Many qualified customers cannot afford their share of measure costs	A few TAs suggested PSE explore ways to help customers finance measures.
Contractors often lose customers because of long process and prefer to use quicker prescriptive rebates when possible	Streamline entire application process, make incentives easier to predict through increased calculation process transparency and technical contractor training.
Many TAs do not feel supported by PSE and would like to have a better relationship with the utility	Enable direct communication between PSE and contractors, improve relationship through outreach and increased PSE presence for customer, keep TAs up to date on program opportunities with emails and periodic training workshops.
Some customers who are less educated about energy efficiency do not believe in the merits of the program	Increase customer education and outreach.
Contractors lose some customers because their needs do not fit into the program well	Increase TA education about program opportunities, consider expanding program to cover wider variety (unspecified) of equipment.
Some reported that training focuses more on process than technical education, and one indicated that PSE staff is not always knowledgeable about technology	Ensure that mechanisms behind incentives are made clear during training, and that PSE staff can provide answers to technical as well as process questions.

3.3.1.6 PSE Customer Feedback

Navigant surveyed a total of 103 [37 participant, 25 partial participant, and 41 non-participant] customers in the Custom Grant program (excluding ESG and BEOP customers), as shown in Table 3-18. In keeping with PSE's commercial and industrial customer base composition, the majority of participants surveyed self-identified as medium-sized businesses while the majority of partial and non-participants surveyed self-identified as small-sized businesses. Note that feedback from commercial real estate and light manufacturing customers is broken out separately in the survey findings where sensible, since these customer segments were identified by PSE program management as potentially under-served segments. However, since there were few commercial real estate and light manufacturing customers among the random survey sample, further research would need to be conducted specific to those sectors in order to confirm the findings in this analysis.

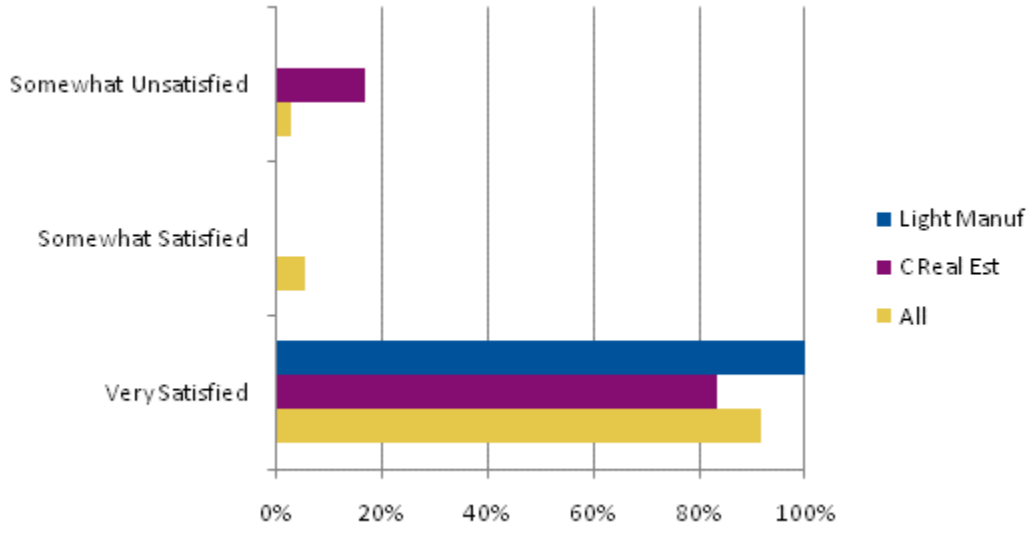
Table 3-18. Schedule E250/G205 Custom Grant (non-ESG and non-BEOP) Customer Survey Overview

Customer Type	# Surveys	% Small	% Medium	% Large	# Light Manufacturing	# Commercial Real Estate
Participant	37	24%	57%	16%	4	6
Partial Participant	25	56%	20%	24%	2	2
Non-Participant	41	49%	29%	5%	7	N/A

Participant Satisfaction

On a scale of one to four with one indicating "very satisfied," and four indicating "very unsatisfied," 92% of program participants reported being "very satisfied" with the program (Figure 3.25). All light manufacturing customers were very satisfied. In contrast, a lower 83% of commercial real estate customers were "very satisfied," while the balance (17%) were "somewhat unsatisfied." No participants reported that they would no longer take part in the program in the future.

Figure 3.25. Participant Satisfaction



Though most participants reported being very satisfied with the program, some issues were identified. About 11% of all customers noted that they experienced problems that included a process that took too long, inconsistent information, unclear requirements, and hard to access representatives. Two real estate participants commented that not all lighting was installed. None of the light manufacturing customers reported having problems while *four out of six* commercial real estate customers noted some variant of

the problems noted above. These issues appear likely to be the source of the lower levels of commercial real estate customer satisfaction with the program.

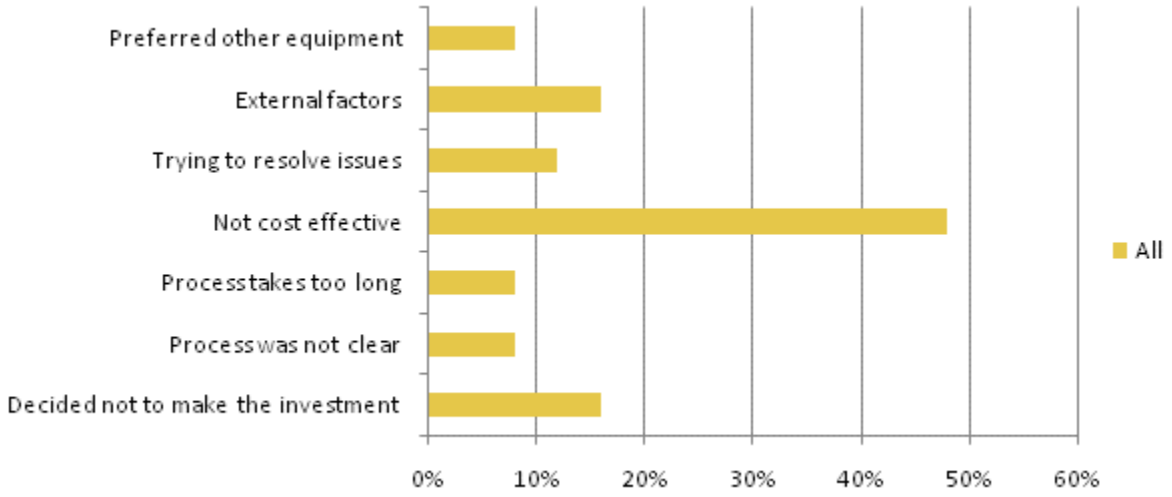
Program Improvement

Participant feedback indicates the **program delivery processes overall are functioning very well**. An estimated 97% of all participant customers agreed or strongly agreed that requesting program services from PSE was easy. Furthermore, another 97% of those customers reported that the application process was simple. The only area where some indicated improvement could be made was in allowing longer times to complete projects.

Marketing and outreach were areas with particular opportunity for improvement, which should be no surprise to PSE since relatively limited efforts have been expended in this area. Of the 41% of participants that gave suggestions to improve the program, one third suggested improving communication. Commercial real estate customers also mainly suggested improving communication and providing longer time periods to complete projects. Of the four light manufacturing customers interviewed, only one suggested an improvement, and that, again, was to improve communication.

Partial participant feedback suggests process-related issues were important for only 16% of those who were contacted. Two indicated that the program process took too long, and two found the process unclear, while 20% of partial participants moved forward with their projects without participating in the program. The most common response from partial participants as to why they stopped participating (48%) was that the projects they were pursuing were not cost effective, even with existing PSE program incentives (Figure 3.26). A few participants still hoped to participate in the program eventually and were addressing internal roadblocks in order to do so. Another 16% had to back out of the program due to external factors unrelated to PSE.

Figure 3.26. Partial Participant Reasons for Ending Participation

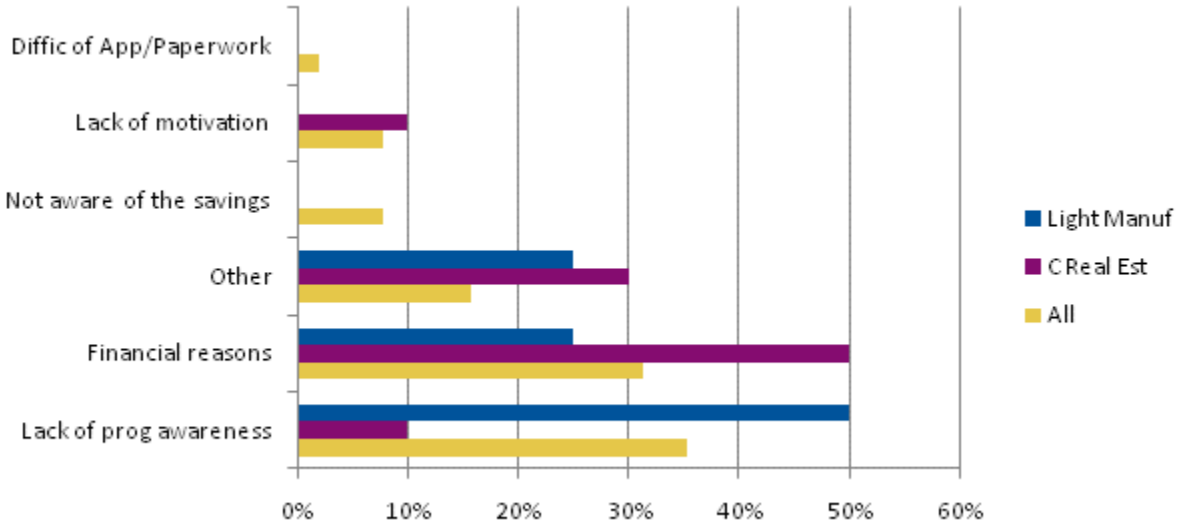


Funding and lack of information were customers' two most cited reasons for **non-participation**. Thus, increasing program information, and either increasing incentives or better explaining the financial benefits, should increase participation, especially since low maintenance costs and energy savings are most commonly cited as the main benefits of participating by non-participants. In fact, **50% of non-participating customers indicated that they are very likely to participate in the program in the future, with another 30% indicating that they are somewhat likely**. This indicates a high potential for nudging these non-participants into action by addressing their main barriers to entry.

Program Barriers

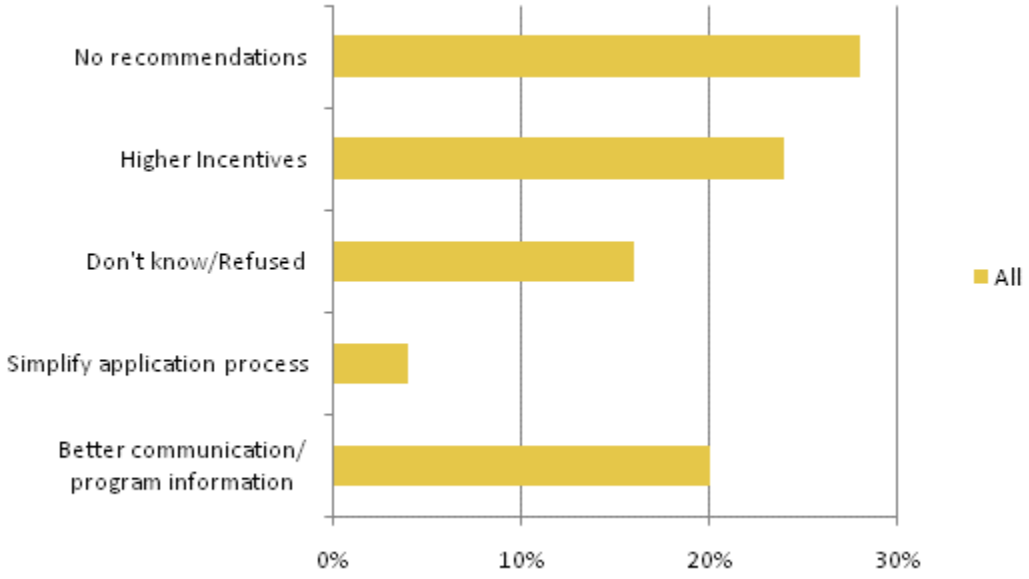
When asked why they thought companies like theirs do not participate in the program, **participating customers** cited a lack of program awareness (35%) and financial reasons (31%) (Figure 3.27). Skepticism and a lack of green prioritization in company management were other frequently mentioned reasons. The commercial real estate customers noted *financial reasons* as the largest perceived potential impediment to participation in their sector while light industry noted a lack of program awareness (two of the four that responded to the question).

Figure 3.27. Participant Perceived Barriers to Participation



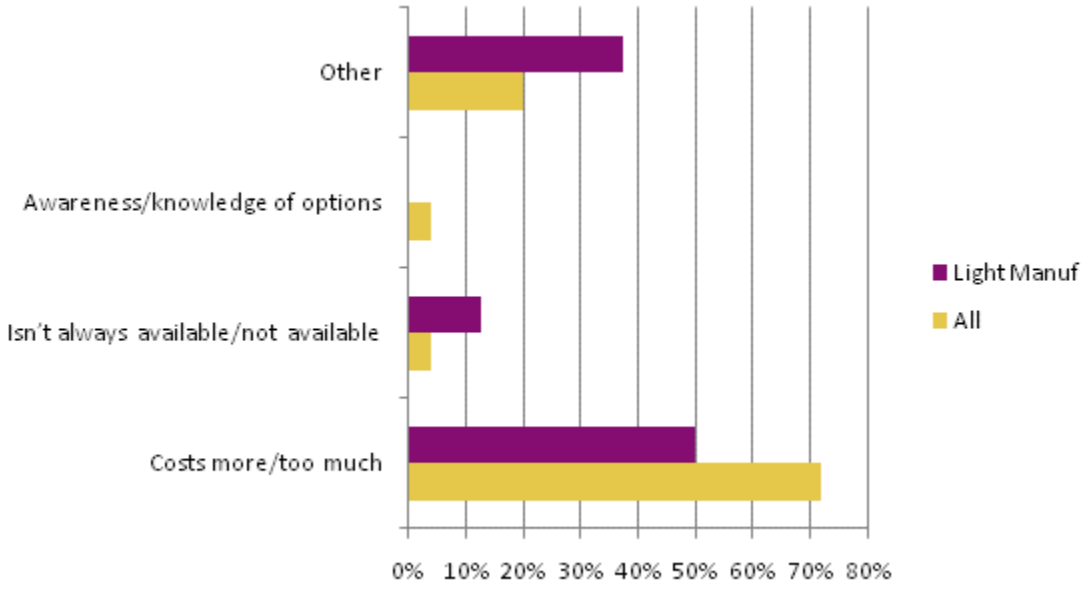
About 28% of the **partial participants** did not have recommendations for how to improve the program, and another 24% said that higher incentives would have kept them in the program (Figure 3.28). This indicates that finances and external factors were often the main reason for these participants dropping out. **The majority of partial participants (81%) did express a desire to participate in the future,** demonstrating that most have not been dissatisfied with the program. However, 20% commented that better communication and program information from PSE would have helped them to participate, and this is an area where PSE can improve. Many who responded that they would like to participate in the future would only do so under certain conditions, most often citing time and cost constraints.

Figure 3.28. Partial Participant Program Improvement Suggestions



About 72% of **non-participants** indicated that the main barrier to installing energy efficiency equipment or changing O&M practices in the program is that it costs more or too much (Figure 3.29). Another 20% of respondents indicated "other", which included funding availability/skepticism, and a lack of time/effort/manpower. The remaining 8% indicated equipment non-availability (4%), and a lack of awareness/knowledge of program options (4%). Initial purchase cost, operation and maintenance costs, energy efficiency, and availability were also ranked by non-participants as important factors in purchasing new equipment.

Figure 3.29. Non-Participant Barriers to Participation



Other survey feedback from **non-participants**, however, suggests that **lack of program awareness** could be a key issue. When asked how familiar customers are with the Custom Grant Program, 45% indicated "not very familiar" and another 36% said they were "somewhat familiar" while an additional 9% were "not at all familiar." Only 9% of non-participants were "very familiar" with the program. Light manufacturing customers were not very familiar to somewhat familiar in most cases (33% and 50%, respectively).

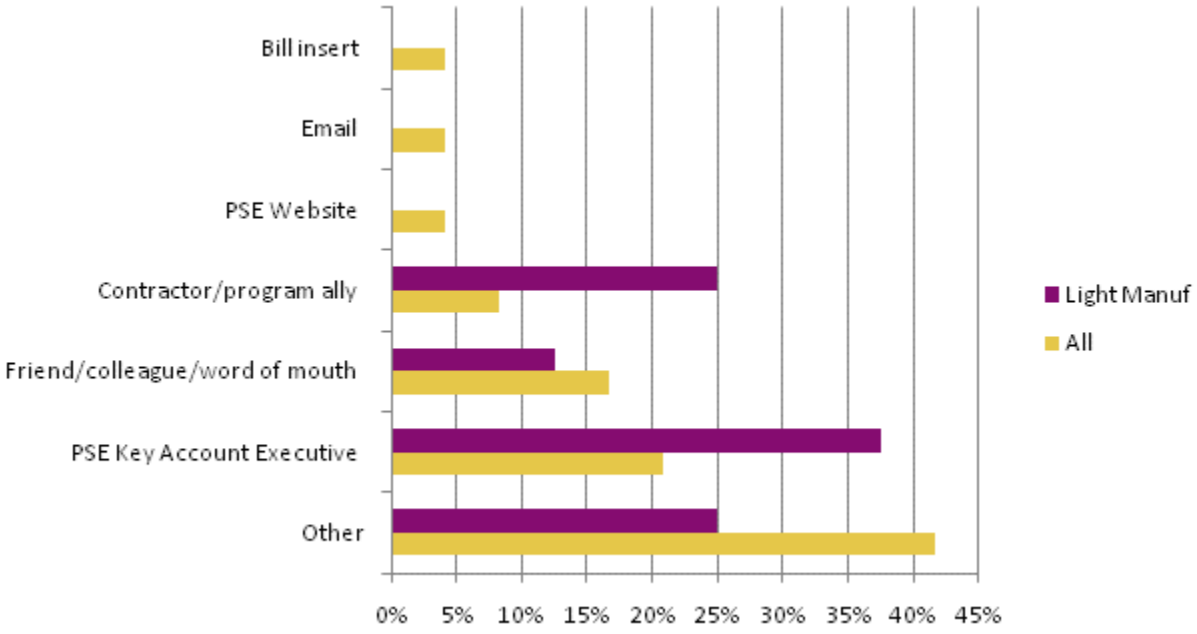
When asked to indicate the main reasons for non-participation (in 2009 and 2010), 64% of non-participating customers cited "other" reasons, including previous participation, lack of funds, and difficult building type as impediments. The second most cited reason (18%) was a lack of information and awareness of the program. Notably, the one light manufacturing non-participant customer that wasn't moving and hadn't been involved with the program before (and was thus a potential new candidate), reported a lack of program awareness. Of the three people that responded to how the custom grant program could be improved, each indicated the need for more publicity and information (specifically on the rate of return, ROR). Two of those were light industrial customers.

Program Awareness and Outreach

A total of 68% of **non-participating customers** indicated that they do not recall seeing or receiving any marketing materials or information about PSE's Custom Grant program. This reflects in part the fact that the survey team contacted customers of all sizes, a number of whom would not necessarily have been targets for the program. Most people that did hear about the program did so through "other" means (42%), which included through vendors, Internet research, and a newsletter (Figure 3.30). Other sources of information included a PSE Key Account Executive (21%) and word of mouth (17%). Light industry customers, on the other hand, most often heard about the program through their PSE Key Account Executive. Note that only 4% of all customers that knew about the program heard about it through

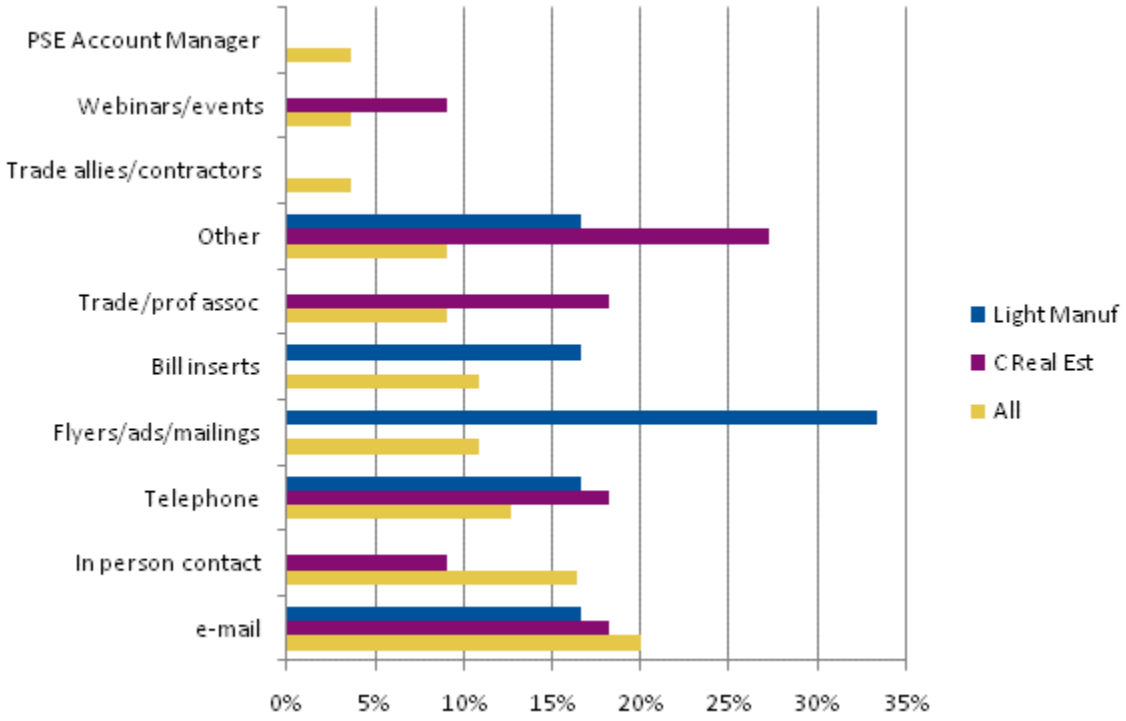
email and another 4% through bill inserts. These means were reported in this survey as the most popular contact methods among non-participants (and e-mail among participants), as discussed in the following sections.

Figure 3.30. Non-Participant First Source of Program Information



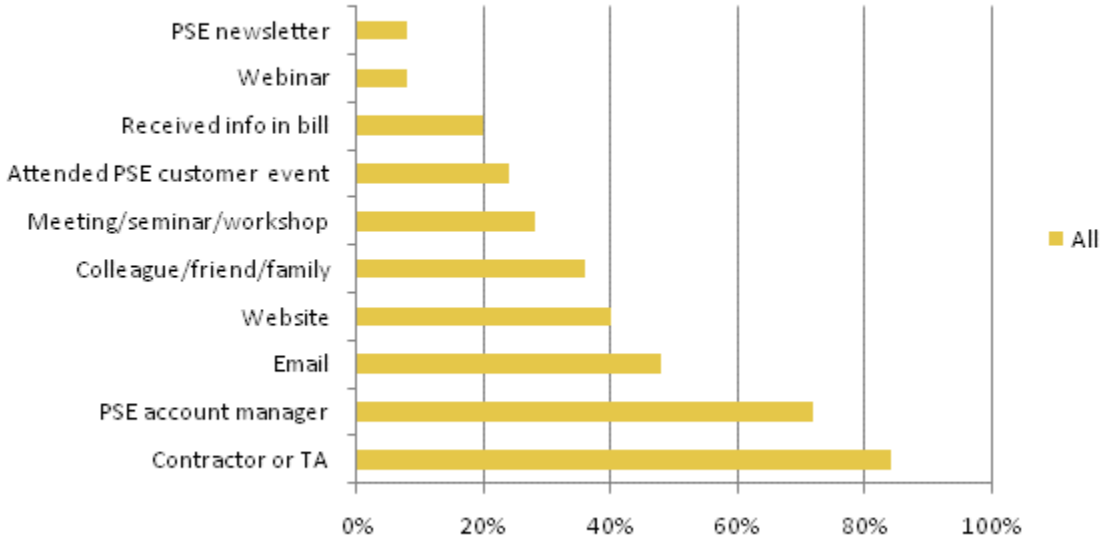
Participants overall indicated email, in-person contact, and telephone calls were the top three ways to reach customers (Figure 3.31). Two of six light industry customers noted flyers/ads/mailings as the best way to reach them, with the remaining four respectively mentioning email, bill inserts, telephone calls, and industry and trade publications. Commercial real estate customers said email, telephone contact, and trade/professional associations and informational meetings were the best way to reach them.

Figure 3.31. Participant Preferred Contact Methods



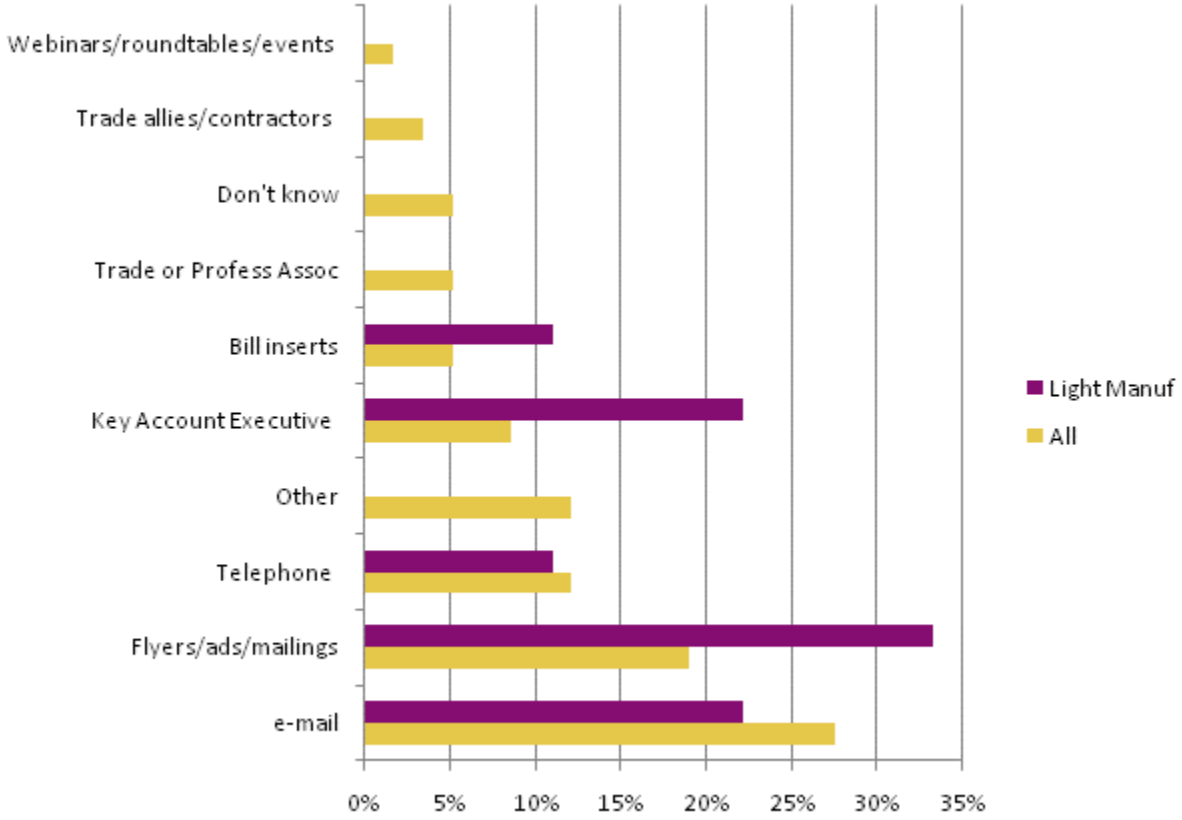
Partial participants had heard about PSE's program in many ways. The most common were through a contractor or trade ally (84%) or a PSE account manager (72%) (Figure 3.32). When prompted for other ways, the most common response was through vendors. However, only 8% of partial participants indicated that the best way to reach them was through trade allies or contractors; more specified that email (48%) or in-person contact (24%) was the most effective way to contact them.

Figure 3.32. Partial Participant Initial Sources of Program Info



Overall, **non-participants** also indicated that email was the best way to reach them (28%) (Figure 3.33). Other top choices were flyers/ads/mailings (19%), telephone calls (12%), and "other" (12%), which included suggestions for in-person visits, ads, and targeting management. The light manufacturing customers seem to prefer flyers/ads/mailings, key account executives, and email as the main means of contact.

Figure 3.33. Non-Participant Preferred Contact Methods



Key Messages

The top reason (52%) **participants** gave for participating in the program was that it is good for saving energy and generating money savings. The monetary incentive was the second most cited reason (24%). Other reasons customers participated were that the program and the experience were positive (10%) and that participating was good for a company's image (7%).

Partial participants' view of participation benefits indicates again that the financial aspects of program participation are very important to customers. A total of 52% cited utility savings as a benefit, and 40% cited the rebate/incentive. Few highlighted the environmental benefits (8%) or advantages of higher quality new equipment (12%).

About 37% of **non-participant respondents** indicated that lower maintenance costs are the main benefit to participating in energy efficiency programs like the Custom Grant program. Energy savings were the next most important perceived benefit, with better quality new equipment in third. Lower maintenance costs were the clear selling point for Light Industry non-participant customers as well (50% compared to the next highest percentage, 17%). Rebate/incentives were listed as the main benefit by only 11% of the respondents. Notably, none of the non-participant customers indicated that the main benefit to participating was that it's good for the environment. These non-participants are thus less likely to be

driven to participate due to environmental concerns, unlike the participants and partial participants who cited environmental benefits. Instead, savings associated with lower maintenance and energy expenditures are the most solid selling points for both participating and non-participating customers.

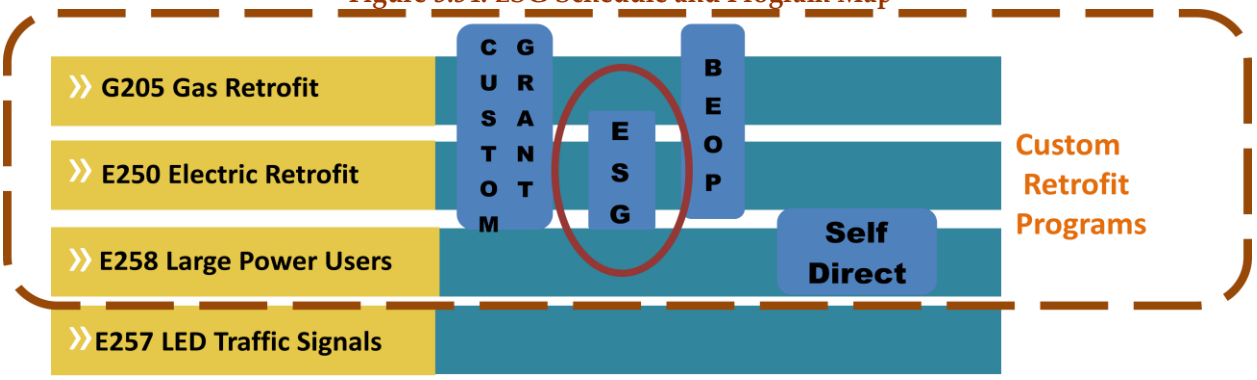
The top two participant benefits claimed overall were new better quality equipment gained through the program and lower maintenance rates. Customer satisfaction and publicity opportunities were also noted as other benefits. Whereas Light Manufacturing customers also most frequently noted better quality new equipment as one of the program benefits, Commercial Real Estate customers noted customer satisfaction and publicity opportunities as top additional benefits of participating in the program. It is interesting to note that fewer Commercial Real Estate participants, 50%, cited additional benefits than all respondents, though again that is half of a very small sample.

3.3.2 EnergySmart Grocer Program

PSE's EnergySmart Grocer (ESG) program funds audits which are used to advise grocers on energy-efficient retrofits of their existing refrigeration and related systems. The program provides grocers with free energy audits that yield information about efficient refrigeration technologies and opportunities for energy savings in the form of an Energy Savings Report (ESR). The EnergySmart Grocer program can assist further by reviewing contractor bids and advising on technical options, many of which are also incented to help offset the upfront investment in new equipment. PSE's program is delivered by Portland Energy Conservation, Inc. (PECI) which provides technical sales staff to call on customers as well as engineers to perform the audits, and also processes the applications, verifies the installations and pays the incentives to customers.

This report subsection details Navigant's findings regarding the EnergySmart Grocer program which is funded solely by Schedule 250. (Figure 3.34)

Figure 3.34. ESG Schedule and Program Map



Navigant's process evaluation for the ESG program draws upon the following sources for these findings:

» Draft EnergySmart Grocer program logic model

» Program database mining

» Program management and implementation in-depth interviews

» Benchmarking and best practices research

» Trade ally in-depth interviews

» Customer surveys

The EnergySmart Grocer program accounts for 19% of total custom retrofit C&I savings, with all measures under this program being refrigeration-related. The program had 127 participants over the two years who implemented 812 measures in total. The average project saved almost 60,000 kWh. The program's average incentive cost per first kWh saved was $0.16, lower than the average of $0.25 for the four schedules evaluated by Navigant. (Table 3-19)

Table 3-19. EnergySmart Grocer Program Overview

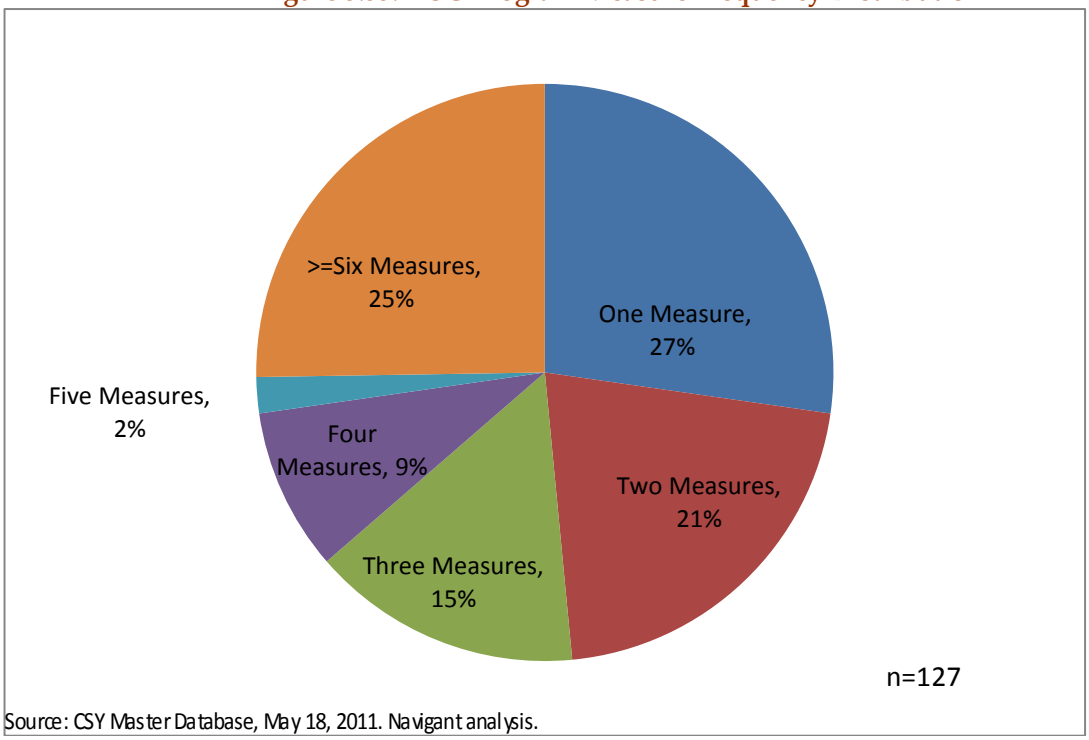
Program	Total					
	GWh Savings	% Electric Savings	Therm Savings (MDth)	% Gas Savings	# Participants	% Participants
EnergySmart Grocer	31.0	19%	0.0	-	127	15%

Program	Number of Projects	Average Per Project			Overall Average	
		Grant Amount	kWh Savings	Therm Savings	$/kWh	$/Therm
EnergySmart Grocer	518	$9,007[1]	59,923	0	$0.16	$0.00
Four Schedule Total	**2,060**	**$18,715**	**77,822**	**1,019**	**$0.25**	**$4.44**

[1] ESG grant calculations are based only on the 7 ESG refrigeration projects that PSE administered. They do not reflect kWh savings for ESG projects processed by PECI, for which data is unavailable. These account for 19% of all kWh savings and approximately 99% of all ESG kWh savings.

The ESG program appeared to be the most successful at generating deep savings, as it has the highest number of measures implemented per participant on average during 2009 and 2010. One quarter of ESG participants implemented six or more measures during this period as shown in Figure 3.35 below.

Figure 3.35. ESG Program Measure Frequency Distribution

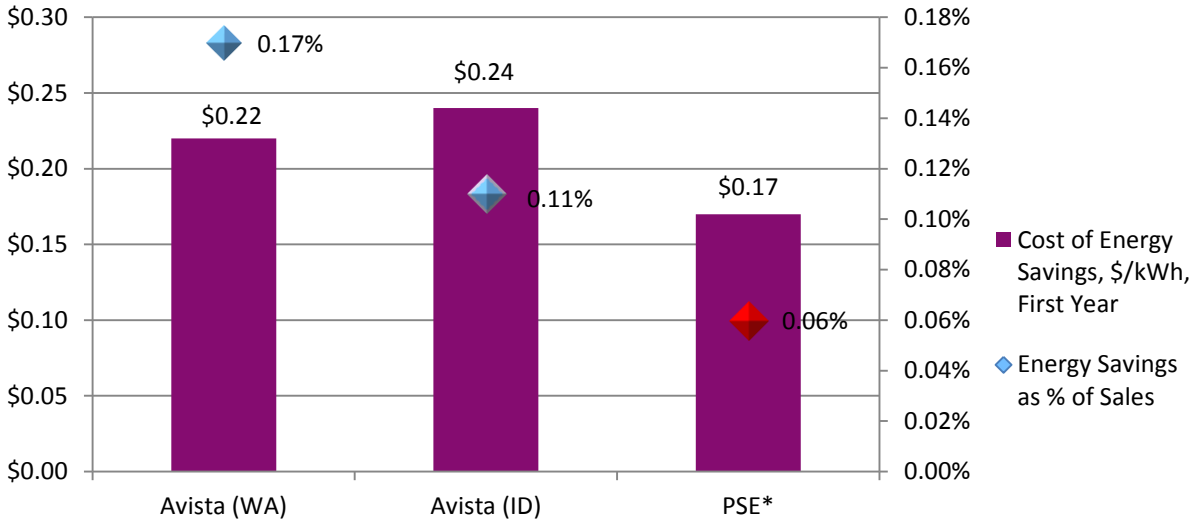


Source: CSY Master Database, May 18, 2011. Navigant analysis.

3.3.2.1 Benchmarking and Best Practices Findings

In the C&I program benchmarking Navigant sought to compare PSE's savings and cost with the other benchmarked utilities who had implemented a similar program. Among the utilities PSE was benchmarked against, only Avista Washington and Idaho reported savings for a Smart Grocer program. Both of those programs reported higher savings as a percent of their C&I usage, while their costs were also somewhat higher. (Note, PSE's costs in the below chart reflect only costs related to incentives, that is, no non-incentive costs.) (Figure 3.36)

Figure 3.36. EnergySmart Grocer Benchmarking Results



*Incentive only 2009-2010 average. Navigant PSE data-mining analysis

Avista Washington's Smart Grocer Program achieved higher savings than PSE's in both Washington and Idaho likely due largely to a wider program breadth. Avista includes measures other than refrigeration in their program, including gas measures. Avista also targets new store construction and has found it to be very effective. Avista did find that smaller customers (convenience stores and commercial kitchens) tend to buy used refrigeration systems, so they no longer target them to the same degree.

3.3.2.2 Trade Ally Feedback: Program Efficiency

This section analyzes the in-depth trade ally interview responses and highlights the key results for the EnergySmart Grocer program in three areas: Program Efficiency, Marketing and Outreach, and Enhancement Opportunities. Five trade allies provided feedback about the ESG program.

Overall, trade allies reported moderate satisfaction with the program, giving it an average satisfaction rating of 2.05 (out of 4, with 1 being the highest possible score). All allies reported increased business as a result of the program, and many increased their staff as well.

Though trade allies participating solely in the ESG Program were generally satisfied with its efficiency, those who also participated in the C&I Retrofit program perceived higher inefficiency in the ESG program. One ally commented that PECI required more paperwork and inspections than the Custom Grant program, but that the same equipment could get much higher incentives through the Custom Grant program.

Table 3-20 details responses regarding specific program characteristics impacting efficiency.

Table 3-20. Trade Ally Feedback on EnergySmart Grocer Program Efficiency

EnergySmart Grocer: Program Efficiency	
Application Process	Most allies find applications easy and quickly processed.
Usefulness of Required Inspections	Some trade allies are frustrated with the large number of required inspections, though one found the double-check helpful. Other utility programs allow TAs to document upgrades with photographs instead of requiring a third party inspection.
Paperwork Issues	Both trade allies who also use the Custom Grant program find ESG documentation requirements excessive. They also report that ESG options are restrictive. One strongly believes that PECI introduced inefficiencies.
Payment process	Most TAs were largely satisfied with grant processing speed. However, all reported delays, some up to a month beyond scheduled payments, and this was a major issue for one ally.
Impact on contractor	All trade allies reported increased business, and many hired additional staff specializing in energy efficiency as a result of the program. Few changes in stocking practices.

3.3.2.3 Trade Ally Feedback: Marketing and Outreach

Although some trade allies preferred to use their own marketing materials tailored to their customers, many commented favorably on the case studies in the brochures and requested more numerical examples to help customers understand the long-term benefits of efficiency measures. Another suggestion was to give participants an ESG program sticker to display in windows, alerting customers to their efficiency efforts and promoting the program. As with the other programs, trade allies expressed a desire for PSE to play a more visible role in the program, recruiting customers and increasing advertising efforts.

Table 3-21 details responses on program training, marketing, and outreach.

Table 3-21. Trade Ally Feedback on EnergySmart Grocer Marketing and Outreach

EnergySmart Grocer: Marketing and Outreach Effectiveness	
Training availability and usefulness	Half of the trade allies had received some training, which one found useful. Others expressed a desire for marketing training and advice on paper processing details.
Availability and quality of marketing materials	Most had received brochures from ESG and found them useful. Some commented that their marketing is too customer-specific to use the ESG brochures. Others found that the case studies highlighted in the brochure were useful in sales.
TA Outreach Desired	Half of the respondents expressed desire for additional marketing materials with clear and quantitative savings examples. Some also wished for introduction of new measures to broaden scope and help getting in touch with customers.

3.3.2.4 Trade Ally Feedback: Enhancement Opportunities

As in the C&I Retrofit program, trade allies who sell a specific product and use a similar process for most of their customers were more satisfied with the program. Correspondingly, trade allies who work on a variety of projects have greater difficulty predicting the value of potential incentives and are more likely to get tripped up in paperwork. Program simplification and transparency about incentive amounts would help these TA's. Another consistent response was a desire for an expansion of the program to cover more LED lighting options.

Table 3-22 highlights the main areas where TAs felt PSE could improve the program.

Table 3-22. Trade Ally Feedback on EnergySmart Grocer Program Enhancement Opportunities

TA Feedback: EnergySmart Grocer Program Enhancement Opportunities	
Problem or Obstacle Identified	*Opportunity*
Some customers view the program as a disruption to business that they do not have time for	Streamline process, especially on-site inspections, increase customer education
Many qualified customers, especially smaller stores, cannot afford their share of measure costs	Investigate ways to help customers finance measures
Some TAs feel limited by current measure scope	Expand program to include new technologies, namely LED lighting and a wider variety of (unspecified) efficient refrigeration measures
Smaller grocery stores with international owners run into language barrier with PSE	PECI should look into hiring multilingual staff to limit barriers to these grocers
Delayed payments have caused some TAs to have financial problems	Expedite payment processing or be accurate about expected payment dates—e.g., within 45-60 days instead of 30
Many TAs reported that program can take a long time, paperwork required is time consuming (principally re-submittals due to mistakes), and amount of incentive is difficult to predict	Make incentive calculation process more transparent so that trade allies can present customers with options sooner

3.3.2.5 Customer Feedback

Customer feedback on the EnergySmart Grocer (ESG) program reflects interview results from five active participants, five participants with below average participation in the past two years, and eight customers who did not participate at all during the past two years, half of which claim to have never participated. In all cases, the interviews were conducted with a primary energy efficiency decision maker in the organization. The findings are summarized in two tables, one addressing program satisfaction and opportunities, and the other addressing marketing issues.

As detailed in Table 3-23 below, overall participant satisfaction with the ESG program is very high, with all ten customers participating over the past two years very satisfied with the program. This level of satisfaction is reinforced by all participants reporting plans to participate in the program again in the future. Also consistent with high participant satisfaction, many participants offered no suggestions for program improvement, and there was no common theme among the few improvement suggestions offered.

The most commonly cited barrier to participation was cost, while lack of program awareness was cited by half of the non-participants. One notable comment, however, is that future participation will depend on the introduction of more measures. This suggests that participants believe that they have either implemented all available measures or all cost-effective measures, and future activity will depend on the offering of additional cost-effective measures.

Table 3-23. Participant Satisfaction With ESG Program

Factor	Feedback
Overall Satisfaction	• All 10 customers who participated over the past two years indicated they were "Very satisfied" overall with PSE's custom grant program. • Those participants whose participation rates were lower than average (based on number of measures installed) indicated that this is because they have already installed all of the cost-effective measures. • All participants indicated that they plan to participate in the program again in the future *when more measures are introduced.*
Key Barriers to Participation	• The most commonly cited barrier to increased participation was the upfront investment, a universal concern of all non-participants and cited by one active and two less active participants. • Four of the more active and one less active participants indicated there were no drawbacks to participation in the ESG program. • Program awareness was an issue for four of the least active participants, where four of the eight had not heard of the program. One moderately active participant commented that he hadn't participated much recently because he hadn't been contacted by the program administrator. • Business climate was cited as an issue by a couple of the moderately active participants, while one other commented that he had not seen any benefits from a previous measure, but this could have been due to a rate increase.
Program Processes	• Customers were generally very satisfied with the ESG program processes. • All participants indicated that the application process was simple, and the majority agreed that requesting program services was easy, and program staff were helpful. • Only one participant disagreed with the statement that "requesting program services from PSE was easy".
Opportunity for Improvement	• Consistent with high levels of program satisfaction, respondents provided limited feedback about improvement opportunities, and any suggestions ranged widely in nature. • Among the most active participants, one wanted better communication about specific measures while another desired more measures. • Among less active recent participants, two suggested that a simplified and/or electronic application process would be useful while one suggested offering no-interest or low-interest financing.

Incremental focus on marketing and outreach is an area of opportunity for PSE. Customer feedback indicates that the most effective approach to inform customers about PSE's program is in person, though smaller participants indicate that bill inserts and fliers are effective. Key marketing messages include the

opportunity to save both money and electricity. More detailed customer feedback relating to ESG program marketing and outreach is summarized in Table 3-24.

Table 3-24. ESG Program Marketing and Outreach

Factor	Feedback
Awareness/ Effectiveness of Marketing Materials	• Bill inserts and fliers were most useful for smaller customers where the decision maker is likely to see the bill. • E-mails had been seen and recalled by more customers than events or meetings. • The PSE website was cited less as a source of program material than might be expected.
How Best To Reach Customers	• For recent participants contractors were the most common source of program information. • Participants consistently reported that the two best ways to reach them are via a PSE representative and/or an in-person visit. • One respondent indicated that there were too many parties coming with information about ESG, and it undermined his efforts to approach ESG in an integrated way.
Marketing Message	• The reported main benefits from participation in ESG are saving money and saving electricity, with saving money being the most consistent response across all those surveyed. • Environmental concerns was the next most common response, though not a universal concern. • Among non-participants, all who responded (7 of 7) indicated both the initial purchase cost and operating cost of new equipment is "very important" in making the decision to install. Less so, though still important were energy efficiency and product availability, followed by product aesthetics.

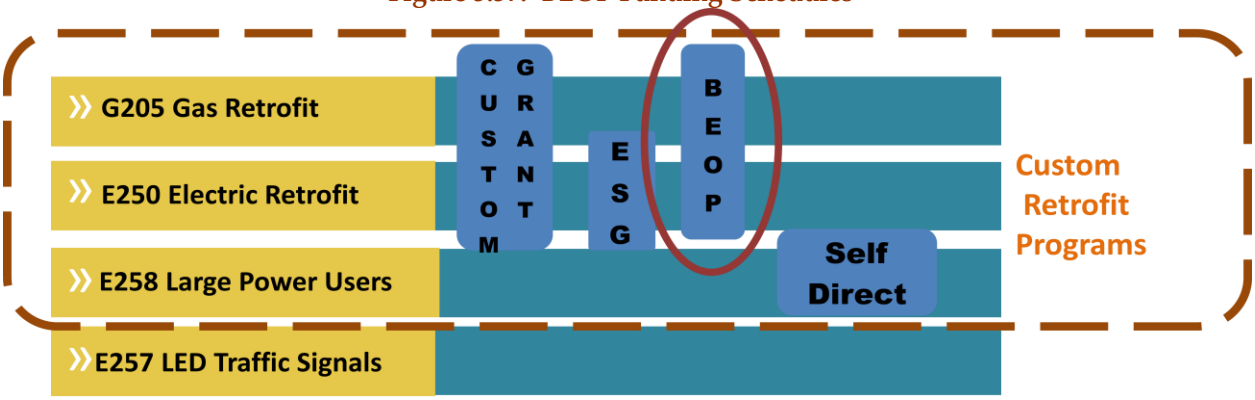
3.3.3 Building Energy Optimization Program (BEOP)

PSE's Building Energy Optimization program (BEOP), a retro-commissioning program, targets persistent, cost-effective, energy-saving changes in existing building systems and operations. The program provides funding and authorizes third party agents to evaluate the operation of existing building systems that need to be recalibrated over the life of the building as changes in occupancy and other factors lead to comfort issues and system inefficiencies. Building managers are trained in the proper maintenance of the changes, and a training manual is created to ensure the knowledge is retained with the building, beyond any staff changes. In addition to funding the evaluation, PSE incentivizes participants to maintain the new, energy efficient controls, by offering a cash bonus one year after the initial changes are implemented if the energy savings are maintained.

This O&M-focused program was redesigned in 2009 in an attempt to increase participation. A significant change was the creation of partnerships with retro-commissioning agents, designated contractors that PSE has qualified through extensive research to do this work. In addition, the incentive structure was changed and incentives were increased to attract participation. The program targets buildings over 50,000 square feet that are at least 3 years in age with 75% occupancy.

BEOP projects can be funded from Schedules G205, E250 and E258 as shown in Figure 3.37 below.

Figure 3.37. BEOP Funding Schedules



Navigant's process evaluation for BEOP draws upon the following sources for these findings:

- Draft BEOP logic model
- Program database mining
- Program management and implementation in-depth interviews
- Benchmarking and best practices research
- Trade ally in-depth interviews
- Customer surveys

As Table 3-25 shows, the BEOP program accounted for only 2% of all C&I retrofit program kWh savings in 2009 and 2010. The average incentive cost per kWh saved was $0.04, and average cost per Therm is $0.13, both significantly lower than the overall average for the four schedules evaluated. During this period, the program had eight participants complete 11 projects, some projects having been initiated under the previous program structure.

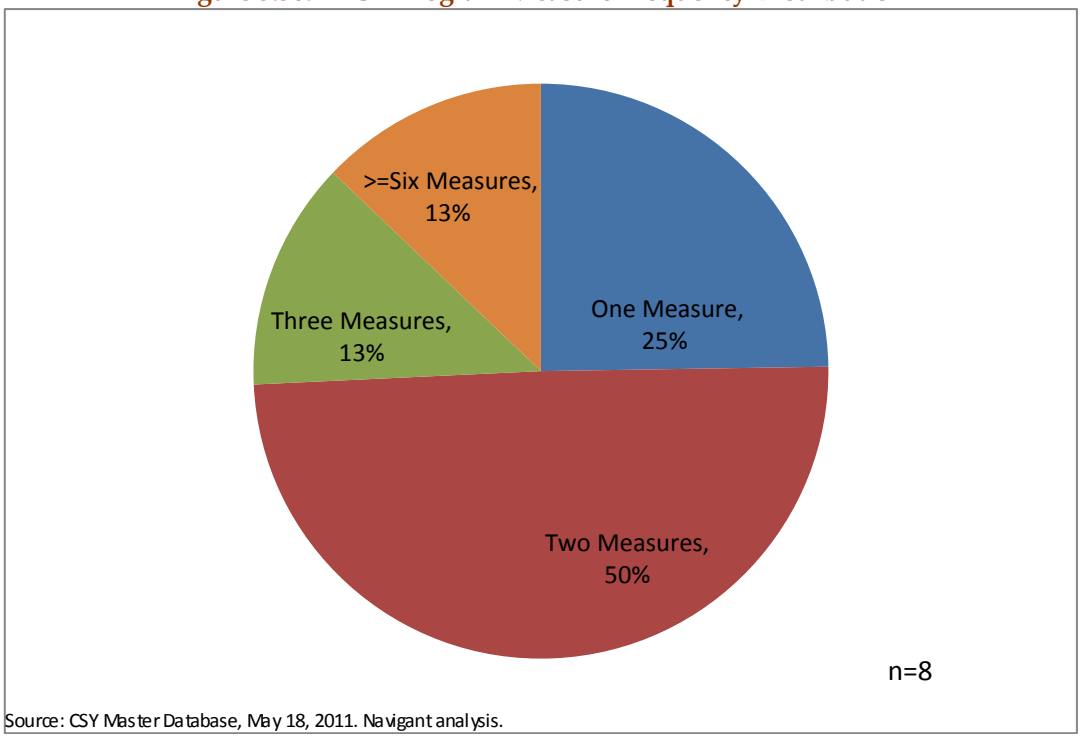
Table 3-25. Building Energy Optimization Program Overview

Program	Total					
	GWh Savings	% Electric Savings	Therm Savings (MDth)	% Gas Savings	# Participants	% Participants
BEOP/ RCx Program	2.5	2%	3.9	3%	8	1%

Program	Number of Projects	Average Per Project			Overall Average	
		Grant Amount	kWh Savings	Therm Savings	$/kWh	$/Therm
BEOP/ RCx Program	11	$27,304	228,450	3,546	$0.04	$0.13
Four Schedule Total	**2,060**	**$18,715**	**77,822**	**1,019**	**$0.25**	**$4.44**

BEOP and other O&M project participants implemented more measures than the average Custom Grant program participant. Only 25% implemented one measure, while 13% (1 participant) implemented six or more measures. (Figure 3.38).

Figure 3.38. BEOP Program Measure Frequency Distribution

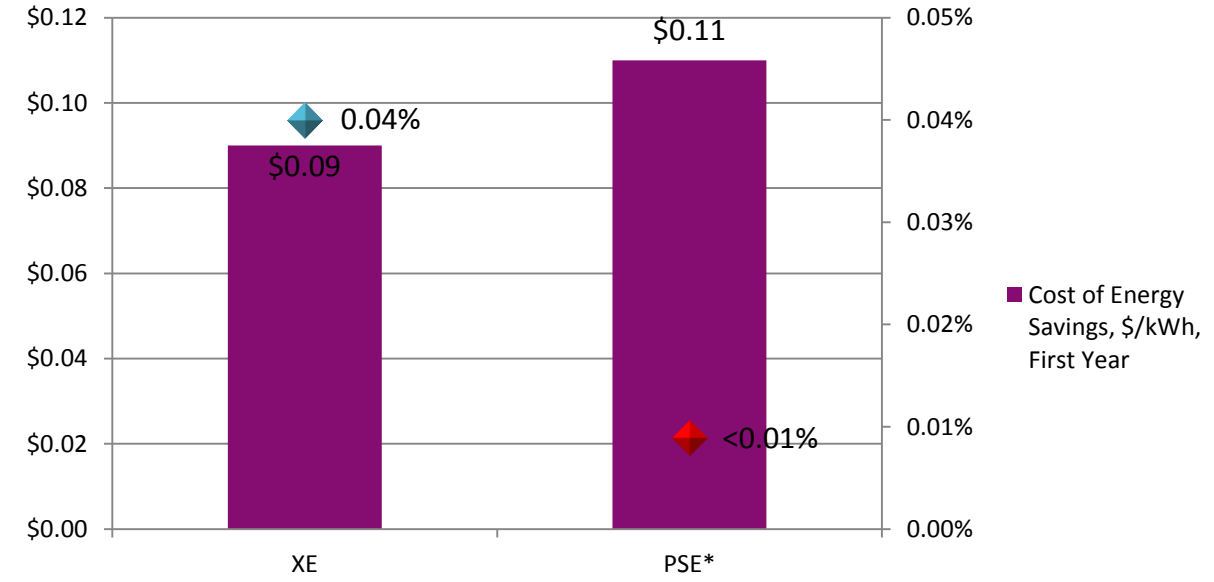


Source: CSY Master Database, May 18, 2011. Navigant analysis.

3.3.3.1 Benchmarking and Best Practices

PSE's BEOP is still relatively young, so any benchmarking of the program with programs that have been around for some time are less meaningful than those that are also in their first few years of operation. The only benchmarked utility to report running a retro-commissioning program was Xcel MN, which has had a program operating over ten years. Although 2009 was not its strongest year, its program savings were four times PSE's and its cost was lower per first year kWh saved than BEOP's. (Figure 3.39)

Figure 3.39. RCx Program Benchmarking of 2009 Results



*Incentive only 2009-2010 average. Navigant PSE data-mining analysis

Xcel's RCx program performance peaked in 2008 when they generated 150% of 2009 savings or 10 to 11 GWh; participation runs at 20 to 40 customers per year with 60 in the pipeline. Xcel MN has 15 to 20 allies providing applications and 10 which are truly active. The utility does not limit customer size but finds <50,000 square foot customers are less cost-effective. In their experience, a study takes 3 to 6 months to complete and 20 months to implement.

In 2009, Xcel significantly increased their incentives because their target savings were increased significantly. Incentives now include 75% of study cost up to $25,000, $400 per KW or $0.045 per kWh up to 60% of measure cost. Measures with less than a nine month payback are not incented and they do not have a persistence incentive. Xcel (through PECI) offers free training every few months for providers and incents only customer training.

Xcel takes two steps to enhance program efficiency: the utility provides a calculator tool to providers to ease savings estimates and is continually adding measures to the tool. Recently, to make sure the provider looks at everything and to encourage customers to implement more measures, Xcel MN implemented a checklist for providers covering 38 measures. They report that this has been effective at increasing project savings.

Navigant also investigated a younger retro-commissioning program that was relatively successful in its first year after its pilot program year. This program, run by ComEd in Illinois had 14 projects completed in its first full year with savings of 5 to 10% on average. ComEd covers 100% of the study cost up to $30,000 or $60,000 (depending on study cost and savings potential) and requires that the customer commit to spending $10,000 or $20,000 (depending on study incentive). They have no limitations on either the agents participating, or customer size, but find that most participants are 100,000 square feet or larger.

3.3.3.2 Trade Ally Feedback: Program Efficiency

These three sections will analyze the in-depth trade ally interview responses and highlight the key results for the Building Energy Optimization program in three areas: Program Efficiency, Marketing and Outreach, and Enhancement Opportunities. Six trade allies were interviewed about BEOP, two of whom are not currently active program users.

Trade allies were not very satisfied with the BEOP program, giving it an average satisfaction rating of only 2.7 out of 4 (where 1 is the highest possible score). The program has had relatively little economic impact on trade ally staffing, in part because of the program's youth but also because it has been slow to generate new business. Trade allies found this program cumbersome to use and difficult to learn. Though documentation became easier after completion of at least one project, TAs report it still requires an unreasonably long time to fill out and adds significantly to the fees they charge to the customer. They report this often results in costs well above the incentive cap on trade ally study cost. TAs reported that documentation of site visits was a particular problem, as they thought it was unnecessary to report the status of every piece of equipment rather than just any anomalies found.

Table 3-26 details responses regarding specific program characteristics impacting efficiency.

Table 3-26. Trade Ally Feedback on Building Energy Optimization Program Efficiency

Building Energy Optimization: Program Efficiency	
Application Process	Nearly all TAs said that the long validation process is very frustrating and customers do not understand delays; it's hard to predict incentives levels; formatting of forms is unnecessarily difficult.
Effectiveness of Inspections	Providers do the inspections, and many commented that documentation required is too general and takes a long time; not everything required by the forms is relevant to all buildings and projects.
Paperwork Issues	Excessive and strangely formatted documentation adds significantly to project cost for most TAs, and time and money are often wasted in back and forth over report details. TAs with more experience in program (two) have grown used to it, but even for them it is cumbersome.
Payment Process	Most reported that payment processing takes a long time.
Impact on Contractor	All report little impact from this program so far: there have been only a few projects and it is new. Cumbersome nature of the program reportedly limits desire of many TAs to do more projects through it.

3.3.3.3 Trade Ally Feedback: Marketing and Outreach

Many trade allies are still struggling to understand and leverage this program. Although training improvements and increased communication with TAs would be helpful, making the program less cumbersome will likely have more potential for increasing its use. One key opportunity is making the incentive level easier to predict. TAs suggested making incentives performance-based or making their calculation more transparent.

Table 3-27 details responses on program training, marketing, and outreach.

Table 3-27. Trade Ally Feedback on Building Energy Optimization Program Marketing and Outreach

Building Energy Optimization: Marketing and Outreach Effectiveness	
Training availability and usefulness	All have had the general program training offered by PSE, but some reported continued confusion over program qualifications, requirements, and documentation.
Availability and quality of marketing materials	A few reported that marketing materials give the impression that far more of the project costs will be covered. Many do not do much marketing for this program.
TA Outreach Desired	More information on what is needed in project forms, more transparency to make incentives more predictable. One suggested qualifying companies, not individuals, because individuals are not permanent company assets. Greater trust in TAs also desired--make point that they have already been vetted in proposal process.

3.3.3.4 Trade Ally Feedback: Enhancement Opportunities

Nearly all trade allies indicated that the main opportunities for this program will be simplification and clarification of program and incentive structure. Increasing customer education and being more realistic about payment processing periods would also be helpful. Many TAs also feel that PSE ought to trust their judgment more, especially given the rigor of the agent screening process.

Table 3-28 highlights the main areas where TAs commented that PSE can improve the program.

Table 3-28. Trade Ally Feedback on Building Energy Optimization Program Enhancement Opportunities

TA Feedback: Building Energy Optimization Program Enhancement Opportunities	
Problem or Obstacle Identified	*Opportunity*
All report that it is difficult to find customers who will benefit from the program, low customer awareness levels	Increase program marketing, adjust incentive structure to cover more projects, and make incentives more predictable.
Most trade allies' costs are high because paperwork is excessive and poorly formatted	Relaxing formatting and detail required in project documentation to lower TA costs
Many trade allies struggle to understand program requirements and incentives, even after training	Improve training on both processing and technical requirements; consider changing structure to performance-based or other
Some TAs feel limited by having a single employee authorized as the provider	Consider expanding provider status to company or a larger group within each company.

3.3.3.5 Customer Feedback

Customer feedback on the **Building Energy Optimization Program (BEOP)** reflects interview results from 3 active participants and 3 "partial participants." In the case of BEOP participants, partial participants had expressed interest in the program and had given participation some level of consideration, but either had not yet committed or had decided against participation. Interviews were conducted with key decision makers when possible. The findings are summarized in two tables, one addressing program satisfaction and opportunities, and the other addressing marketing issues.

As shown in Table 3-29 below, customers familiar with BEOP had mixed feelings about the program. Those who participated were satisfied with the results, but they and others were concerned about the amount of time required to participate. **Most respondents commented that the program was too complicated, and that paperwork and verification requirements were excessive.** Feedback on PSE staff, however, was universally positive.

Table 3-29. Participant Satisfaction with BEOP

Factor	Feedback
Overall Satisfaction	• All participants are satisfied with their retro-commissioning results; however, many commented that it was a lot more work than they had expected. • Participants indicated that they would nonetheless participate again in the future. • All respondents, unprompted, gave positive reviews of PSE staff.
Key Barriers to Participation	• Participants indicated that the amount of time required to participate in BEOP was significant. • Working with a third-party contractor who is not already familiar with the building also takes time and may cause initial overlooking of some savings opportunities. • Respondents were unhappy with the program requirement to make an uncertain financial commitment with an unknown ROI up front. None of the partial participants could say whether they would participate in the future because of the uncertainty surrounding the up-front funding requirements and the related payback.
Program Processes	• Paperwork and verification requirements were perceived to be more than necessary by some respondents, and time consuming by all. • Most interviewees commented that the program was too complicated. • Program process clarity was cited as an issue by one interviewee.
Opportunity for Improvement	• One interviewee suggested the program should allow incremental adjustments or quick fixes, as opposed to requiring an "all or nothing" approach to RCx, to reduce the participant's investment, still generate savings, and at the same time be a foot in the door for the program and for larger improvements at a later date.

Customer interview feedback related to key marketing and outreach issues is summarized in Table 3-30 below. Highlights include the findings that the best means for outreach to potential participants include the PSE account representatives and customer events, such as the Powerful Business Conference. Case studies distributed through these two channels would seem to be a key marketing approach since participants indicate that BEOP generates significant savings and does so quickly.

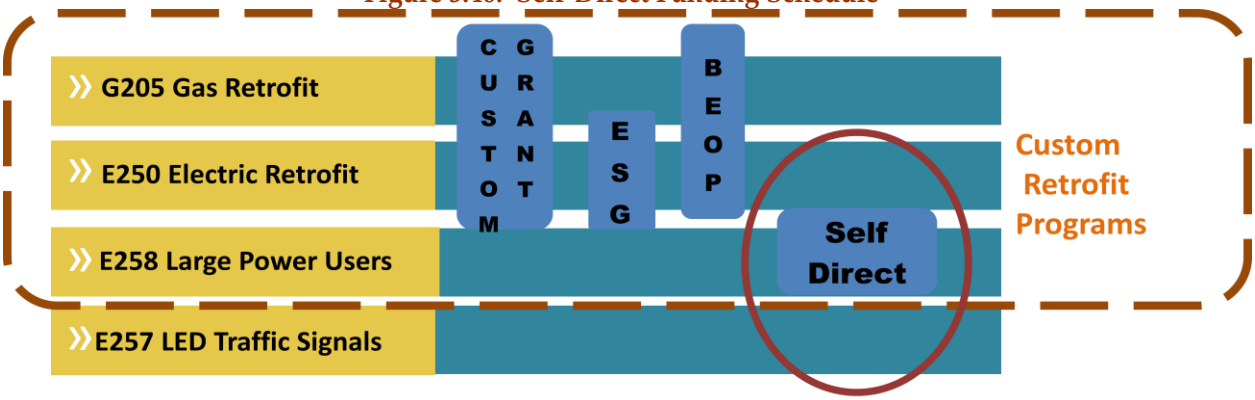
Table 3-30. BEOP Program Marketing and Outreach

Factor	Feedback
Awareness/ Effectiveness of Marketing Materials	• PSE Account representatives were consistently cited as an avenue for information about the program. This was the only avenue through which all respondents indicated they had learned about the program. • While other C&I custom programs did not report significant levels of program awareness though customer events, BEOP participants and partial participants had high levels of awareness through this channel. One respondent cited the "Powerful Business Conference" as the avenue for first becoming aware of BEOP.
How Best To Reach Customers	• In-person contact and PSE Account Managers were cited by all respondents as the best way to reach them.

3.3.4 Schedule E258 Large Power User Self-Direct Program

PSE's Large Power User Self-Direct program is designed to encourage PSE's large power users (approximately 40 customers) to invest in energy efficient projects that they identify and bring to PSE. PSE allocates the incentive funding based on each company's electric usage, and thereby the amount they've paid in; however those customers who do not use their allocation forfeit their funds, which are then combined in a funding pool. Through a combination of applications and proposals, participants may then apply for the unclaimed funds. Each funding cycle runs four years. In 2009 to 2010, approximately 14 of the approximate 40 eligible customers participated in the program. The Self-Direct Program has its own funding mechanism through Schedule E258, though some eligible customers are also eligible for Schedule 250 funds. (Figure 3.40)

Figure 3.40. Self-Direct Funding Schedule



Navigant's process evaluation for the Large Power User Self-Direct program draws upon the following sources for these findings:

» Draft custom program logic model

» Program database mining

» Program management and implementation in-depth interviews

» Results from initial eight in-depth customer interviews

The E258 Large Power User Self Direct program served 14 of PSE's largest C&I customers in this two year period. It accounted for 10% of all C&I savings as shown in Table 3-31 below. The average incentive cost per first year kWh saved was slightly lower than the overall average, at $.23 per kWh.

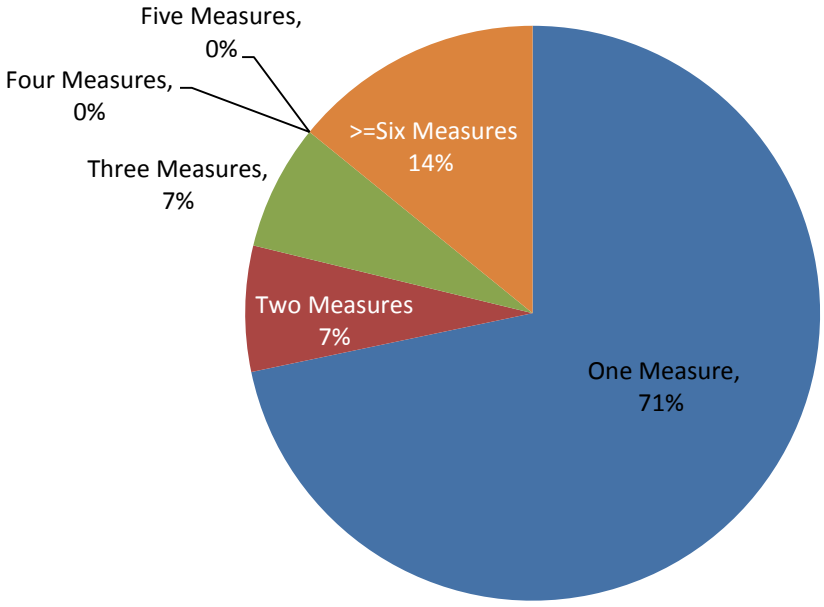
Table 3-31. Large Power User Self-Direct Program Overview

Program	Total					
	GWh Savings	% Electric Savings	Therm Savings (MDth)	% Gas Savings	# Participants	% Participants
Self Direct	16.8	10%	0.0	-	14	2%

Program	Number of Projects	Average Per Project			Overall Average	
		Grant Amount	kWh Savings	Therm Savings	$/kWh	$/Therm
Self Direct	61	$64,732	276,099	-	$0.23	$0.00
Four Schedule Total	**2,060**	**$18,715**	**77,822**	**1,019**	**$0.25**	**$4.44**

The majority of Self Direct program participants implemented only one measure during the two year period. As shown in Figure 3.41 however, 14% implemented 6 or more measures during those two years.

Figure 3.41. Large Power User Self Direct Program Measure Frequency Distribution



n=14

Source: CSY Master Database, May 18, 2011. Navigant analysis.

3.3.4.1 Customer Feedback

In-depth interviews to explore market and process evaluation matters were proposed for 12 Schedule E258 customers. Due to some dropouts and pending additional interview completions, feedback from the initial eight of those interviews is summarized below.

Interview feedback indicates that participants are generally satisfied with the program and find program participation easy. (Table 3-32) Participants appreciate the fact that Schedule 258 money is labeled "theirs" as it helps motivate management to authorize projects to get access to those funds. They find it more difficult to interest management in projects that would go through the Schedule 250 process since the money is not "theirs" to be lost. The biggest barrier to doing more projects is other demands on capital. Feedback on how they can be encouraged to participate more was quite limited, confirming that internal issues are the primary barrier.

Table 3-32. Large Power User Program Feedback

Topic	Customer Feedback
Overall Satisfaction	• There is generally good satisfaction among participants. Almost all report they are satisfied or very satisfied with the program. • Customers are motivated to get their own money back.
Ease of Participation	• Participation is relatively easy. A minority found the application too complicated and a drain on resources that could have been applied to the efficiency projects. The calculation of return on investment was singled out as particularly onerous. • Most participants think they are getting good and timely information from their account representatives. A few are effusive about their representatives. • A few participants complained about the speed of incentive payment. One complained that project approval took too long and the project was implemented without incentives.
Biggest Barrier to Doing More Projects	• Other demands on capital. Relatively easy to get funds to leverage their own 258 funds, but harder to go deeper with more projects
Suggested Changes	• Include fuel-switching projects • Make application simpler • Add more prescriptive savings measures

While Navigant received no comments on the May 1, 2011, increase in Schedule 120 Conservation Rider charges for Schedule E258 eligible customers, customer feedback indicates there are many untapped efficiency projects yet to be undertaken. The biggest barrier to Schedule E258 customers undertaking additional projects is other business demands for capital, which presumably have more attractive returns than energy efficiency projects without the incentives.

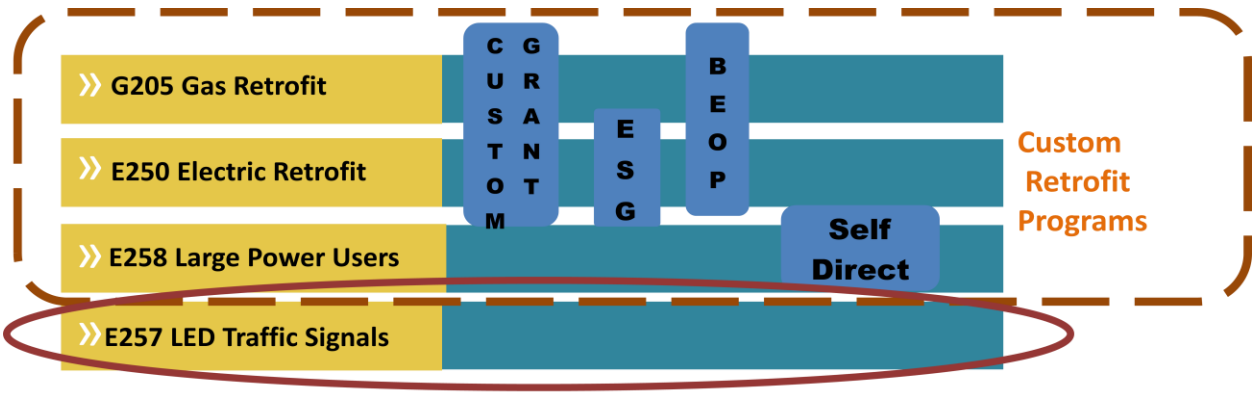
3.3.5 LED Traffic Signals Program

PSE's LED Traffic Signal program is a rebate program that is designed to increase replacement of existing traffic lights with energy-efficient LED traffic lights. The program educates public-sector customers on the benefits of installing red, yellow and green LED traffic signals. PSE provides an LED informational packet along with a rebate application by mail or in person. Customers must receive electric service from PSE to qualify for the rebates, and customers with unmetered accounts must document all connected load at the intersection. New installations are not eligible for an incentive as the LED traffic lights are required by code.

Over this two year period the LED Traffic Signals program operated in an environment in which there was considerable stimulus money that could be applied to these retrofit projects. Program activity reportedly had been declining in prior years but picked up again with the additional funding availability.

The LED Traffic Signals program is funded by Schedule 257 as shown in the below schematic. (Figure 3.42)

Figure 3.42. LED Traffic Signal Funding Schedule



This process evaluation looked only minimally at the LED Traffic Signals program both because the program is expected to be discontinued shortly due to high saturation levels and a transformed market, but also because its savings as a percent of total program savings evaluated is quite small. Consequently, Navigant did not make particular efforts to identify specific program enhancement opportunities or opportunities to increase program efficiency. Program savings and participation levels were assessed in the course of the Team's data mining, and the results are detailed below.

As shown in Table 3-33, the LED Traffic Signals program accounts for 5% of PSE's DSM savings reviewed in this evaluation. With a cost of just $.04 per kWh saved, this program is PSE's most cost effective by a large margin of those four evaluated by Navigant. The 18 participants over this two year period are all cities and counties in PSE's service territory.

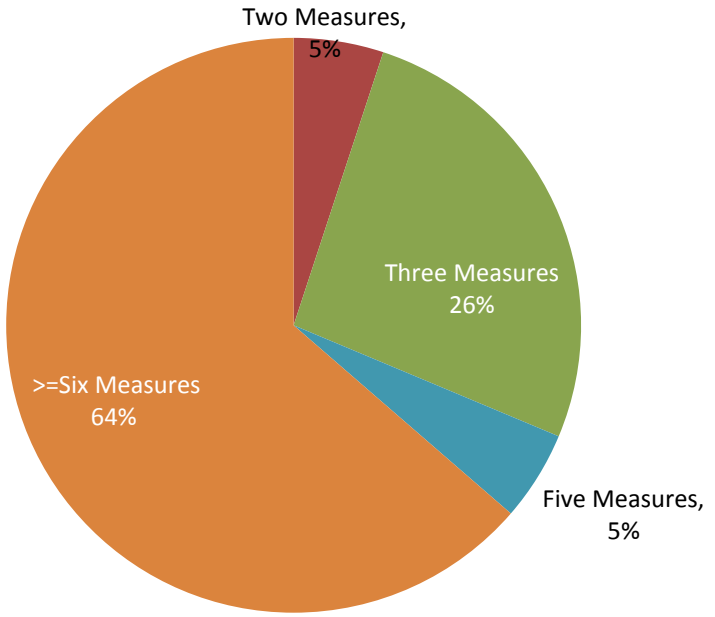
Table 3-33. LED Traffic Signals Program Overview

Program	Total					
	GWh Savings	% Electric Savings	Therm Savings (MDth)	% Gas Savings	# Participants	% Participants
LED Traffic Signals	8.1	5%	0.0	-	18	2%

Program	Number of Projects	Average Per Project			Overall Average	
		Grant Amount	kWh Savings	Therm Savings	$/kWh	$/Therm
LED Traffic Signals	84	$3,736	96,024	-	$0.04	$0.00
Four Schedule Total	**2,060**	**$18,715**	**77,822**	**1,019**	**$0.25**	**$4.44**

Most LED Traffic Signal participants implemented six or more measures during 2009 and 2010 as shown in Figure 3.43.

Figure 3.43. LED Traffic Signals Program Measure Frequency Distribution



n=18

Source: CSY Master Database, May 18, 2011. Navigant analysis.

3.4 Conclusions

PSE's custom retrofit programs are generating considerable energy savings, and customer feedback on its longer-running custom programs is quite positive. PSE's programs have penetrated very effectively its largest customers over the past two years while making some inroads among its smaller C&I customers as well. Nonetheless, PSE appears to have a number of opportunities to enhance the efficiency and effectiveness of its custom retrofit programs, particularly its *Schedule E250 programs* – Electric Custom Grant, ESG and BEOP. Benchmarking of 2009 results suggests that PSE spends more (as a percent of C&I revenue) and its programs cost more (per first year kWh saved) than other regional utilities' (with the possible exception of Seattle City Light for which data is not available at that level) and national best practice utilities. While a significant percentage of PSE's program cost is incentives, these high incentives are not driving the high savings levels achieved by other programs which are offering lower incentives. PSE's savings rates (savings as a percent of total C&I consumption) are at about the median level and can similarly be improved.

Navigant's mining of PSE's 2009 and 2010 *electric performance data* indicate that there are particular opportunities for deeper penetration in both Schedule 25 and 31 electric customers generally, and among large customers (all but Schedule 24 and 25) in manufacturing and educational services. Somewhat higher than average participation rates in even the smallest customers in the accommodation and retail trade sectors indicate that where rebate hunters like *Real Win-Win* can be attracted and where a well-designed highly targeted segment program like ESG can be deployed, higher savings rates are possible from even schedule 24 and 25 customers. The high concentration of program activity in PSE's most active trade allies also suggests that there are opportunities to further leverage the balance of less active trade allies.

PSE's *Schedule 205 Custom Gas program* is a top performer regionally in 2009 based on Navigant's benchmarking in spite of its low rate of savings relative to its companion electric program. Navigant's PSE gas data mining indicates that considerable savings opportunities remain and that large customer opportunities are likely to be most notable in the real estate/leasing and other services (except public administration) sectors.

Navigant's evaluation of PSE's other individual programs' performance revealed a wide range of variability:

- The ESG program has obtained deeper savings than PSE's other programs, but its results compared to Avista's Smart Grocer program suggests there may be considerable remaining savings opportunity in new construction and non-refrigeration measures. PSE does not appear to be leveraging either directly or indirectly PECI's considerable presence at these customers' premises to capture savings from other measures.

- BEOP is clearly a program in an early stage with tremendous potential. Compared to at least one other program of similar age BEOP has completed fewer projects and has fewer in the pipeline. While it is unclear why this may be the case, it's more complex incentive structure and it's

qualifying of providers may to have contributed to the lower number of projects completed and in the pipeline.

» The LED Traffic Signals program is a very low cost source of limited savings, but may very well merit discontinuation if the market has been transformed.

» The Schedule 258 Large Power User Self Direct program brought in relatively large projects that commanded lower incentives per kWh saved than custom grant projects (excluding BEOP and ESG.) The Self Direct program is notable as well for receiving very positive feedback from those six customers contacted to date, who also expressed strong interest in seeing the program continue.

Trade ally feedback varied by program as summarized in Table 3-34 below. Virtually all trade allies interviewed regarding the BEOP program had multiple suggestions for program improvement which program management is aware of and reviewing.. TA feedback on both the Custom Grant and ESG programs was generally favorable, though TAs believe the Custom Grant program suffers from lack of PSE marketing and outreach as well as long turnaround times.

Table 3-34. Highlights of Trade Ally In-depth Interviews

Element	TA Feedback	TA Suggestions to Improve
Overall satisfaction	Most ESG and Custom Grant TAs are fairly satisfied, most BEOP agents are less satisfied	Many BEOP agents would like less stringent documentation requirements and relaxation of formatting guidelines.
Ease of participation	Most found participation in ESG and Custom Grant programs easy, though long process was a challenge. Most BEOP agents found program difficult.	Many would like processes to be shorter and more transparent. Most BEOP agents want reduced and simpler paperwork.
Marketing support	Many TAs found PSE's marketing efforts to customers lacking.	Many want PSE to be more active in recruiting customers, and to act and be visible to customers as a partner to TAs throughout projects.
Training support	Many found training helpful. Some desired additional training, and type of training desired varied widely.	Some TAs thought training should be more technical, and some wanted program savings calculations to be more understandable.
Customer feedback To TAs	TAs report many customers are dissuaded by the long application processes and uncertain savings/incentives.	Many trade allies want savings and incentive calculations to be more transparent so that they can more accurately predict incentives for customers.
Greatest opportunity for more savings	The most frequently reported opportunities were LED lighting, commissioning, and outdoor/parking lot lighting.	These options should be more widely covered by incentives, and commissioning program should be improved and expanded.
Greatest opportunity for improvement	Many believe that shorter processing periods, clearer and more understandable processes, and better relationships with PSE are critical to program improvement.	Many, especially those with less program experience, would like to develop their relationship with PSE and understand the program better.

Navigant's best practices research suggests there are a number of areas for PSE to explore that may yield improved program efficiency and effectiveness. An overarching observation is that PSE has done relatively limited program marketing and customer outreach (with the notable exception of Schedule 258 customers.) PECI through ESG quite actively markets its programs through technical sales reps that are calling on former participants and urging them to undertake still additional projects identified in their initial audit. Selected marketing tactics that PSE may wish to explore are detailed in Table 3-35.

Table 3-35. Best Practices Research Findings Highlights

Strategy Component	Tactic	Example
Customer Outreach	Use Account Executives to generate additional projects (tie to compensation)	Avista
	Use call center to sign customers up for audits and compensate staff per audit	National Grid (smaller customers)
	Use Government Affairs/Community Outreach staff to orchestrate community-specific blitz campaigns (around audits)	National Grid
	Use Account Reps to schedule technical sales folks (3rd party) to do facility audits	Xcel MN, AEP OK
	Devise a focused delivery methodology for 200 to 750 kW customers who need more attention	National Grid
	Leverage ESG presence at customers.	Avista
Program Design	Develop segment focused programs targeting high-potential customer segments	Xcel MN/CO
	Perform up front audit (of varying depths) and stage recommended measures	Xcel MN/CO/PECI/AEP-OK
Customer Relationship Maintenance	Develop and use a customer contact system – follow up on audit findings to generate additional measure uptake	PECI
	Maintain records of audit-recommended measures and which have NOT been done	PECI

The aforementioned marketing and sales tactics clearly involve more than increased spending. They could require changes in staff skills and number, information system capabilities and firm compensation. Before embarking on any such deep changes, PSE should look deeply into those organizations employing these strategies to understand all the key surrounding circumstances and determine whether any make sense for PSE specifically. Subsequently an integrated marketing strategy should be developed leveraging and interweaving those components that make sense for PSE.

PSE is quite rightly proud of the care staff engineers take to evaluate project opportunities for its customers. However, with the growth in the custom DSM programs, the staff has had to narrow its focus, eliminating the upfront audits that they used to perform to identify all savings opportunities at a customer and now focusing only on reviewing proposed projects. Engineering staff appears to be somewhat overloaded, and trade allies have commented on the long application and payment processes. There appear to be a number of potential means by which PSE could better leverage its engineering staff and at the same time continue to deliver high quality service to customers.

Table 3-36 presents a number of possible measures PSE could undertake to leverage its engineering staff while at the same time better meeting the needs of its trade allies. Many TA's indicated that having

calculators that would better enable them to estimate savings would be very useful. PSE may also wish to selectively bring in third parties to conduct audits to identify deeper savings opportunities and review proposed projects.

Table 3-36. Potential Staff Leveraging Opportunities

Potential Enhancement	Utility Employing
Develop participant screening tools for TAs	Xcel MN RCx
Develop additional calculators	Xcel MN RCx
Identify additional prescriptive measures	MAEC (IA), Xcel MN
Employ a 3rd party to only do customer audit and follow paperwork through	Xcel MN
Employ external engineering resources for selected more complex measures	Avista
Incent customer use of prescriptive path	None identified (speed of payment)

Better enabling PSE's engineers to focus their skills on the most complex of projects seems highly likely to be in the best interest of PSE, its trade allies and its customers. PSE has been working on developing some tools, like its boiler calculator tool, to enable exactly that. The benchmarking analysis suggests that PSE should continue to develop such tools and also to identify custom measures that can be shifted to its rebate program, where applications are processed more quickly and consistently.

Navigant recommends that PSE undertake the following nine steps to enhance the efficiency and effectiveness of its C&I custom retrofit programs:

» ***Recommendation 1***. **Schedule 258 Self Direct Program** is effective at inducing larger customers to undertake energy efficiency programs, and apparently more effective than Schedule 250 funded programs alone would be with these customers. Navigant recommends that PSE continue efforts to restructure this program per recent discussions with the Conservation Resource Advisory Group (CRAG) and, as feasible, consider applying the program concept of "customer's own funding available to be used or lost" to increase participation of larger Schedule 250 customers.

» ***Recommendation 2***. As PSE has correctly concluded, retro-commissioning represents an attractive opportunity for increased energy savings, and Navigant recommends that PSE **continue to focus resources on optimizing** its new (Schedule 205, 250, and, ultimately, 258) **BEOP structure**, including consideration of the following:

- Simplifying the program incentive structure and documentation requirements per TA and best practice feedback
- Enhancing program transparency by providing savings calculators to providers
- Opening the program to additional providers
- Enhancing marketing materials, particularly case studies

» ***Recommendation 3***. PSE should **assess the potential benefits of reallocating resources from Schedule 205 and 250 custom grant program incentives to TA and customer support and outreach.**

- TAs are looking to PSE for additional marketing and technical support.
- Case study material appears to be particularly valued.
- PSE should assess the potential for creating savings calculators for TAs that would reduce the uncertainty around likely incentive levels.

» ***Recommendation 4***. Navigant recommends that PSE assess the potential for **leveraging the success of its ESG program**, both through replicating its structure as feasible and better leveraging PECI's presence at grocers.

- The ESG program yielded implementation of more measures per customer on average during this period than other programs, suggesting that there are program elements that could merit adopting in other programs and market segments.
- ESG program elements that are common to other strong utility DSM programs include: initial customer audit with timely feedback, staging of measures, customer follow up, and potentially others.
- PSE should consider expanding PECI's measure portfolio beyond just retrofit refrigeration to gas and other electric measures as well as new construction in the grocery store market segment.
- Alternatively, PSE should consider developing a mechanism for PECI to communicate potential opportunities outside their measure portfolio to PSE.

» ***Recommendation 5***. Navigant recommends that PSE explore **opportunities to increase Custom Grant program efficiency** and reduce application processing time.

- Possible approaches include identifying additional measures that can be made prescriptive and developing savings calculators to make calculations more consistent.

» ***Recommendation 6***. PSE should review the potential to better **utilize its many customer touch points** to market its EE programs.

- Best practice utilities are organized to encourage Account Executive, Business Segment Manager, Energy Advisor, and Government/Community Relations staff to bring customers into DSM programs.
- Such plans would need to consider associated implications for staffing, training, compensation, and required skills.
- Further leverage existing trade ally relationships

» ***Recommendation 7.*** Navigant recommends that PSE continue to invest in enhancing its marketing materials and approach around market segments. PSE has already begun to do so with its EE website redesign and with some targeted marketing materials.

» ***Recommendation 8***. Navigant recommends that PSE confirm and then develop specific strategies and tactics to address its **target market segments**, including potentially the following:

- Manufacturing
- Real estate
- Education
- National chains

Any confirmation should leverage related findings from Navigant's market assessment and could include a deeper review of program uptake to date or in combination a review of current baseline data. Strategies may include target marketing of programs, use of third parties for all or components of program delivery, and use of PSE marketing resources.

» ***Recommendation 9.*** PSE should ensure that its new **program tracking system** provides the functionality required for future program delivery.

- Best practice systems address needs for customer relationship management by engineering staff, maintaining records of past interactions and future opportunities.
- System functionality typically enables tracking of key program delivery metrics, such as application processing time, verification process time, grant payment processing time, and the like, as well as engineering resource commitments and availability.
- The tracking system content should be enhanced to include key trade ally contact information and standardized to ensure consistency in naming conventions to the degree feasible.
- To the extent possible, tracking system should be designed to support future reporting and evaluation requirements

4 Impact Evaluation

This section summarizes the Impact Evaluation methods and findings used to develop measure-, program-, and schedule-level realization rates for the G205, E250, and E258 Commercial/Industrial Retrofit Schedules. Findings from the Impact Evaluation provide PSE staff with the feedback they need to increase program efficacy and to advance the research and policy objectives of PSE staff and the Conservation Resource Advisory Group (CRAG) by providing independent review of program schedule achievements.

More specifically, the Impact Evaluation of PSE's 2009-2010 C&I Program Schedules aimed to characterize Program Schedule specific energy and demand impacts for commercial and industrial retrofit measures, including:

- Quantifying the impacts of all retrofit measures and activities on annual gross energy consumption while accounting for any interactions among technologies.
- Establishing post-implementation performance profiles for installed measures and activities.
- Explaining discrepancies between the results of this study and the *ex ante* savings estimates.

Evaluation metrics and parameters reported through this study include:

- Gross program savings estimates and realizations rates, by fuel type (i.e., kWh and Therms), for retrofit projects.
- Energy usage profiles for C&I technologies metered through on-site Measurement & Verification (M&V) activities.

Table 4-1 provides an overview of the *As Evaluated* realization rates for each of the three Program schedules included through this study.

Table 4-1. Summary of *As Evaluated* Program Schedule Realization Rates (PY 2009 – 2010)

Program Schedule	Program Spending	Ex Ante Savings	Ex Post Savings	Realization Rate
E250 & E258	$39,954,232	152,247 MWh	155,749 MWh	102.3%
G205	$3,864,784	1,424,472 Therms	1,428,745 Therms	100.3%

It should be noted that the project-/program-level realization rates provided in Table ES reflect the difference between expected savings at the time of installation and verified savings more than one year after project completion. And throughout the evaluation, Navigant observed that many participants altered their operating profiles between this timeframe for a myriad of reasons outside the realm of program influence, including:

- **Idiosyncratic Factors** – changes in equipment usage and operating patterns that are unique to a participant's financial health, employee attrition, and corresponding production schedules.

» **Economic Factors** – changes in equipment usage and operating patterns as a result of shifts in industry and economic climates.

The Impact Evaluation explored each of these non-programmatic factors while quantifying their impact on project-/program-level realization rates. Navigant distinguished the impacts from each of these factors through discussions with facility personnel and in-depth file reviews to calibrate responses.

Table 4-2 provides an overview of program schedule realization rates when removing the influence of *idiosyncratic factors* on project level savings. This was accomplished by carefully reviewing the documentation on evaluated projects and comparing the pre-installation assumptions used to develop *ex ante* savings estimates to the *ex post* observations and feedback from facility personnel. In addition to the project input assumptions, Navigant also reviewed the *ex ante* calculation methodologies against industry standards and accepted engineering practices. Finally, Navigant collaborated with PSE to ensure that all available information collected during the participation process was properly accounted for in the *ex post* savings analyses.

Collectively, this information was used to reconstruct the project planning/pre-installation conditions along with the corresponding savings that would have been achieved upon project completion (*As Installed Realization Rate)*. The realization rate metric at this particular point in the program cycle is a significant milestone and of key interest from a stakeholder perspective which warranted this additional level of investigation.

Table 4-2. Summary of *As Installed* Program Schedule Realization Rates

Program Schedule	Program Spending	Ex Ante Savings	Ex Post Savings	Realization Rate
E250 & E258	$39,954,232	152,247 MWh	151,181 MWh	99.3%
G205	$3,864,784	1,424,472 Therms	1,423,047 Therms	99.9%

The *As Installed* realization rates provided in Table 4-2 are **conservative**; the realization rates at the point of installation is an instantaneous metric that cannot account for variability in weather patterns and productions schedules which inevitably drive project performance over time. Accordingly, the *As Installed* realization rates only capture overestimates in the *ex ante* savings methodologies, of which PSE's C&I Program Schedules had limited instances of. More importantly, the *As Installed* realization rates provide insight into the accuracy of the calculations used to forecast savings in the absence of post-installation data. The results of this effort clearly indicate that PSE's EME's are applying mathematically astute methods to the *ex ante* analyses that are consistent with industry standards and accurately predict *ex post* savings estimates.

The C&I sector is particularly sensitive to economic changes because production throughput, occupancy, and operating schedules are driven by customer demand. Similarly, the changes in equipment usage also affect the efficiency of the baseline and replacement technologies incented through PSE's Program Schedules. Throughout the Impact Evaluation, Navigant encountered a number of participant sites affected by these *economic factors*; a majority of which realized lower than expected *ex post* savings estimates.

The subsequent impact of these economic-driven changes on project-/program-level realization rates compound over time because savings estimates apply across a measure lifetime of several years. As such, Navigant recognized the importance of disaggregating the effects of these factors when assessing program performance and developed a robust method that accounted for variations in operating conditions attributed to external economic activity.

For temporary changes in the participant production schedule, Navigant calculated *Economically Adjusted* savings using two consistent baselines:

2.) *Full Production (Ex Ante) Baseline Operating Schedule:* Both pre- and post-installation energy consumption was calculated using the production schedule observed at the time of participation (i.e., full production schedule). . Full-production adjusted operating schedules were derived from a comprehensive review of historic production logs relative to current operating schedules.

3.) *Current Production (Ex Post) Baseline Operating Schedule:* Both pre- and post-installation energy consumption was calculated using the production schedule during the on-site M&V process (i.e., current production schedule).

Table 4-3 provides an overview of program schedule realization rates when removing the influence of economic factors on project-level realization rates. *Section 4.3 Factors Influencing Evaluation Realization Rates* provides a more in-depth discussion of the approach and assumptions used to separate these economic factors.

Table 4-3. Summary of *Economically Adjusted* Program Schedule Realization Rates

Program Schedule	Program Spending	Ex Ante Savings	Ex Post Savings	Realization Rate
E250 & E258	$39,954,232	152,247 MWh	161,230 MWh	105.9%
G205	$3,864,784	1,424,472 Therms	1,428,745 Therms	102.4%

Navigant recognized that economic volatility occurs periodically, and it is no more valid to choose an "up cycle" than a "down cycle" when evaluating Program Schedule performance. By providing a clear distinction between programmatic and non-programmatic factors affecting the realization rate, future evaluation results will ensure a fair assessment of Program Schedule performance over the EUL of incented measures.

Finally, Table 4-4 summarizes the key research objectives addressed through the Impact Evaluation while specifying report locations that expand upon each topic area.

Table 4-4. Impact Evaluation Research Analyses

Topic Area	Research Analyses	Location in the Report
Impact Evaluation Methodology	Measure Prioritization Project File Review Impact Evaluation Sampling Framework On-Site M&V Analysis	Section 4.1
Impact Evaluation Findings/Results	Technology Level Realization Rates Program Schedule Level Realization Rates	Section 4.2
Factors Influencing Evaluation Realization Rates	Idiosyncratic Factors Economic Factors	Section 4.3
Validity and Reliability of M&V Findings	Uncertainties from Sampling Error Uncertainties from Physical Measurement Error Uncertainties from Engineering Analysis Error	Section 4.4
Impact Evaluation Conclusions & Recommendations	Overarching Program Evaluation Findings and Recommendations	Section 4.5
Appendices	On-Site M&V Plans Industry Best Practices in EM&V Evaluation Database Development Quantification of Non-Energy Benefits Review of Cost-Effectiveness Input Assumptions	Appendices

4.1 Methodology

The following subsections provide a detailed description of the evaluation methodologies used in the Impact Evaluation of PSE's 2009-2010 C&I Program Schedules. These methods were developed and informed through an independent review of evaluation Best Practices.[93]

The term "*Best Practice*" refers to practices that, when compared against other practices, produce superior results. In the context of this study, Navigant defined best practices to be those methods, procedures, and protocols which maximized the accuracy and statistical validity of Impact Evaluation findings. And the specific best practices considered in this study were compiled through a review of secondary literature, a comparison of similar programs and evaluation outcomes, and prior evaluation experience. Table 4-5 details the specific reports reviewed through this effort:

[93] See Appendix L - Best Practices for Impact Evaluation Measurement and Verification (EM&V) Cycles

Table 4-5. EM&V Best Practice Studies Reviewed

Organization	Study Name	Publication Year
The Brattle Group	Measurement and Verification Principles for Behavior-Based Efficiency Programs	2011
Ernest Orlando Lawrence Berkeley National Laboratory	Review of Evaluation, Measurement and Verification Approaches Used to Estimate the Load Impacts and Effectiveness of Energy Efficiency Programs	2010
State of California, Public Utilities Commission	Best Practices Benchmarking for Energy Efficiency Programs	2009
Enbridge Gas Distribution	DSM Best Practices for Natural Gas Utilities: the Canadian Experience	2008
Consortium for Energy Efficiency	Energy Efficiency Program Evaluation: A Guide to the Guides	2008
Minnesota Office of Energy Security	Measurement and Verification Protocols for Large Custom CIP Projects - Version 1.0	2008
Northern California Power Agency	E, M &V Best Practices: Lessons Learned from California Municipal Utilities	2008
National Action Plan for Energy Efficiency Leadership Group	Model Energy Efficiency Program Impact Evaluation Guide: A Resource of the National Action Plan for Energy Efficiency	2007
State of California, Public Utilities Commission	California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals	2006
American Council for an Energy-Efficient Economy	America's Best: Profiles of America's Leading Energy Efficiency Programs	2003
American Council for an Energy-Efficient Economy	America's Best: Profiles of America's Leading Energy Efficiency Programs	2003

While each report presented valuable insight into best practices within the field of EM&V, Navigant documented, characterized, and prioritized those best practices with the following properties:

- Cross-cutting best practices with a high level of representation across each of the studies reviewed.
- Best practices consistent with past evaluation experience and interviews with program managers in other jurisdictions.
- Best practices demonstrating the most applicability towards PSE's C&I Program Schedules evaluated in this study.

The subsequent M&V methods developed for the Impact Evaluation of PSE's 2009-2010 C&I Program Schedules reflect the outcome of this independent review.

4.1.1 Measure Prioritization

The development of a measure prioritization hierarchy was crucial to ensure the cost-effective allocation of limited evaluation resources towards specific technologies and/or projects of utility interest. Navigant adopted this *Best Practice* for the Impact Evaluation of PSE's C&I Program Schedules.

The first step in the measure prioritization process involved a thorough review of PSE's Program Tracking Databases which store contextual project data along with *ex ante* project savings estimates. In addition to verifying both the consistency and quality of information within the each database, Navigant used the available data to gain a better understanding of the distribution of savings across measure technologies and participant segments. This review focused primarily on verifying the factors that influence *ex post* realized savings estimates, including:

- Quantity of measures installed.
- Capacity of measures installed (e.g., lamp wattage for lighting, tons for air conditioning).
- Contact information for all parties involved – Navigant recommends clearly identifying all parties involved in a savings claim (customer, contractor etc.) and collecting contact information for each. This will help evaluators to easily identify and reach out to the appropriate party for a given task.
- Efficiencies of measures installed (e.g., SEER/EER for air conditioning).
- Unique performance features of the measures installed (e.g., variable speed, low-emissivity, etc.).
- Contextual variables such as building type and square footage, operating hours and usage/occupancy profiles.

The subsequent measure prioritization process involved calculating a unique score for each electric and gas measure category implemented within Program Schedules E250, E258 and G205. A unique score was assigned to each measure category based on the following three prioritization criterion:

- **Distribution *of Ex Ante* Savings** – Navigant calculated the distribution of *ex ante* savings across all measure categories incented through Program Schedules E250, E258, and G205. Measures that contributed to more than five percent of a Program Schedule's claimed savings were assigned a score of 3. Similarly, measures that contributed between one percent and five percent of Program Schedule claimed savings were assigned a score of 2, with the remainder receiving a score of 1.
- **Measure Uncertainty** – Measures with a high level of uncertainty were defined as those technologies which (1) possessed variable operating conditions, (2) yielded significant variability in application claimed savings estimates, and (3) had not been investigated extensively in previous evaluation studies. Measures with the highest level of uncertainty were assigned a score of 3, while measures with the lowest uncertainty received a score of 1.
- **PSE Priority** – PSE also assigned a unique score to each measure category based on utility interest in that measure. This score was dependent upon a host of factors including measure

maturity, CRAG feedback, future program planning efforts, etc. Measures of significant priority to PSE were assigned a score of 3, with the score scaling downwards with decreasing priority.

Scores for each criterion were then aggregated across each measure category. Measure categories exhibiting a score higher than 7 points were labeled "Tier 1" measures of higher priority. Measures scoring between 5 and 7 were labeled "Tier 2" measures, while the remaining measures were labeled "Tier 3" measures of lower priority.

Tier 1 Measures were measures for which Navigant recommended adhering to an *enhanced level of rigor* when evaluating impacts. Evaluation methods involved the modeling impacts using end-use metering or billing data consistent with the International Performance, Measurement and Verification Protocols[94] (IPMVP). Electric and gas measure categories designated as "Tier 1" are presented in Table 4-6 and Table 4-7, below:

Table 4-6. Tier 1 Electric Measures

Measure Name	Measure Category	Ex Ante kWh Savings
Lighting	Lighting - Commercial	28,435,838
Lighting fixtures plus controls	Lighting - Commercial	19,175,278
Fluorescent luminaries	Lighting - Commercial	11,915,490
HVAC controls only	HVAC - Commercial and Industrial	6,900,580
Process Modification	Process, Commercial	2,931,838
Other Process - High Voltage Program	Process, Commercial	2,816,568
Energy mgmt. control system	HVAC - Commercial and Industrial	2,551,764

Table 4-7. Tier 1 Gas Measures

Measure Name	Measure Category	Ex Ante Therm Savings
Boilers, hot water GAS	HVAC - Commercial and Industrial	431,309
Heat recovery systems GAS	Heat recovery, Commercial	231,349
Gas Energy mgmt. control system	HVAC - Commercial and Industrial	74,155
Boilers - steam GAS	HVAC - Commercial and Industrial	17,894
Water heater, other gas	Water Heating - Commercial	15,656

Tier 2 Measures were measures for which Navigant recommended a *medium level of rigor* for evaluating energy impacts. The evaluation methods for these measures involved algorithm based energy savings calculations utilizing spot measurement and on-site verification of equipment installation. Table 4-8 and Table 4-9 detail the electric and gas measure technologies that fell into this prioritization tier.

[94] http://www.evo-world.org/

Table 4-8. Tier 2 Electric Measures

Measure Name	Measure Category	Ex Ante kWh Savings to date
Phase 2 - ECM Motors	Refrigeration – Commercial	9,735,506
Phase 2 - Floating Head Pressure	Refrigeration – Commercial	5,185,090
Other process	Process, Commercial	4,565,222
Chiller	HVAC - Commercial and Industrial	4,402,390
Refrigeration	Refrigeration – Commercial	3,802,865
Fans, variable frequency drive	HVAC - Commercial and Industrial	2,837,783
Lighting - High Voltage Program	Lighting – Commercial	2,687,777
HVAC Central equipment	HVAC - Commercial and Industrial	2,448,831
Phase 3 – Cases	Refrigeration – Commercial	2,021,448
Lighting - controls only	Lighting – Commercial	1,974,028
Phase 2 - Floating Suction Pressure	Refrigeration – Commercial	1,707,936
Commissioning, electric - Final 50%	O&M	1,568,240
Industrial Plant Lighting	Lighting – Commercial	1,065,606
Pumps	Process, Commercial	447,888

Table 4-9. Tier 2 Gas Measures

Measure Name	Measure Category	Ex Ante Therm Savings
HVAC Central equip – GAS	HVAC - Commercial and Industrial	146,421
HVAC controls only – GAS	HVAC - Commercial and Industrial	124,645
Gas Process Heating	Process, Commercial	86,420
Other Process – gas	Process, Commercial	56,633
Fans - gas, variable frequency drive	HVAC - Commercial and Industrial	43,267
Roof ceiling insulation GAS	Building Shell - Commercial	39,312
HVAC Unitary equip. GAS	HVAC - Commercial and Industrial	39,193
Commissioning GAS	O&M	30,758
Other GAS	Core Services - Commercial	25,416
Wall insulation GAS	Building Shell - Commercial	19,036
Gas Energy Recovery System	Energy Recovery	6,352

Tier 3 Measures included the remaining measure categories for which Navigant recommended a *lower level of rigor*. The evaluation of these measures involved *desk reviews* of project files and comparisons of input assumptions to industry resources.

To provide additional context, Figure 4.1 and Figure 4.2 graphically depict measure category savings across each Program Schedule and Program Year evaluated in this study:

Figure 4.1. PY 2009 - 2010 *Ex Ante* Electric Savings for Schedules E250 & E258

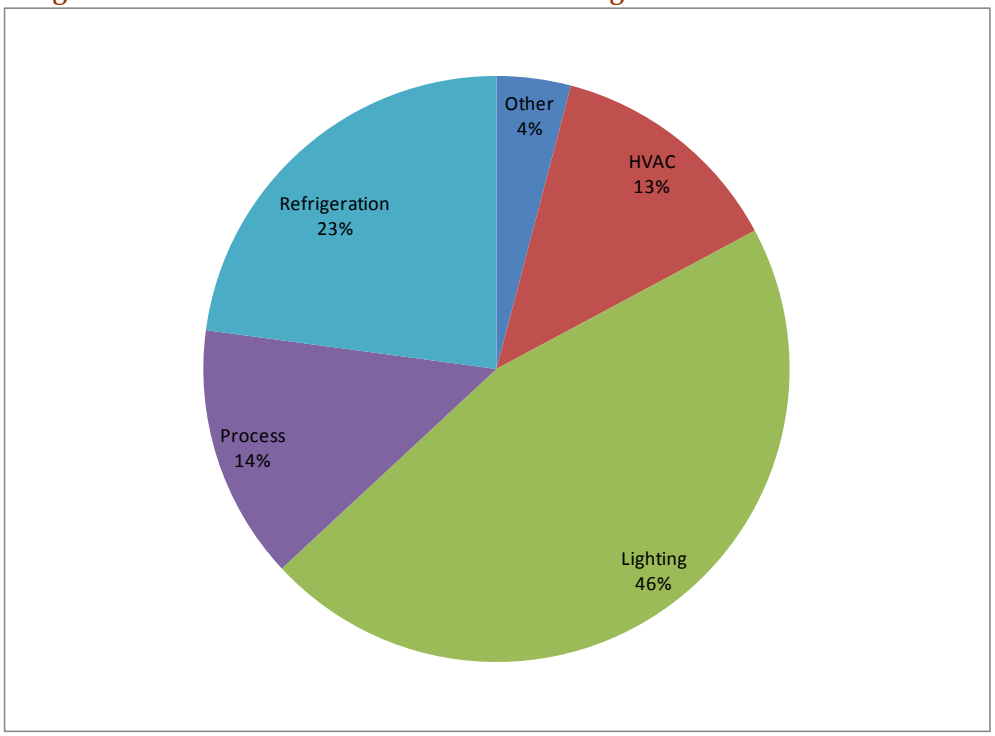
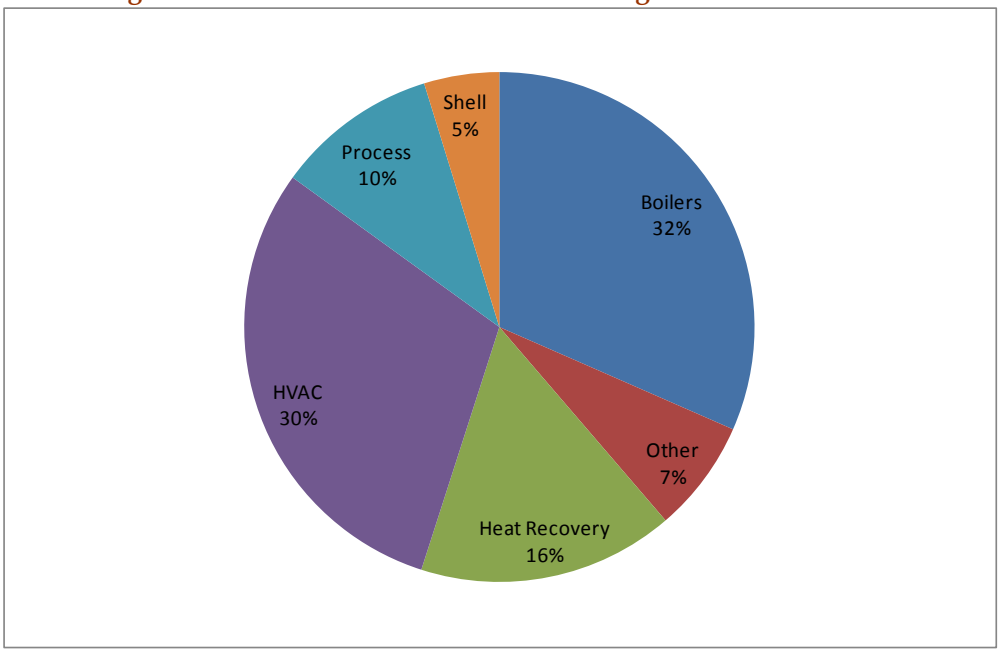


Figure 4.2. PY 2009 - 2010 *Ex Ante* Gas Savings for Schedule G205



4.1.2 Project File Reviews

Navigant's in-depth review of PSE's project files allowed Navigant to verify the accuracy of input assumptions and calculated savings; thereby ensuring that they were representative of installation conditions and consistent with industry standards. Navigant leveraged the measure prioritization hierarchy previously developed in which measures assigned to a higher "Tier" received a commensurate level of review effort.

The review of PSE's project files also allowed Navigant to prioritize on-site M&V metrics based on potential data gaps or inconsistencies within project-specific records. For example, Navigant remained cognizant of opportunities for bias in the data set, either because some customers were not included or because there was an absence of eligibility data for a particular group of participants. Navigant also reviewed the reasonableness of each parameter's *range* by assessing the variability/uncertainty between PSE's input assumptions and secondary studies. This type of sensitivity analysis was crucial in prioritizing and aligning task resources. Understanding the available data, and problems within each unique project file, allowed the evaluation team to make informed recommendations for future program cycles and custom calculation revisions.

Examples of secondary industry literature included through this review are listed below:

- Commercial and Institutional Building Energy Use Survey (CIBEUS).[95]
- Database for Energy Efficient Resources (DEER).[96]
- Buildings Energy Data Book (BEDB).[97]
- Commercial Buildings Energy Consumption Survey (CBECS).[98]

Navigant provided the full compendium of project files reviews to PSE prior to calculating Program Schedule-, Program-, and measure-level realization rates.

4.1.3 Impact Evaluation Sampling Framework

Navigant developed a sampling framework that provided a reasonable level of statistical accuracy, maximized the use of integrated surveys that effectively address Impact Evaluation objectives, and minimized evaluation expenditures. Furthermore, feedback from PSE staff ensured that the final sample design was consistent with both industry[99] and PSE's internal standards of statistical veracity.

For this evaluation, Navigant adopted a *Ratio Estimation* approach to sampling which achieves increased precision and reliability by taking advantage of a relatively stable correlation between an auxiliary variable and the variable of interest (i.e., the ratio of actual savings to program reported savings). This approach served to reduce the overall coefficient of variation within the population.

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[95] Demand Policy and Analysis Division of the Office of Energy Efficiency, Commercial and Institutional Building Energy Use Detailed Statistical Report, December 2002
[96] California Public Utilities Commission, Database for Energy Efficient Resources, 2008
[97] U.S. Department of Energy, 2008 Buildings Energy Data Book, 2008
[98] Energy Information Administration, Commercial Buildings Energy Consumption Survey, 2003
[99] TecMarket Works Team California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals, April 2006

As an example, consider a custom rebate program for business customers where project savings may range from 5 kW to 5,000 kW based on the size of each participating facility. Both the average size and the average savings for this group of customers will have very large coefficients of variation, thereby increasing the sample size required to achieve a specific confidence/precision threshold if the evaluation aims to estimate the *magnitude* of program savings.

However, evaluation experience has demonstrated that a majority of customers will have a ratio of actual savings to program reported savings between 70 – 100 percent, regardless of the *magnitude* of each individual project's energy savings. This ratio is the *realization rate* for gross verified savings and a core objective of this Impact Evaluation. As such, the standard deviation of the realization rate is generally much smaller than that of the magnitude of individual project savings. It follows that the sample sizes required to achieve a specific confidence/precision threshold may be greatly improved by estimating the realization rate instead of total energy savings.

Per the 2004 California Evaluation Framework[100], sample sizes developed using the Stratified Ratio Estimation approach complied with the following equation:

$$n = \frac{\left(\frac{Z * \varepsilon}{rp}\right)^2}{1 + \left(\frac{Z * \varepsilon}{rp}\right)^2 / N}$$

Where:

n = Sample Size
Z = Z-Score for Desired Confidence Level
ε = Assumed Error Ratio (0.4 Based on Prior Evaluation Studies)
rp = Desired Relative Precision
N = Population Size

Navigant proportionately stratified the sample by program reported savings. Under this approach, the sample population was divided into subgroups (i.e., strata) and sample units were chosen equal to the portion of the population in the strata. This strategy ensured that the largest contributors to program performance were evaluated, while also addressing a sufficient number of smaller projects that may inform future program design efforts (e.g., are there other savings opportunities at the smaller sites?).

The final sample developed in Table 4-10 below, achieved 90/10 confidence and precision by:

» Electric (Schedules 250 & 258) and Gas (G205) Program Schedules.

» Aggregated 2009-2010 Program Years.

[100] TecMarket Works, The California Evaluation Framework, June 2004

Table 4-10. Final Impact Evaluation Sample Sizes[101]

Confidence/ Margin of Error (%)	Schedules 250 and 258	Schedule 205	Total Sample Size
90/10	42	37	79

Navigant found that combining program years was appropriate under the assumption that within the populations for each year, the mean realization rate and variance around this mean was the same across years and programs that offered similar technologies. Throughout the course of the Impact Evaluation activities, Navigant continued to examine the validity of this assumption and found no biases with this approach.

PSE also expressed an interest in maximizing the confidence and precision of realization rate estimates for key measures of interest identified through the measure prioritization task; recognizing that the expected total sample size would remain the same.

[101] Due to relatively narrow scope of Schedule E257's tariff, coupled with its modest contribution to the aggregated MWh savings across PSE's three electric C&I Program Schedules being evaluated, evaluation activities for this Schedule were limited to a secondary literature review.

Table 4-11 and Table 4-12 provide sample size estimates around various measure-level confidence/precision intervals considered during the Impact Evaluation sample design process. The highlighted cells correspond to the confidence and precision thresholds ultimately achieved across these technologies while the overall Program Schedule sample size remained constant.

Table 4-11. Sample Sizes for Electric Measures of Interest

Confidence/ Margin of Error (%)	Lighting* (1057 Projects)	Refrigeration (826 Projects)	HVAC (192 Projects)	Process (120 Projects)	Total for Measures of Interest
80/10	7	25	23	22	77
80/15	3	12	11	11	37
80/20	2	7	6	6	21
90/5	42	143	91	71	347
90/10	11	41	35	32	119
90/15	5	19	17	17	58
90/20	3	11	10	10	34

*Values for a standard deviation of 20%.

Table 4-12. Sample Sizes for Gas Measures of Interest

Confidence/ Margin of Error (%)	Boilers (71 Projects)	HVAC (100 Projects)	Process (20 Projects)	Total for Measures of Interest
80/10	20	21	11	52
80/15	10	10	7	27
80/20	6	6	5	17
90/5	53	63	18	134
90/10	28	30	14	72
90/15	15	16	10	41
90/20	9	10	7	26

Table 4-13 provides a summary of the *Final Sampling Frame* for Electric and Gas projects slated to receive on-site M&V evaluation activities. Per PSE's feedback, Navigant developed the sampling framework to achieve 90/10 confidence and precision across lighting technologies, 80/20 across the remaining electric technologies, and 80/15 across the gas technologies offered through Schedule G205.

Table 4-13. Final Sample Sizes for On-Site M&V

Category	Lighting	HVAC	Boilers	Process	Refrigeration	Other	Total Sample Size
Electric	11*	8	N/A	8	9	6	42
Gas		10	10	7	N/A	10	37
Total	11	18	10	15	9	16	79

*Value for an assumed error ratio of 20% and 90/10 confidence/precision

Table 4-14 and Table 4-15 provide additional context on the final Impact Evaluation samples by total Program Schedule population savings. The E250 & E258 Impact Evaluation sample reviewed nearly 10% of total claimed savings while the G205 Impact Evaluation sample reviewed approximately 60% of total claimed savings. Furthermore, Navigant was able to achieve fairly good penetration within each measure category (e.g., 55% of boiler population savings verified) by ensuring that the largest projects were appropriately stratified and included within the evaluation samples. Conversely, measure categories with lower penetration values (e.g., 3% of lighting population savings verified) generally had more consistent savings claimed across all projects.

Table 4-14. Distribution of E250 & E258 Final Impact Evaluation Sample by Total Program Schedule Savings

Measure Category	IPMVP Strategy	Projects in Program Population	Program Population Savings (kWh)	Projects in Evaluation Sample	Sample Savings	% of Population Savings Verified
Lighting	B	974	69,653,719	11	2,075,117	3%
HVAC Measures	B/C	187	17,080,822	8	2,288,724	13%
Process Modification	B/C	35	10,313,628	8	6,044,070	59%
Refrigeration	B	288	15,699,942	9	3,456,050	22%
Other	B/C	786	39,499,005	6	1,116,077	2%
Total		***2,270***	***152,247,116***	***42***	***14,980,038***	***10%***

Table 4-15. Distribution of G205 Final Impact Evaluation Sample by Total Program Schedule Savings

Measure Category	IPMVP Strategy	Projects in Program Population	Program Population Savings (kWh)	Projects in Evaluation Sample	Sample Savings	% of Population Savings Verified
Boilers	B/C	77	48,756	10	247,971	55%
HVAC Measures	B/C	97	384,414	10	209,133	54%
Process Modification	B/C	20	146,205	7	120,527	82%
Other	B/C	82	445,097	10	266,513	60%
Total		***276***	***1,424,472***	***37***	***844,144***	***59%***

4.1.4 On-Site Measurement & Verification Analysis

In light of both the time and resources required for on-site data collection, Navigant recognized the importance of limiting EM&V activities to project-specific areas where knowledge was most limited, data gaps were the greatest, and uncertainty the highest. For monitoring purposes, measures within the EM&V sampling framework were classified according to the following construct:

> "***If both*** the efficiency ***and*** the output of the technology were constant, the measure was deemed ***constant performance.***"
>
> "***If either*** the efficiency ***or*** the output of the technology was variable, the measure was deemed ***variable performance.***"

This construct *complemented* the IPMVP Options recommended through the measure prioritization process for each "Tier." Table 4-16 provides an overview of these IPMVP Options employed throughout the course of this study and their relationship to both *constant* and *variable* performance measures:

Table 4-16. IPMVP Options and their Corresponding Data Requirements

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
Option A: Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	Verified installation Nameplate or stipulated performance parameters Spot measurements Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	Verified installation Nameplate or stipulated performance parameters End-use metered data
Option C: Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multivariate regression analysis.	Variable performance	Verified installation Utility metered or end-use metered data Engineering estimate of savings input to SAE model
Option D: Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	Verified installation Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models Utility billing records, end-use metering, or other indices to calibrate models

The corresponding data requirements for each IPMVP Option and measure performance characteristic informed the development of On-Site M&V Plans.[102] The intent of each measure-level On-Site M&V Plan was to clearly specify which parameters would be collected on-site, how that information would be collected, and which methods would be used to translate the collected data into *ex post* gross realization rates. Moreover, these plans also integrated findings / data collection priorities revealed through the project file review process. Each On-Site M&V Plan addressed the following metrics:

[102] See Appendix L for the full volume of On-Site M&V Plans

- Project Evaluation Goals & Objectives
- Pre-Installation Equipment & Operation
- As-Built Equipment & Operation
- Seasonal Variability in Schedule and Production
- Algorithms Used in the *Ex Ante* Savings Estimates
- Algorithms Used in the Evaluation
- Site Specific Parameters and Data Collection Methods
- Quality Assurance Procedures and Uncertainty
- EM&V Analysis

Additionally, the On-Site M&V Plans provided a clear rationale for selecting a specific data collection strategy for key project performance variables (e.g., operating hours, loading capacity, etc.). In additional to visual verification and discussions with facility management staff, data collection activities generally fell into the following categories:

- **Spot Measurements** – Spot measurements were the first and simplest level of on-site performance measurement and included one-time instantaneous measurements of technology, system, or environmental factors including temperature, volts, amperes, true power, power factor, light levels, etc. As a general guide, this data collection strategy was used to quantify single operating parameters that did not vary significantly over time or were intended to provide a snap-shot in time. Spot measurements were not appropriate for measures sensitive to seasonal and/or longer term effects, but could be used in conjunction with other data collection activities to inform evaluation analyses.
- **Run-Time Data Logging** – Run-time monitoring represented the second level of performance measurement and was used to record run-time profiles over a given time period. Run-time monitoring was particularly useful for estimating long-term energy consumption from short-term measurements, particularly for technologies which exhibited constant performance characteristics. For example, this method was used extensively for assessing the operating hours of lighting retrofits incented through PSE's C&I Program Schedules.
- **Interval Metering** – Interval metering represented the most rigorous (and resource intensive) level of on-site performance measurement and involved real-time monitoring of a project's energy usage over a specified time period. This typically involved recording true energy use or "proxy" values such as voltage and amperes from which energy use could be extrapolated. Navigant reserved interval metering for larger projects falling into the higher priority measure "*Tiers*" that were particularly sensitive to true power readings and exhibited variable performance characteristics dependent upon both the weather and fluctuating demand (e.g., NCI ID #104)

Table 4-17 presents a summary of these evaluation IPMVP designations for this study:

Table 4-17. IPMVP Options for Prioritization Tiers

Tier	Fuel	IPMVP Option
1	Electric	A/B/C
1	Gas	B/C
2	Electric	A
2	Gas	A

Table 4-18 and Table 4-19 provide additional fidelity on the IPMVP data collection strategies employed for Tier 1 Electric and Gas Measures:

Table 4-18. IPMVP Option Designations for Tier 1 Electric Measures.

Measure Name	Measure Category	IPMVP Option
Lighting	Lighting – Commercial	A
Lighting fixtures plus controls	Lighting – Commercial	B
Fluorescent luminaries	Lighting – Commercial	A
HVAC controls only	HVAC - Commercial and Industrial	B/C
Process Modification	Process, Commercial	B/C
Other Process - High Voltage Program	Process, Commercial	B/C
Energy mgmt. control system	HVAC - Commercial and Industrial	B/C

Table 4-19. IPMVP Option Designations for Tier 1 Gas Measures.

Measure Name	Measure Category	IPMVP Option
Boilers, hot water GAS	HVAC - Commercial and Industrial	B/C
Heat recovery systems GAS	Heat recovery, Commercial	B/C
Gas Energy mgmt. control system	HVAC - Commercial and Industrial	B/C
Boilers - steam GAS	HVAC - Commercial and Industrial	B/C
Water heater, other gas	Water Heating – Commercial	A/B/C

Table 4-20 and Table 4-21 provide additional fidelity on the IPMVP data collection options that were adopted for Tier 2 Electric and Gas Measures:

Table 4-20. IPMVP Option Designations for Tier 2 Electric Measures.

Measure Name	Measure Category	IPMVP Option
Phase 2 - ECM Motors	Refrigeration – Commercial	A
Phase 2 - Floating Head Pressure	Refrigeration – Commercial	A
Other process	Process, Commercial	A
Chiller	HVAC - Commercial and Industrial	A
Refrigeration	Refrigeration – Commercial	B/C
Fans, variable frequency drive	HVAC - Commercial and Industrial	C
Lighting - High Voltage Program	Lighting – Commercial	A/B
HVAC Central equipment	HVAC - Commercial and Industrial	B/C
Phase 3 – Cases	Refrigeration – Commercial	A
Lighting - controls only	Lighting – Commercial	B/C
Phase 2 - Floating Suction Pressure	Refrigeration – Commercial	A
Commissioning, electric - Final 50%	O&M	A
Industrial Plant Lighting	Lighting – Commercial	A
Pumps	Process, Commercial	B/C

Table 4-21. IPMVP Option Designations for Tier 2 Gas Measures.

Measure Name	Measure Category	IPMVP Option
HVAC Central equip – GAS	HVAC - Commercial and Industrial	B/C
HVAC controls only – GAS	HVAC - Commercial and Industrial	B/C
Gas Process Heating	Process, Commercial	B/C
Other Process – gas	Process, Commercial	B/C
Fans - gas, variable frequency drive	HVAC - Commercial and Industrial	B/C
Roof ceiling insulation GAS	Building Shell – Commercial	A
HVAC Unitary equip. GAS	HVAC - Commercial and Industrial	A
Commissioning GAS	O&M	A
Other GAS	Core Services – Commercial	A
Wall insulation GAS	Building Shell – Commercial	A
Gas Energy Recovery System	Energy Recovery	A

Upon collecting the necessary data from each project included in the Impact Evaluation sampling framework, Navigant addressed the following issues in order to accurately determine *gross program impacts and realization rates*:

- » Determined the pre-installation technology performance baseline.
- » Verified that the incented measures listed for projects in the evaluation sample were installed and operating as intended.
- » Verified the baseline and measure performance characteristics of the measures installed and revising or computing performance variables (e.g., operating hours) as needed.
- » Determined the energy saving (kWh & Therm) impacts of the incented measures installed.
- » Estimated the load shapes for the incented measures installed through the programs, including the coincidence of each incented measure with peak demand periods.
- » Estimated the long-term persistence of project/Program Schedule impacts. Navigant observed cases where less than 100% of the incented measures' impacts persisted over time due to customer removal, tenant or occupant changeover, and other changes.

Other technical issues associated with determining *gross program impacts* included assessing the quality of the data that was available to work with from the on-site M&V data collection strategy, and determining what data manipulation systems and supplemental analyses were required to produce reliable estimates of program impacts.

4.2 Findings

As noted earlier, Navigant adopted the Stratified Ratio Estimation sampling approach to achieve 90/10 confidence/precision for the evaluation of PSE's *Program Schedule-level* realization rates. Under this approach, Navigant divided the sample population into subgroups (i.e., strata) and selected sample units equal to the portion of the population in each strata. This strategy ensured that Navigant evaluated the largest contributors to program performance, while also addressing a sufficient number of smaller projects that, in aggregate, could represent a substantial percentage of *ex ante* savings.

PSE also expressed an interest in maximizing the confidence and precision of realization rate estimates for key *measures of interest* identified through the measure prioritization task; recognizing that the expected total sample size would remain the same. The final sampling framework achieved 90/10 confidence and precision across lighting technologies, 80/20 across the remaining electric technologies, and 80/15 across the gas technologies offered through Schedule G205.

The following subsections present the realization rates across each of these two categories, along with an additional interpretation of realization rates by *Program*.

4.2.1 Measure and Program Schedule Realization Rates (As Evaluated)

The following tables present the *ex post* gross savings and realization rates for each Measure included in the final sampling framework, along with the corresponding realization rate. It should be noted that in addition to achieving 90/10 confidence/precision at the program schedule level, verified savings at the measure technology level achieved 80/20 confidence/precision through the sampling framework. The remainder of this section presents realization rates for the following technologies, along with a description of any unique observations from the field that may explain outlier realization rates:

- Gas Boilers
- Electric HVAC Measure
- Gas HVAC Measures
- Lighting Measures
- Electric Process Measures
- Gas Process Measures
- Refrigeration Measures
- Other Electric Measures
- Other Gas Measures

Navigant verified all boiler projects within the Impact Evaluation sample on-site; this included the collection of nameplate data and available production logs from the facility. Where possible, Navigant also used a combustion analyzer to verify proper boiler operation and efficiency. Billing data was primarily used to estimate boiler gas usage and HVAC boiler operation was compared to local outdoor air temperature (OAT) and normalized to TMY3 (typical meteorological year) data for the nearest available weather station to adjust for any weather variations that could affect *ex post* gas consumption.

Table 4-22. *As Evaluated* Gas Boiler Measure Realization Rates

Navigant ID	*Ex Ante* Therm Savings	*Ex Post* Therm Savings	Therm Realization Rate
45	182,197	163,977	90%
46	2,011	3,255	162%
50	526	439	84%
53	7,327	8,573	117%
67	934	1,064	114%
68	4,272	3,806	89%
69	21,859	24,263	111%
71	21,572	23,298	108%
73	2,189	2,999	137%
75	5,084	5,084	100%
	247,971	***236,759***	***95%***

NCI ID #73 had internal sub-meter billing data which could not be used for a pre-project baseline because it was improperly calibrated. In these cases, where pre-installation data was not reliable, Navigant used the post-installation usage and rated boiler efficiencies to estimate baseline consumption and *ex post* savings. Other boiler projects sites had additional gas measures implemented in parallel with the boiler retrofit. In these cases, where it was not possible to disaggregate gas usage for the multiple

measures, Navigant reviewed the *ex ante* calculations and used the relative savings estimates to allocate savings from the billing analysis across each project. Observations from the field confirmed that most boilers operated within the ex ante specifications with the exception of two boilers exhibiting incomplete combustion. Figure 4.3 provides an example of the relationship between OAT and monthly boiler gas usage.

Figure 4.3. Outside Air Temperature and Boiler Gas Usage

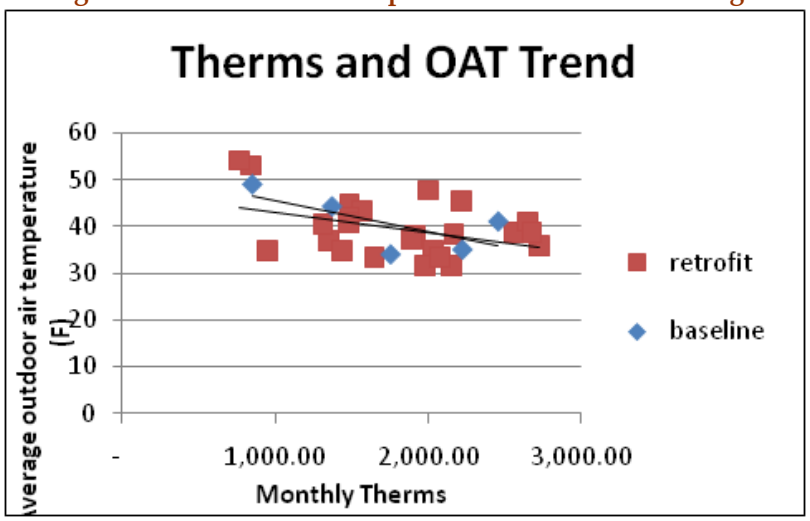


Table 4-23 and

Table 4-24 provide the realization rates for non-boiler HVAC measures. Chillers, air conditioners, furnaces, and HVAC controls fell into this classification. Due to the short time frame of the evaluation during a warming swing temperature season, heating measures received evaluation priority. Data collection for chiller projects was delayed by the unusually cold spring, and data collection for some heating measures was limited to low partial loads. Overall, baseline gas usage was modeled using long-term records of equipment operation from participating facilities.

Table 4-23. *As Evaluated* Electric HVAC Measure Realization Rates

Navigant ID	*Ex Ante* kWh Savings	*Ex Post* kWh Savings	kWh Realization Rate
1	516,361	588,652	114%
5	242,526	-	0%
9	638,135	620,905	97%
13	259,399	256,805	99%
15	256,312	492,119	192%
17	7,122	26,067	366%
25	16,462	39,344	239%
39	352,407	352,407	100%
Total	***2,288,724***	***2,376,299***	***104%***

It is worth mentioning that NCI ID #5 was unoccupied at the time of the evaluation, and the chillers were in standby. As a proxy, Navigant utilized the daily chiller logs from this site, coupled with facility billing records, to confirm savings. Although the chiller logs provided reliable trends, they only included chiller current draw and OAT. The lack of power factor information introduced increased uncertainty into the savings estimates; depending on the power factor assumption used, realization rates for this project ranged from 85% - 103%. A majority of the other projects shown in Table 4-23 provided Navigant with data from facility energy monitoring systems (EMS), which served as a third resource to triangulate verified savings.

Table 4-24. *As Evaluated* Gas HVAC Measure Realization Rates

Navigant ID	*Ex Ante* Therm Savings	*Ex Post* Therm Savings	Therm Realization Rate
48	40,047	36,042	90%
58	7,648	9,484	124%
60	84,628	80,904	96%
61	27,356	30,639	112%
63	152	512	337%
65	26,040	18,228	70%
77	1,424	926	65%
78	1,240	806	65%
79	4,218	5,399	128%
101	16,380	20,269	124%
Total	***209,133***	***203,209***	***97%***

Similar to their electric counterpart, gas HVAC measures were primarily evaluated through facility billing records, OAT, and TMY3 data from the nearest available weather station. When possible, spot measurements and end-use metering complemented the aforementioned data sources. NCI ID #48 installed multiple gas measures simultaneously and the *ex post* realization rate was calculated on the suite of measures installed since their individual impacts could not be disaggregated with the available data. And NCI ID #65 was mostly idle due to decreased occupancy/demand within the laboratory spaces where the incentivized fume hoods were installed. This phenomenon was largely driven by economic factors outside of PSE's program influence.

Figure 4.4 provides an example of the linear relationship between energy consumption and OAT for an electric HVAC project, while Figure 4.5 provides a graphical depiction of pre-/post-installation consumption for a gas HVAC project included in the Impact Evaluation sample.

Figure 4.4. Regression of Energy Usage over OAT

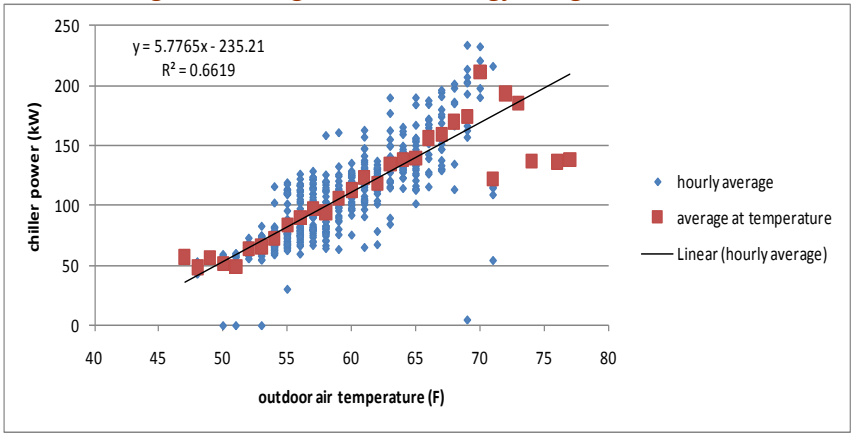
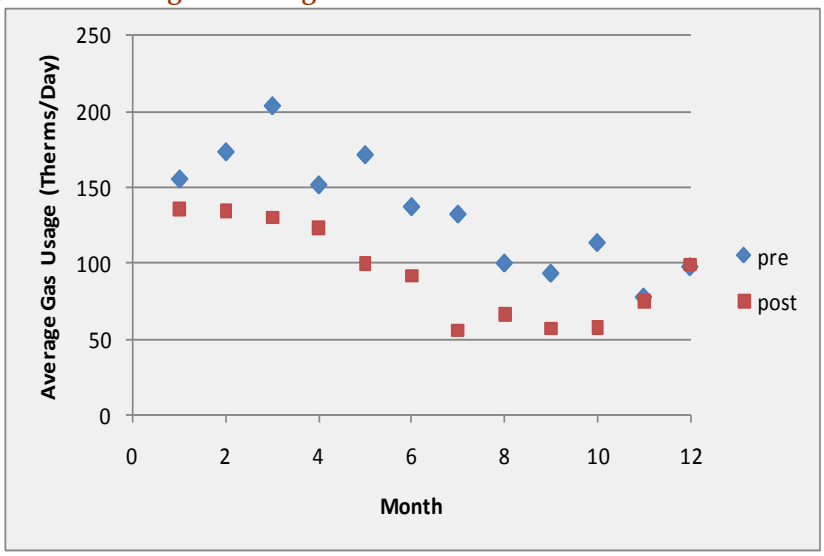


Figure 4.5. Average Gas Usage of HVAC Unit Pre-retrofit and Post-retrofit



All of the lighting projects included in the Impact Evaluation sample yielded realization rates greater than 90%. On-Site M&V activities focused on confirming measure presence/operation, on-off logging of representative spaces affected by lighting retrofits, and discussions with facility staff to contrast against metering findings.

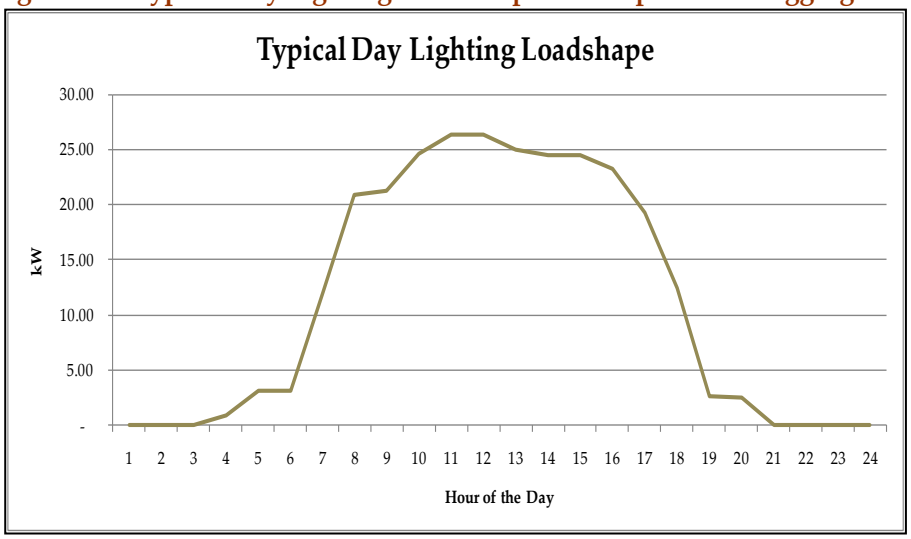
Table 4-25. *As Evaluted* Lighting Measure Realization Rates

Navigant ID	*Ex Ante* kWh Savings	*Ex Post* kWh Savings	kWh Realization Rate
6	108,726	104,377	96%
7	244,167	244,167	100%
10	344,643	344,643	100%
16	16,832	17,674	105%
19	55,492	55,492	100%
27	116,744	140,093	120%
28	112,492	157,489	140%
32	11,122	11,567	104%
35	103,464	101,395	98%
36	336,238	339,600	101%
40	625,197	625,197	100%
Total	***2,075,117***	***2,141,693***	***103%***

A key component of evaluating lighting projects within this study involved developed pre-/post-installation operating profiles (

Figure 4-6). Navigant extrapolated thee operating profiles to estimate annual hours of operation. Collectively, the annual operating hours were applied across the wattage savings attributed to the more efficient lighting technologies incented through the program to develop *ex post* savings estimates.

Figure 4.6. Typical Day Lighting Load Shape Developed from Logging Data



Process measures included air compressor retrofits, data center modifications, pump and fan VFDs, process equipment, and control modifications. Compressed air measures and data center modifications contributed the largest portion of electric savings in this category. The realization rate of electric process measures was generally greater than 90%.

Gas process measures included a variety of custom gas process efficiency measures such as process equipment for drying, fume hood ventilation, glass blowing, and cooking, as well as a greenhouse improvement measure.

Table 4-26. *As Evaluated* Electric Process Measure Realization Rates

Navigant ID	*Ex Ante* kWh Savings	*Ex Post* kWh Savings	kWh Realization Rate
2	199,360	189,392	95%
4	78,151	77,213	99%
8	18,553	19,295	104%
14	1,087,566	1,457,338	134%
21	368,886	365,197	99%
38	2,028,130	2,616,288	129%
41	1,069,786	1,133,973	106%
42	1,193,638	1,611,411	135%
Total	***6,044,070***	***7,470,108***	***124%***

Two data center projects (NCI ID#14 and NCI ID #42) included improvements to their respective cooling and airflow systems to reduce the energy required to maintain appropriate server temperatures. A combination of metered data, facility logs, and historical billing records were used to evaluate, and confirm, the savings for these projects. Navigant ID #38 implemented controls on their compressed air system, which enabled the detailed monitoring of system operating characteristics. The facility found that these data allowed them to decrease the air pressure in the system beyond what they had originally expected, resulting in increased savings above *ex ante* estimates.

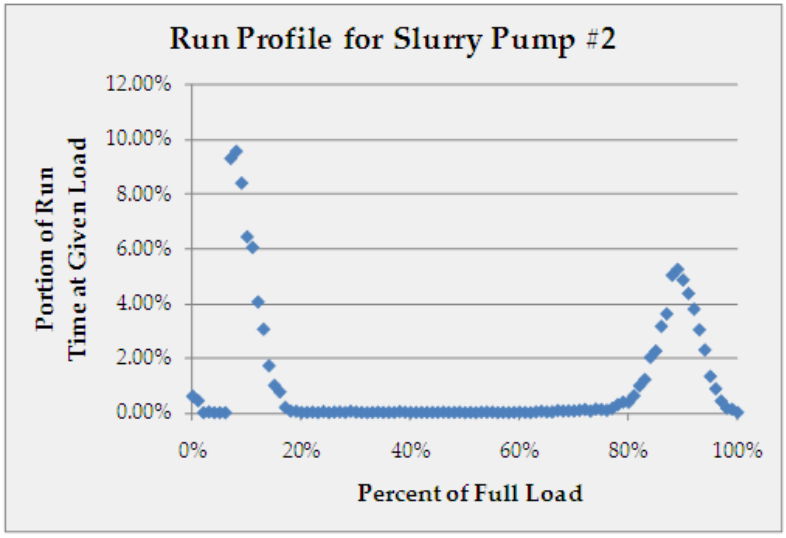
Table 4-27. *As Evaluated* Gas Process Measure Realization Rates

Navigant ID	*Ex Ante* Therm Savings	*Ex Post* Therm Savings	Therm Realization Rate
49	8,934	10,176	114%
51	7,958	6,446	81%
52	708	-	0%
55	1,576	1,434	91%
66	9,659	6,761	70%
70	86,420	47,531	55%
74	5,272	6,326	120%
Total	***120,527***	***78,675***	***65%***

Navigant utilized facility billing records as the primary tool for evaluating gas process improvement savings. And while all gas process measures in the Impact Evaluation sample received on-site verifications, production schedules heavily influenced equipment operation and, by association, realized savings. In these cases, Navigant normalized energy consumption against historical production data to ensure the baseline schedules were uniform in both the *ex ante* and *ex post* analyses. Similarly, most electric process improvement equipment, such as the slurry pump installed at NCI ID #41 (Figure 4.7), received run-time logging coupled with a review of trend data from the participating facility's EMS system to evaluate *ex post* savings.

NCI ID #52 claimed to install an automatically controlled "energy curtain." However, engineers on-site observed a manually operated shade cloth that was only used April through October. For two of the past four years, three of these summer months have shown zero gas use, resulting in 0 Therm savings.

Figure 4.7. Operational profile of Slurry Pump #2 from Logged Data



Of the 13 refrigeration projects verified on-site, 12 projects were implemented through PSE's Energy Smart Grocer (ESG) program. However, the single project that was not part of the ESG program, NCI ID #104, comprised 77% of the sampled *ex ante* energy savings under the refrigeration category. Additionally, floating head pressure and/or floating suction controls, including those installed at NCI ID #104, accounted for 97% of the *ex ante* energy savings under the refrigeration category and were deemed a measure of interest by PSE.

As refrigeration compressor racks were typically custom built, Navigant procured refrigeration measure performance data using a combination of end-use metering and available trend data. Either the power or the current draw of the refrigeration rack was logged depending on whether the compressor operation was staged or had variable speed drives. Compressor energy usage was compared to OAT and normalized to TMY3 data for the nearest available weather station. M&V occurred during low production; therefore, some refrigeration control strategies could not be directly verified during operating hours.

Table 4-28. *As Installed* Refrigeration Measure Realization Rates

Navigant ID	*Ex Ante* kWh Savings	*Ex Post* kWh Savings	kWh Realization Rate
11	6,520	6,520	100%
12	1,865	1,865	100%
18	81,672	23,685	29%
26	130,656	173,772	133%
29	80,737	-	0%
30	68,508	70,974	104%
31	10,193	10,193	100%
34	109,555	111,746	102%
37	138,674	140,061	101%
104	2,827,670	2,047,233	72%
Total	***3,456,050***	***2,586,050***	***75%***

NCI ID #104, the only refrigeration project in the evaluation sample outside of the ESG program, provided Navigant with detailed facility trends that were used to evaluate savings at the site. It is worth noting that a tenant, for whom operational details were not available, occupied a portion of the facility. Although this introduced increased uncertainty into the savings estimates, the facility trend data permitted the analysis to provide a reasonably reliable estimate of savings for the site.

NCI ID #29 was closed due to the economic downturn and realized 0% of the project claimed savings. However, Navigant calculated *Economically Adjusted* realization rates for these measures and provides the rationale for their savings in *Section 4.3 Factors Influencing Evaluation Realization Rates.*

Measures that did not fall into the lighting, HVAC, boilers, refrigeration, or process categories were categorized as "Other Technologies." These measures included heat recovery systems, insulation and shell measures, and pool covers. Several sites installed multiple measures with interactive effects; NCI ID #57 and NCI ID #59 installed heat recovery systems along with pool covers. In such cases, Navigant did not attempt to disaggregate the savings for each project in order to properly account for potential interactive effects at the facility.

In general, Navigant identified the measures installed and logged or obtained facility monitoring data for most electrical systems in this category. Conversely, billing data served as the primary tool for the evaluation of all gas technologies in this technology. Overall, the realization rates of *other* gas projects were very high while the realization rates of *other* electric projects exhibited more variability due to the unique applications in which the measures were installed.

Table 4-29. *As Evaluated* Other Electric Measure Realization Rates

Navigant ID	*Ex Ante* kWh Savings	*Ex Post* kWh Savings	kWh Realization Rate
20	263,703	263,703	100%
22	467,607	448,435	96%
24	129,215	152,086	118%
33	9,158	8,215	90%
43	206,394	63,982	31%
83	40,000	23,600	59%
Total	***1,116,077***	***960,821***	***86%***

As an example, NCI ID#43 had an exceptionally low realization rate because it was the secondary pump at the project site and the initial estimate of operational hours was significantly higher than indicated by the facility logs three months prior to the evaluation, along with discussions with facility personnel.[103] NCI ID #22 and NCI ID #24 also provided Navigant with a robust set of trend data from facility monitoring systems which were leveraged to evaluate savings for the two replacement chillers.

[103] It should be noted that the second pump retrofit (not included in the Impact Evaluation sample) achieved a realization rate of 111%. The total realization rate for the two pump retrofits at the facility was 74%.

Table 4-30. *As Evaluated* Other Gas Measure Realization Rates

Navigant ID	*Ex Ante* Therm Savings	*Ex Post* Therm Savings	Therm Realization Rate
44	1,148	3,685	321%
47	30,636	27,572	90%
54	10,716	12,538	117%
56	707	778	110%
57	62,484	76,230	122%
59	34,149	34,149	100%
62	111,058	111,058	100%
64	444	417	94%
76	13,552	12,739	94%
80	1,619	1,991	123%
Total	***266,513***	***281,158***	***105%***

The realization rate for NCI ID #47 accounted for the interactive effects among four projects installed in parallel at the site. In this case, savings were combined across all projects because the individual measure savings could not be disaggregated using the available data.

Table 4-31 and

Table 4-32 provide a summary of measure-level realization rates for both electric and gas technologies. Overall, PSE's C&I portfolio has achieved realization rates that reflect the accuracy of *ex ante* savings estimates. The lower than average realization rates for Refrigeration (75%) and Other Electric Measures (86%) were primarily attributed to a reduction in production throughput due to the economic downturn. We discuss methods for separating the non-programmatic economic impacts from the calculated realization rates in *Section 4.3 Factors Influencing Evaluation Realization Rates.*

Table 4-31. Summary of *As Evaluated* Realization Rates by Measure Category for Program Schedules E250 & E258

Measure Category	Projects in Evaluation Sample	*Ex Ante* Savings	*Ex Post* Savings	Realization Rate
Lighting	11	2,075,117	2,141,693	103%
HVAC Measures	8	2,288,724	2,376,299	104%
Process Modification	8	6,044,070	7,470,108	124%
Refrigeration	9	3,456,050	2,586,050	75%
Other	6	1,116,077	960,821	86%
Total	***42***	***14,980,038***	***15,534,971***	***104%***

Table 4-32. Summary of *As Evaluated* Realization Rates by Measure Category for Program Schedule G205

Measure Category	Projects in Evaluation Sample	*Ex Ante* Savings	*Ex Post* Savings	Realization Rate
Boilers	10	247,971	236,759	95%
HVAC Measures	10	209,133	203,209	97%
Process Modification	7	120,527	78,675	65%
Other	10	266,513	281,158	105%
Total	***37***	***844,144***	***799,801***	***95%***

As previously noted, the Impact Evaluation Framework achieved 80/20 confidence/precision at the measure technology level. Conversely, the Impact Evaluation Framework achieved 90/10 confidence/precision at the *Program Schedule* level. This was accomplished by first calculating *case weights* for each evaluated project; the case weight is simply the number of projects in the population in each stratum divided by the number of projects in the final sample in the corresponding stratum.[104]

The program level realization rate was then calculated as the ratio between the product of case weights and *verified* savings estimates and the product of case weights and *reported* savings estimates. This process is illustrated by the equation below:

$$Program\ Realization\ Rate_i = \frac{\sum_{i=1}^{n} Case\ Weight_i \times Verified\ Savings\ Estimate_i}{\sum_{i=1}^{n} Case\ Weight_i \times Reported\ Savings\ Estimate_i}$$

Table 4-33 provides the final *As Evaluated* Realization Rates for PSE's C&I Program Schedules.

Table 4-33. Summary of *As Evaluated* Program Schedule Realization Rates (PY 2009 – 2010)

Program Schedule	Program Spending	Ex Ante Savings	Ex Post Savings	Realization Rate
E250 & E258	$39,954,232	152,247 MWh	155,749 MWh	102.3%
G205	$3,864,784	1,424,472 Therms	1,428,745 Therms	100.3%

[104] The TecMarket Works Team, The California Evaluation Framework, Prepared for the California Public Utilities Commission and the Project Advisory Group, June 2004

4.3 *Factors Influencing Program Schedule Realization Rates*

As noted earlier, the project-/program-level realization rates provided in the previous section reflect the difference between expected savings at the time of installation and verified savings more than one year after project completion. Navigant observed that many participants altered their operating profiles between this timeframe for a myriad of reasons outside the realm of program influence, including:

- **Idiosyncratic Factors** – changes in equipment usage and operating patterns that are unique to a participant's financial health, employee attrition, and corresponding production schedules.
- **Economic Factors** – changes in equipment usage and operating patterns as a result of shifts in industry and economic climates.

The following sections explore each of the non-programmatic factors and while quantifying their impact on project-/program-level realization rates. Navigant distinguished the impacts from each of these factors through ongoing discussions with facility personnel during the evaluation process.

4.3.1 Idiosyncratic Factors (As Installed Realization Rates)

Out of necessity, the merits of energy efficiency projects must be judged by the best information available, which is usually operating practices observed at the time of evaluation. Navigant recognized, however, that operations observed during the M&V process may differ significantly from the planning and/or installation conditions. When energy efficiency measures are climate dependent the process for weather normalization is well-established, whether by simulation, typical meteorological year data, or degree days. However, when other *idiosyncratic* factors affect operations (e.g., attrition, unforeseen operating and maintenance requirements, etc.), the normalization process is less clear.

As a proxy, Navigant carefully reviewed the documentation on evaluated projects and compared the pre-installation assumptions used to develop *ex ante* savings estimates to the *ex post* observations and feedback from facility personnel. In addition to the project input assumptions, Navigant also reviewed the *ex ante* calculation methodologies against industry standards and accepted engineering practices. Finally, Navigant collaborated with PSE to ensure that all available information collected during the participation process was properly accounted for in the *ex post* savings analyses.

Collectively, Navigant used this information to reconstruct the project planning/pre-installation conditions along with the corresponding savings realized upon project completion (*As Installed Realization Rate)*. The realization rate metric at this particular point in the program cycle is a significant milestone and of key interest from a stakeholder perspective which warranted this additional level of investigation.

Table 4-34. Summary of *As Installed* Program Schedule Realization Rates

Program Schedule	Program Spending	Ex Ante Savings	Ex Post Savings	Realization Rate
E250 & E258	$39,954,232	152,247 MWh	151,181 MWh	99.3%
G205	$3,864,784	1,424,472 Therms	1,423,047 Therms	99.9%

It is important to note that the realization rates provided in Table 4-34 are conservative; the realization rate at the point of installation is an instantaneous metric that cannot account for variability in weather patterns and productions schedules which inevitably drive project performance over time. As such, the *As Installed* realization rates only capture overestimates in the *ex ante* savings methodologies, of which PSE's C&I Program Schedules had limited instances of:

- NCI ID #26: The *ex ante* analysis leveraged Regional Technical Forum (RTF) values to calculate refrigeration project savings. Navigant accepted this analysis and assigned an *As Installed* realization rate of 100% to this project. However, the *As Evaluated* realization rate was calculated to be 133%; similar to the realization rates found from a BPA impact study of the Energy Smart Grocer Program from several years ago. In this case, the *As Installed* realization rate was lower than what was actually achieved.
- NCI ID #18: This project involved the installation of refrigerator strip curtains. However, the HVAC system was more efficient than assumed in the *ex ante* analysis resulting in an *As Installed* realization rate of 61%. PSE subsequently removed this project from its claimed savings due to lack of proper documentation. The project was netted to 0 savings by creating a project 085-0263 claiming a -81,672 kWh savings.
- NCI ID #43: This project involved two pump retrofits at one facility, only one retrofit of which was evaluated. Discussions with facility personnel revealed an overestimate in pump operating hours resulting in an *As Installed* realization rate of 31%. However, the second pump retrofit (not included in the Impact Evaluation sample), achieved a 111% realization rate, resulting in a 71% realization rate for the facility
- NCI ID # 64: This project involved the installation of insulation at a participant facility. The *As Evaluated* realization rate was 94% due to the addition of ceiling fans which were not present at the time of installation. Through discussions with PSE, Navigant recognized that in some cases, ceiling fans actually increase convective heat loss through the roof. In the absence of the ceiling fans, the *As Installed* realization rate was actually 100%.
- NCI ID #83: This project involved the installation of a retrofit compressor. Navigant noted a calculation error in the VFD compressor power calculation which reduced the *As Installed* realization rate to 59%

More importantly, the *As Installed* realization rates provide insight into the accuracy of the calculations used to forecast savings in the absence of post-installation data. And the results of this effort clearly indicate that PSE's EME's are correctly applying mathematically astute methods to the *ex ante* analyses. This finding is reflective of the high realization rates for PSE's C&I Program Schedules across both program years evaluated. For a majority of the projects evaluated, deviations between the *ex ante* and *ex post* savings estimates were explainable through idiosyncratic factors, economic factors (discussed further, in the following subsection), and by the inherent variability surrounding measure performance (e.g., occupancy sensors).

4.3.2 Economic Factors (Economically Adjusted Realization Rates)

The C&I sector is particularly sensitive to economic changes because production throughput, occupancy, and operating schedules are driven by customer demand. Similarly, the changes in equipment usage also affect the efficiency of the baseline and replacement technologies incented through PSE's Program Schedules. Throughout the Impact Evaluation, Navigant encountered a number of participant sites affected by these *economic* factors; a majority of which realized lower than expected *ex post* savings estimates. Examples of the economic factors affecting program realization rates, included:

» **Change in Production Schedules**

- NCI ID #21: This project involved the installation of compressor upgrades at a manufacturing site. Although the *As Evaluated* realization rate was 99%, the facility actually increased their production requirements by consolidating all production into one line as a result of the economic downturn. This increased the load on the compressor, resulting in lower savings. The *Economically Adjusted* realization rate for this project was 109%.

» **Idled Equipment (Temporary Shutdown):**

- NCI ID #65 and NCI ID #66: This project installed fume hood retrofits at a participant lab. As a result of the economic recession, a majority of the fume hoods are now idle with future occupancy (and usage) expectations. The *As Evaluated* realization rates were 70%, but the *As Installed* and *Economically Adjusted* realization rates were both 100%.
- NCI ID #5: This project involved the chiller upgrades at a large facility. As a result of the economic downturn, the facility has since closed but is expected to re-open. And though the *As Evaluated* realization rate is 0%, both the *As Installed* and *Economically Adjusted* realization rates are 100%.

» **Site Closure (Permanent Shutdown):**

- NCI ID #29: This facility installed refrigeration upgrades but as a result of the economic downturn, is permanently closed. Even though the *As Evaluated* realization rate was 0%, Navigant confirmed that the *As Installed* and *Economically Adjusted* realization rates were 100%.

The subsequent impact of these economic-driven changes on project-/program-level realization rates compound over time because savings estimates apply across a measure lifetime of several years. As such, Navigant recognized the importance of disaggregating the effects of these factors when assessing program performance and developed a robust method that accounted for variations in operating conditions attributed to external economic activity.

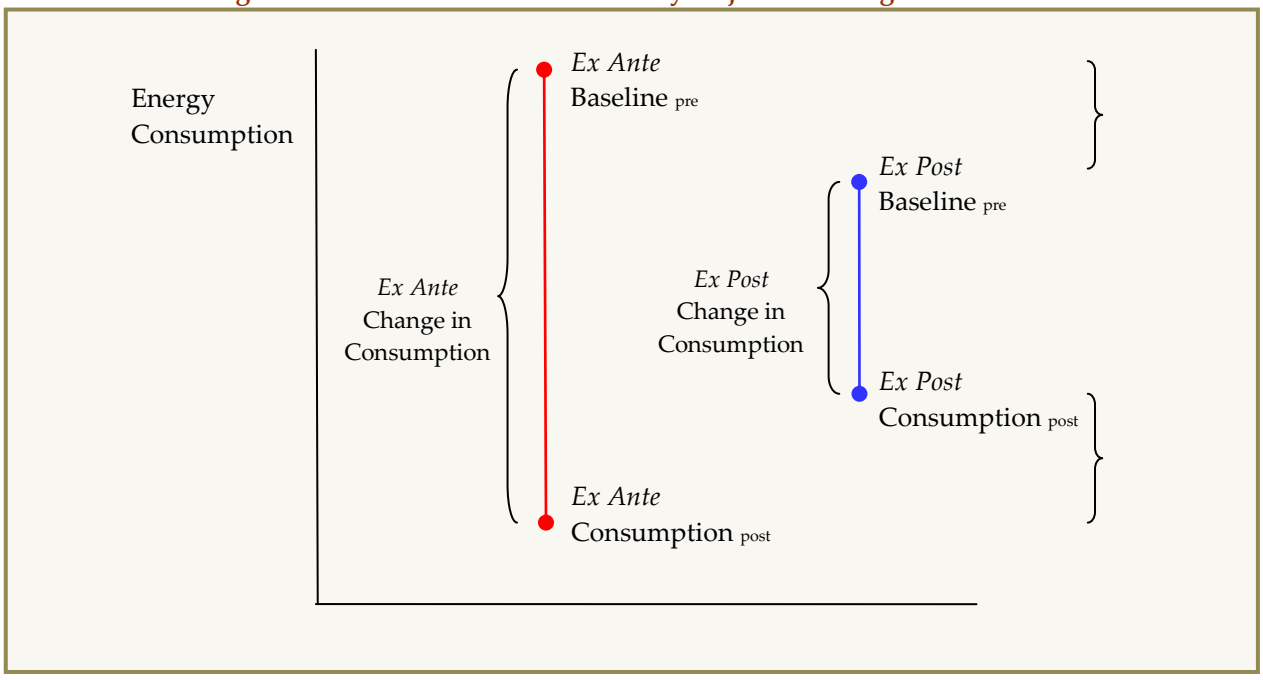
For temporary changes in the participant production schedule, Navigant calculated savings using two consistent baselines:

4.) *Full Production (Ex Ante) Baseline Operating Schedule:* Both pre- and post-installation energy consumption was calculated using the production schedule observed at the time of participation (i.e., full production schedule). Full-production adjusted operating schedules were derived from a comprehensive review of historic production logs relative to current operating schedules.

5.) *Current Production (Ex Post) Baseline Operating Schedule:* Both pre- and post-installation energy consumption was calculated using the production schedule during the on-site M&V process (i.e., current production schedule).

Figure 4.8 provides a graphical representation of the savings estimates for each baseline condition; the difference of which distinguished savings attributed to the economic downturn. This approach discounted production schedule changes associated with demand-driven capacity requirements.

Figure 4.8. Illustration of Economically Adjusted Savings Estimates



With the recent downturn, many businesses experienced temporarily idled production areas, but still planned on recovering this excess capacity when business conditions improved. Navigant's approach to normalizing realization rates for the current and full production operating schedules ensured a more representative perspective on long-term program savings potential. Conversely, once a site or process was completely shut down (e.g., sold or reconfigured), savings were deemed irrecoverable.

It should be noted that while the recession generally reduced realized savings, there existed opportunities for *increased* energy savings in specific applications. The part-load efficiency of variable speed compressors, for example, are much more efficient than their single-speed counterparts. Figure 4.9 illustrates the different operating modes and relative efficiency of a rotary screw compressor with different capacity modulation. Assuming a compressor upgrade is incented, a PSE project may have operated two shifts in the region labeled "A" with approximately 10% full load power savings over a baseline machine with slide-valve modulation. The remainder of the time the compressor would operate in region "C" with savings of approximately 50% full load power. However, under a reduced

production schedule, the facility may no longer operate in the "A" region but instead save 25% of full-load power in the "B" region during approximately 1.5 shifts of plant operation and spend more time unloaded (50% of full load savings versus the baseline machine) in the absence of demand for compressed air. Though these situations do arise, the upside in savings potential is often overshadowed by the overwhelming number of projects experiencing a decrease in realized savings.

Figure 4.9. Illustrative Compressor Performance at Key Operating Points

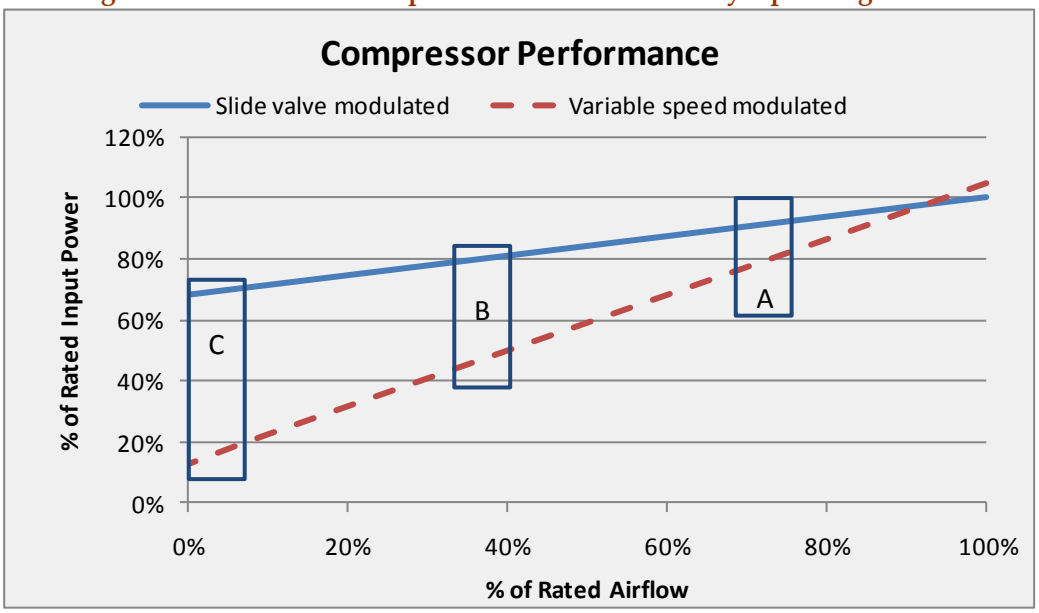


Table 4-35 provides a summary of economically adjusted Program Schedule realization rates. The findings reveal an increase in realization rates when excluding the effects of the *economic* factors, particularly for two sites that closed would have yielded a 100% realization rate.

Table 4-35. Summary of *Economically Adjusted* Program Schedule Realization Rates

Program Schedule	Program Spending	Ex Ante Savings	Ex Post Savings	Realization Rate
E250 & E258	$39,954,232	152,247 MWh	161,230 MWh	105.9%
G205	$3,864,784	1,424,472 Therms	1,428,745 Therms	102.4%

4.4 Validity and Reliability of M&V Findings

Navigant identified several sources of uncertainty associated with estimating the impacts of the PSE C&I Program Schedules. Examples of such sources include:

- Sample selection bias.
- Physical measurement bias (e.g., meter bias, sensor placement, non-random selection of equipment or circuits to monitor).

» Engineering analysis error (e.g., baseline construction, engineering model bias, modeler bias).

Navigant remained cognizant of these issues throughout the evaluation process and adopted methods to reduce the uncertainty arising from these sources, thereby improving the validity and reliability of study findings. Key uncertainty sources and mitigation strategies are discussed further below.

4.4.1 Reducing Uncertainty from Sample Selection Bias

The problem that selection bias creates for program evaluation has been long recognized. Although projects were chosen in the impact evaluation sample according to prescribed protocols, bias may have been introduced if the selected projects did not choose to participate in the evaluation effort. In an effort to minimize non-response bias, Navigant established and implemented the following recruitment protocols:

» Notified participants as early as possible in the evaluation process.

» Accurately characterize M&V activities and the duration of the evaluation process.

» Maintained brief and frequent communication with participants and inform them of any changes/additions to the evaluation effort.

The intent of these protocols was to give each participant ample time to prepare documentation and secure the appropriate resources to support the evaluation effort. Brief and frequent contact with each participant ensured the participant remained engaged.

In the event that a non-respondent was encountered, Navigant first identified the nature of the project (i.e., measure type). Non-response for non-certainty projects was addressed by oversampling projects within each of the original stratum. These "alternative" projects were substituted into the impact sample in the event that a project did not respond to evaluation requests. Non-response for certainty projects were generally addressed by choosing similar projects (i.e., measure technologies) with equivalent, or larger savings. Collectively, this effort ensured that precision levels were met within the overall impact evaluation sample.

4.4.2 Reducing Uncertainty from Physical Measurement Error

There is inevitably some error associated with all physical measurement. For the impact evaluation of PSE's C&I Program Schedules, a large measurement effort involved installing lighting/current/power loggers to determine the operating characteristics of baseline and retrofit technologies across a broad range of applications. Several steps were taken to minimize the uncertainty resulting from bias/error that may have been introduced in this process:

» Prior evaluation experience indicates that lighting loggers sometimes fail in the field due to flickering or battery issues.[105] To account for the possibility that some of these loggers might fail in this evaluation, Navigant deployed backup loggers for each site. This ensured that the sample size requirements would be met even if a percentage of the loggers failed.

[105] Evaluation experience has found that 'typical' failure rates generally range between 5% – 10%.

» To minimize measurement error from improper calibration of the lighting/current/power loggers, Navigant checked all loggers used in the field to ensure that they were properly calibrated prior to being deployed. Field staff were also trained to use consistent measurement intervals whenever possible, and to synchronize the logger deployment activities (e.g., time delay). This ensured that the data could be compared across a uniform time period.

» To minimize biases arising because of improper placement of the loggers, field staff were given a prescribed protocol for the placement and installation of loggers on circuits (e.g., CT placement) and fixtures (e.g., uniform distance from the lamps).

» Usage patterns for retrofit measures may vary from month-to-month. Sampling for a short duration could therefore introduce a degree of error into the overall results. To reduce this type of error, loggers were typically deployed for a minimum of four weeks and supplemented with available facility records (e.g., EMS trends, production logs, etc.). The logged data was used to calibrate the facility records which spanned multiple months or years. These extended logging intervals minimized the bias introduced from extrapolating short term metering results to longer periods of time.

» Poor quality data can also be a significant source of error and uncertainty. To minimize the potential impact of this problem, various quality assurance checks were applied to the logger results. This included consistent spot measurements that could be compared against both the EMS and logger data. Additionally, qualified analysts reviewed all logger files to ensure that the results were representative of the technology being investigated:

  - Lighting loggers were reviewed to identify inconsistencies in operating characteristics and/or extended periods of inactivity. If a particular file was deemed suspicious, Navigant followed up with field staff and facility managers to ensure that the findings were reasonable. Inaccurate results were removed from the analysis.

  - Current/power loggers were reviewed to ensure that consumption was representative of the technology being investigated. Suspect operating characteristics were reviewed with field staff and facility managers to clarify usage pattern anomalies. As with the lighting loggers, inaccurate findings were removed from the analysis.

4.4.3 Reducing Uncertainty from Engineering Analysis Error

There are several opportunities for biases in engineering analyses that may compound the error and uncertainty of *ex post* savings estimates. Navigant adopted the following protocols to minimize uncertainty from engineering analysis error in this study:

» All project analysis findings were peer reviewed to ensure that consistent methods and assumptions were used throughout the Impact Evaluation

» Navigant developed data collection protocols that yielded appropriate inputs into the analysis models and reviewed all field observations with the evaluation team. Collectively, this served to reduce potential modeling error in this study.

4.4.4 Recommendations for Reducing Uncertainty in Future Evaluation Cycles

Most of the sources of bias and uncertainty discussed here are documented and well-researched. Moreover, the recommendations for addressing and/or minimizing these sources have proven successful in previous evaluation studies. However, equipment (e.g., logger) failure has not received a great deal of attention and may reduce the precision and confidence of evaluation findings. To compensate for the consistent nature of these failures, Navigant recommends developing future evaluation frameworks to identify failure rates by equipment type, and accounting for these failure rates when estimating the quantify of metering equipment needed to achieve confidence and precision level targets.

4.5 Impact Evaluation Conclusions and Recommendations

Navigant staff thoroughly documented the Impact Evaluation process in an effort to capture and assess program feedback based on discussions with participants, program data, auxiliary reports, and evaluation observations. This information has been used to develop recommendations that will improve future program and impact evaluation cycles.

Recommendation 1: Standardize Participant Data Requirements

The accuracy of impact evaluation findings is dependent upon the availability and quality of participant measure data. Although a majority of the projects included comprehensive participation data that allowed for the calculation of both *ex ante* and *ex post* energy savings, some projects had insufficient data within the project application to plan evaluation activities. Specifically, projects within the ESG Program were difficult to contact and evaluate for the following reasons:

1.) Lack of available project documentation and supporting energy savings methodologies.

2.) Lack of participant support for the impact evaluation process.

The implementation contractor for the Energy Smart Grocer Program is PECI, and the savings estimates are universally calculated using their proprietary software tool. In response to this preliminary feedback during the Impact Evaluation, PECI presented an overview of the software suite used to generate savings estimates to Navigant. The software allowed for comprehensive energy audits of grocery sites by inputting facility equipment parameters into a spreadsheet based tool during site visits. Although Navigant found the software algorithms to be solid, it was not possible to fully review all of the inputs to the model during the presentation. However, the *ex post* realization rates for ESG projects in the evaluation sample were consistently above 90%, indicating that PECI's software tool is a reliable measure of achievable savings. These findings are consistent with those found in a previous review of an EnergySmart Grocer program administered by PECI for the Bonneville Power Administration.[106]

However, in an effort to improve the efficiency of future impact evaluations, Navigant recommends standardizing data requirements on project application forms to support M&V activities. Navigant also recommends future evaluation efforts closely monitor the quality of project-level documentation provided to support the impact evaluation effort, along with the calculation of project-level realization

[106] *BPA EnergySmart Grocer Program: Process and Impact Evaluations*, September 28, 2009, Summit Blue Consulting, pp. 56-57; http://www.bpa.gov/energy/n/reports/evaluation/commercial/pdf/BPA_ESGrocerProcess_Impact_Eval_9-28-09.pdf

rates. This information can be leveraged to develop measure-specific verification guidelines when low realization rates intersect with prioritized measure technologies (e.g., those measures outside of the ESG program).

Recommendation 2: Request Participants with Energy Management Systems Provide Pre-/Post-Trend Data

Due to the seasonality of HVAC-related measures, an annual energy usage profile is essential for properly correlating savings to changing weather profiles. A majority of projects involving complex technologies (e.g., VFD retrofits on supply and return fans, chiller retrofits, etc.) have both the technology and capacity to store pre-/post-trend data in support of evaluation efforts. This information will serve as an additional data source to consider / contrast during the Impact Evaluation process, thereby improving the accuracy and validity of convergent savings estimates calculated from different resources (e.g., historical billing records, spot measurements, etc.)

Recommendation 3: Normalize Program Schedule Tracking Databases to Enhance Reporting and Evaluation Integrity

Through a review of evaluation *Best Practices*[107] and the Memorandum of development principles designed to guide the construction and integration of a Future Evaluation Database,[108] Navigant identified four industry-accepted standards governing the design of an effective evaluation database. They include:

- The data must be complete enough to accurately describe and quantify what measures and technologies were installed, and what they replaced (if applicable).
- The data must include additional explanatory variables needed to characterize how the measures are applied and their respective operating characteristics.
- Quality Control (QC) metrics must be developed to ensure the integrity of information collected; both computational and manual review processes may drive these metrics.
- The data collection process must be systematic to ensure consistency across the dataset. This will also ensure that the evaluation database(s) seamlessly integrates with PSE's internal data systems.

Adherence to these principles will minimize the potential for data entry error while maximizing the efficiency of data storage. These characteristics will reduce the amount of time and resources spent reviewing and/or correcting any database discrepancies in future evaluation efforts, while yielding more accurate findings.

Recommendation 4: Continue to Incorporate an Economic Analysis Component for Future Evaluations

The economic malaise is a significant *non-programmatic* factor driving realization rates. By continuing to incorporate an economic analysis component in future evaluation efforts, PSE will be able to distinguish between reduced energy consumption achieved through improved controls and efficient measure installations, relative to a decrease in production as a result of economic influencers. Navigant

[107] See Appendix L - Best Practices for Impact Evaluation Measurement and Verification (EM&V) Cycles
[108] See Appendix L – Memorandum: Evaluation Database Guidelines

recognizes that economic volatility occurs periodically, and it is no more valid to choose an "up cycle" than a "down cycle" when evaluating Program Schedule performance. By providing a clear distinction between programmatic and non-programmatic factors affecting the realization rate, future evaluation results will ensure a fair assessment of Program Schedule performance over the EUL of incented measures.

5 Key Opportunities for PSE

This section highlights opportunities for PSE to consider as it moves forward with its C&I energy efficiency retrofit programs. It integrates the key recommendations from previous sections at a high level. Additional detail on these strategies is located in Sections 2.2.4.2 (Market), 3.4 (Process), and 4.5 (Impact).

5.1 Schedules G205 and E250

The opportunities presented to PSE for Schedules G205 and E250 overlap almost entirely. This section organizes the key recommendations according to four themes.

5.1.1 Target Specific Sectors

Several sectors are strong prospects for future PSE energy efficiency efforts: offices, public sector, hospitals, and food processors. The approach to each sector varies according to the energy efficiency opportunities available, the conditions in each sector, the balance sheet strength of firms in the sector, and the unique capital budgeting cycle that is typical of those organizations. The unique combinations of conditions in each sector lead to different approaches to realizing the opportunities.

The specific programs within Schedules G205 and E250 can address the varied opportunities in each of these sectors. Table 5-1 summarizes the extent to which each program can serve the opportunities in each sector.

Table 5-1. Sector-Specific Opportunities by Program

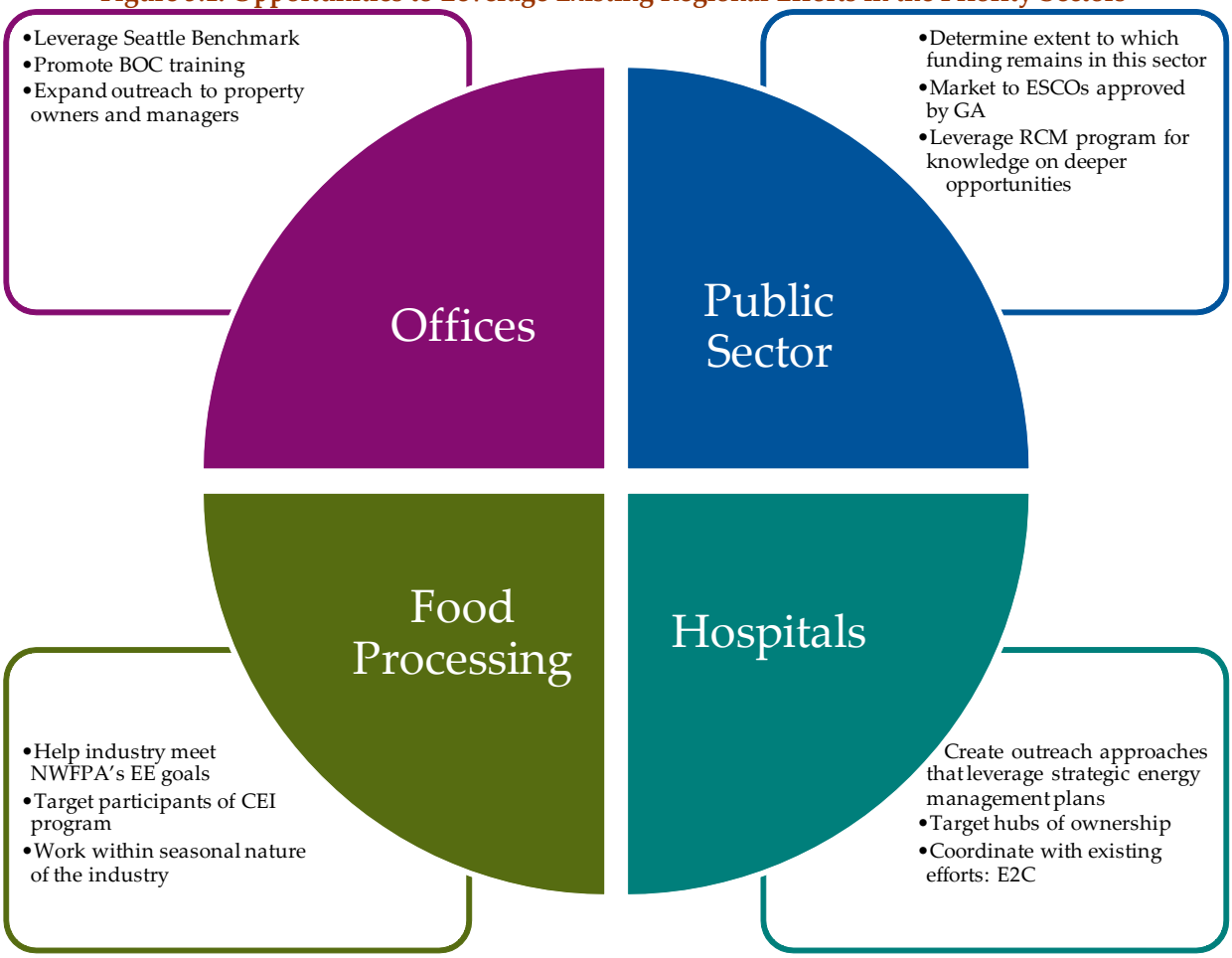
● Good ◉ Fair ○ Poor	Offices	Public Sector	Hospitals	Food Processors
Energy Smart Grocer	○	○	○	○
BEOP	●	●	◉	○
Custom Grant – Gas	◉	◉	●	●
Custom Grant – Electric	◉	◉	◉	◉

Source: Navigant analysis 2011.

To reach these segments effectively, PSE may consider hiring staff with sector-specific expertise. This approach enables PSE to tailor its offerings to the unique conditions in each sector. It also enables PSE to deploy technical sales teams with the expertise needed to convince decision makers to adopt energy efficiency. These staff may be internal or third-party staff as long as they are given the flexibility needed to adapt program offerings and marketing to each specific sector.

PSE's program can leverage a wide variety of activities in these sectors in the region to achieve deeper penetration of energy efficiency. Some of these initiatives relied on sector-specific efforts, while other efforts relied on NEEA's investment in these sectors. Figure 5.1 outlines the existing structures and initiatives that PSE may consider integrating into its own efforts to reach these sectors.

Figure 5.1. Opportunities to Leverage Existing Regional Efforts in the Priority Sectors



5.1.2 Reassess the Measure Portfolio

PSE may consider adjusting its portfolio of measures to reflect changing trends among its C&I customers and the broader market.

» LEDs, building automation, and RCx are poised to expand significantly in the next two to five years. Building automation and RCx are closely aligned, as building automation may increase demand for RCx by helping building operators recognize inefficiencies or anomalies in energy use more easily. Developing incentive structures that facilitate straightforward implementation of these measures, coupled with trade ally relationships that promote the adoption of proven technologies, may help PSE to secure cost-effective savings from these important technologies.

» PSE should continue to focus resources on optimizing its new BEOP structure, including considering the following:
  - Simplifying the program per TA and best practice feedback
  - Making the program more transparent by providing savings calculators to providers
  - Opening the program to additional providers
  - Enhancing marketing materials, particularly case studies

» PSE should explore opportunities to increase program efficiency and reduce application processing time. To do so, PSE may consider identifying additional measures that can be made prescriptive. In addition, PSE may consider investing additional resources in developing savings calculators to make calculations more consistent and staff more productive.

5.1.3 Focus Additional Resources on Outreach to Achieve Deeper Penetration

Effective marketing of the programs can enhance program participation. The channels selected for outreach affect the credibility of the message and the customers' response to it in many cases. In addition, the messages used to promote the programs will affect how customers consider the program in light of their other business priorities.

» PSE is already working with a strong set of service providers and internal partners to promote its programs. Building on those efforts, PSE may consider expanding its partnerships with the following entities to enhance its marketing of its C&I offerings:
  - Account representatives and account managers
  - NEEA's partners
  - New account communications
  - Nearby utilities
  - PECI, the implementation contractor for Energy Smart Grocer
  - Business segment managers
  - Energy advisors
  - PSE's government/community relations staff

  Such plans would need to consider associated implications for staffing, training, compensation, and required skills.

» PSE should assess the benefits of reallocating resources from incentives to trade allies and customer support and outreach. Enhancing the relationships with and support of these key partners can lead to stronger marketing channels in the future. Trade allies are looking to PSE for additional marketing and technical support, indicating that case study material is particularly valued. Energy savings and incentive calculators would also provide these partners with additional tools with which to market PSE's program offerings.

» Allocating additional resources to **subsidizing up-front audits** would provide PSE with a low-pressure approach to engaging customers. This would enable PSE to record information about specific opportunities at customer sites, providing a valuable set of information for outreach partners to use in engaging customers. PSE may consider reintroducing the audit for at least a targeted subset of their customers. Other best-practice program approaches can inform the packaging of this tool.

» Two key messages emerged as strong value propositions for PSE's customers. PSE may consider further integrating these key messages in its marketing efforts:

  - Energy is a variable cost reduction opportunity.
  - Energy efficiency helps to promote a "green" business image.

5.1.4 Expand Functionality of Program Tracking Database

PSE should assure that the new program tracking system provides the functionality that program staff requires for future program delivery.

» The system should address needs for customer relationship management by PSE engineering staff, maintaining records of past interactions and future opportunities.

» System functionality should also enable tracking of key program delivery metrics, such as application processing times, grant payment processing time, and the like, as well as engineering resource commitments and availability.

» The tracking system content should be enhanced to include key trade ally contact information and standardized to ensure consistency in naming conventions to the degree feasible.

Additional best practices for program tracking database design and management can be found in Section 4.1.4.

5.2 Schedule 257

PSE may consider discontinuing the Schedule 257 offerings. Initial findings indicate that this market may be transformed. Governments are choosing to implement traffic light LEDs in the absence of PSE incentives on a regular basis.

5.3 Schedule 258

Preliminary findings indicate that customers are satisfied with this program, seek to continue their participating in it, and have additional project opportunities to pursue.

Evaluation Report Response

Program: C&I Retrofit Programs, Schedules E250, G205, E257 & E258

Program Managers: Jeff Petersen (E250, G205), Joe Schmutzler (E257), David Montgomery (E258)

Study Report Name: Commercial and Industrial Energy Efficiency Retrofit Custom Programs Portfolio Evaluation

Report Date: February 3, 2012

Evaluation Analyst: Eric Brateng

Evaluation Firm: Navigant Consulting, Inc.

Date of ERR: 2/10/2012

Please describe in detail, action plans to address the study's key findings and recommendations.

PSE contracted with Navigant Consulting, Inc. to provide independent 3rd party evaluation services for four of its program schedules: E250, G205, E257, & E258. The evaluation addressed 3 major program elements: Marketing, Process and Impact. Navigant sought input from numerous sources both within PSE and external to PSE in order to provide input and recommendations from all aspects of program delivery.

Marketing: PSE has worked closely with Navigant since early 2011 to provide input into all three aspects of the evaluation – Marketing, Process and Impact. In an effort to advise PSE in its 2012-2013 planning cycle, PSE requested accelerated input for the Marketing portion of the evaluation.

Action: As a result of this input, PSE has considered many of the market findings in its program design for 2012/2013 and has contracted for several 3rd party efficiency programs in targeted customer segments. These programs will augment PSE staff and will enhance the delivery of PSE programs.

Process: Navigant spent a significant amount of time meeting with individuals within PSE and with customers in order to gain a thorough understanding of PSE processes. Interviews were conducted with a broad spectrum of employees and customers who interface with the C/I Retrofit and Self-Directed Programs.

Key findings were that "PSE's custom retrofit program has generated considerable energy savings through program implementation. Spillover and customer feedback on its longer-running custom programs is quite positive. Nonetheless, PSE appears to have a number of opportunities to enhance the efficiency and effectiveness of its custom retrofit programs" as expressed in nine recommendations.

Impact: PSE engineers and supervisors worked with Navigant field staff to address questions and differences in realization rates. The team quickly realized that economic conditions had a significant impact on individual project savings claims. PSE requested that Navigant determine realization rates based on "As Evaluated" observed conditions during site inspections and also provide realization rates as if economic conditions were not a factor, which are listed as the "Economically Adjusted" realization rate. Overall, the Impact Evaluation found PSE's C&I Program Schedules to accurately forecast and assess realized savings. As Evaluated realization rates were 100.3% for E250 & E258 and 102.3% for G205. Impact Recommendations 1 – 4 start on page 7 of this document.

Action: PSE will continue to employ strategies and procedures to ensure that we maintain these robust realization rates.

Process Recommendations, pages 181-183

Recommendation 1:

Schedule 258 Self Direct Program is effective at inducing larger customers to undertake energy efficiency programs, and apparently more effective than Schedule 250 funded programs alone would be with these customers. Navigant recommends that PSE continue efforts to restructure this program per recent discussions with the Conservation Resource Advisory Group (CRAG) and, as feasible, consider applying the program concept of "customer's own funding available to be used or lost" to increase participation of larger Schedule 250 customers.

Action: PSE has completed restructuring efforts and is continuing with the current Schedule 258 program cycle. During 2012-2013 program planning, PSE discussed the possibility of creating an expanded version of its Schedule 258 program which would be available to larger customers eligible for electric Schedule 250 and gas Schedule 205 programs. However, expanding the Schedule 258 program concept to additional rate schedules would require significant levels of accounting in order to track individual customer contributions and remaining dedicated funding allocations per customer. It was determined that added complexities required to administer an expanded program makes it an infeasible option at this time.

Recommendation 2:

As PSE has correctly concluded, retro-commissioning represents an attractive opportunity for increased energy savings, and Navigant recommends that PSE continue to focus resources on optimizing its new (Schedule 205, 250, and, ultimately, 258) BEOP structure, including consideration of the following:

- Simplifying the program incentive structure and documentation requirements per Trade Allies (TA) and best practice feedback
- Enhancing program transparency by providing savings calculators to providers
- Opening the program to additional providers
- Enhancing marketing materials, particularly case studies

Action: Continued increases in BEOP participation during the 2012-2013 planning process led PSE to determine current incentive levels and structure are sufficient to encourage program participation. PSE is operating under its target, budget and program plans for 2012/2013 which maintains the same incentive structure that was used previously. PSE will continue to evaluate the BEOP incentive structure and documentation requirements for opportunities to simplify them and will implement modifications as necessary.

PSE does provide savings calculators where appropriate and continually searches out and employs standard savings calculators where possible for all of its energy efficiency programs. Many energy efficiency measures lend themselves well to standard calculation tools with limited variables. The nature of "optimizing" a building requires non-standard site-specific calculations in order to accurately estimate energy savings.

The 2012-13 program planning cycle was used to further improve the BEOP based on the results of the first year of the program. While PSE continually looks for ways to streamline and simplify the documentation requirements, providers that have participated in more than one project have indicated that the program requirements are clearer for subsequent projects.

PSE has changed program requirements to allow more approved providers for BEOP in an effort to increase participation. Additional staff resources have and will be added to respond to increased customer and trade ally participation.

PSE has also contracted for a simplified 3rd party commissioning program which will be added to PSE's commercial programs to address buildings with less-complex operational issues. This new program will complement PSE's existing commissioning offerings by allowing for a streamlined tune-up of buildings with less complicated operational issues while identifying projects that may require the more thorough investigational and correctional structure offered by the BEOP.

PSE has recognized that trade allies are seeking additional marketing support and case studies. During 2012 we are planning to develop several BEOP case studies of projects that will be available to trade allies and we will feature some of these cases in our quarterly newsletter, Re-Energize Your Business, which is distributed to trade allies.

Recommendation 3:

PSE should assess the potential benefits of reallocating resources from Schedule 205 and 250 custom grant program incentives to Trade Allies (TA) and customer support and outreach.

- TA's are looking to PSE for additional marketing and technical support.
- Case study material appears to be particularly valued.
- PSE should assess the potential for creating savings calculators for TAs that would reduce the uncertainty around likely incentive levels.

Action: PSE realizes and agrees that trade allies are a major contributor to the past and future success of its programs. PSE used the accelerated Navigant Marketing Evaluation results to establish three third-party trade ally-operated programs which have been incorporated into its Schedule E250 and G205 offerings. These programs allow our trade allies to engage in customer support and outreach in specified customer segments and provide expertise required to scope, design and deliver cost-effective projects to Business Energy Management. Outside of this program delivery mechanism, proposed reallocation of resources from the custom grant incentives to Trade Allies and customer outreach will be reviewed and discussed for regulatory compliance and cost effectiveness, along with the potential return on investment for meeting savings targets.

PSE has recognized that trade allies are seeking additional marketing support and case studies. During 2012 we are planning to develop several case studies of projects that will be available to trade allies and we will be featuring some of these cases in our quarterly newsletter, Re-Energize Your Business, which is distributed to trade allies.

Many trade allies provide a savings estimator of their own when submitting a project to PSE or approaching a customer. PSE engineers often solicit and welcome the input from trade allies.

Recommendation 4:

Navigant recommends that PSE assess the potential for leveraging the success of its EnergySmart Grocer (ESG) program, both through replicating its structure as feasible and better leveraging PECI's presence at grocers.

- The ESG program yielded implementation of more measures per customer on average during this period than other programs, suggesting that there are program elements that could merit adopting in other programs and market segments.
- ESG program elements that are common to other strong utility DSM programs include: initial customer audit with timely feedback, staging of measures, customer follow up, and potentially others.
- PSE should consider expanding PECI's measure portfolio beyond just retrofit refrigeration to gas and other electric measures as well as new construction in the grocery store market segment.

- Alternatively, PSE should consider developing a mechanism for PECI to communicate potential opportunities outside their measure portfolio to PSE.

Action: PECI has been very successful in its implementation of the Energy Smart Grocer Program throughout the region and has significantly contributed to PSE's energy savings goals. Virtually all of PSE's grocery customers have implemented at least one measure through the ESG program. Many more have implemented multiple measures. The ESG program achieves much of its success through providing a large list of measures that address technologies common and specific to grocery stores. Market penetration is fairly simple and universally deployable to the target market once these measures have been identified and savings vetted. Measures are funded at a fixed amount per unit installed.

PSE has incorporated many of the attributes that contribute to the success of ESG into its program offerings. Common, limited savings variability measures such as LED lighting, occupancy sensors and specific VFD applications have been converted to fixed incentives. Also, third party programs will provide customers with comprehensive services ranging from audits to construction management and savings verification.

PECI is continually looking at new energy efficiency measures to add to the ESG program. Within the current contract structure, the ESG Program has been expanded to include gas savings measures and lighting measures in convenience stores. Currently new measures proposed by PECI for the ESG program are vetted through the commercial refrigeration subcommittee at the Regional Technical Forum (RTF). New measures are typically proposed with deemed values and require a calibration plan methodology that is accepted by the RTF prior to implementation. Currently, several measures are being proposed or have been proposed under this process including glass doors for open medium temperature refrigerated cases and floating head pressure on single condensing units.

PECI and PSE currently have a feedback mechanism for additional savings opportunities through the ESG program. Savings measures outside of the ESG measure portfolio are referred to the PSE program manager who will evaluate the measure for possible creation of a custom grant.

Recommendation 5:

Navigant recommends that PSE explore opportunities to increase Custom Grant program efficiency and reduce application processing time.

- Possible approaches include identifying additional measures that can be made prescriptive and developing savings calculators to make calculations more consistent.

Action: Application time includes everything from initial facility information gathering through grant payment. A significant portion of this processing time involves data analysis, engineering calculation development and refinement and the verification of assumptions through trend logging, billing analysis and second engineer review prior to grant creation. PSE realizes that the timeline from application to grant payment can vary significantly from project to project and that the variables dictating the timelines are not always apparent to the customer or trade allies. PSE will provide greater clarity to its customers and trade allies regarding the grant process and associated timelines.

PSE is continually looking to identify and transfer custom grant measures into prescriptive rebates where possible. Examples of prescriptive measure creation and process streamlining are:

- In August of 2011, PSE consolidated its approach to funding of screw-in LED lamps. For all PSE programs, LED lamps are now funded via rebate and energy savings per lamp is a Unit Energy Savings (UES) value based on the type of lamp installed.
- Linear fluorescent lamp rebates which provide a lamp wattage reduction are now available to all customers via a standardized application and processing mechanism.
- PSE has created and implemented an Enhanced Lighting Program designed to capture additional lighting efficiency opportunities that exist in a facility, but may be overlooked. This program provides a single-page savings calculation spreadsheet that also serves as a streamlined technical document providing all information necessary to create a grant. Use of this single-page resource reduces project processing time.

PSE is investigating the possibility of modifying the Enhanced Lighting Spreadsheet for use in all lighting projects. The spreadsheet features drop-down menus with standard options designed to both standardize inputs and reduce data entry times.

These consolidated approaches have reduced grant processing time as well as provided for a more consistent approach to savings calculations and funding.

In addition to internal process improvements, Standard Protocols for Commercial measures, being developed by the RTF, will be reviewed and commented on and incorporated into BEM programs where deemed appropriate and applicable. These Standard Protocols promise to streamline calculations and incentive payments.

This evaluation occurred during a period of record program participation levels, primarily due to economic stimulus funding driving accelerated participation in utility energy efficiency programs, which resulted in PSE staff experiencing greater than usual workload. Since the beginning of the evaluation PSE has added engineering staff and is continuing to add staff in 2012 in order to improve project turnaround time and provide more expedient response to customer requests.

In addition to review and evaluation of prescriptive measures, PSE has made changes to its internal processes. PSE has added features to the project tracking database (CSY) to display individual QC workloads in order to more evenly distribute the workload and decrease project turnaround time.

PSE has incorporated an administrative function where grant applications are submitted electronically to a dedicated e-mail address with enough information to establish a project number. By transferring this function to contracts administration, engineering time previously used to perform this task has been eliminated. The payment request process has been incorporated into the tracking program. This process modification has eliminated duplicate data entry, reduced the possibility for data entry errors, and reduced administration time on contracts administration and engineering staff. PSE continues to look for opportunities to improve efficiency in custom grant processing and in late 2011 recruited the services of PSE's Performance Excellence Group to assess the custom grant process and identify potential opportunities for improved efficiency. Recommendations for improvement are expected from the Performance Excellence Group in April 2012.

Recommendation 6:

PSE should review the potential to better utilize its many customer touch points to market its EE programs.

- Best practice utilities are organized to encourage Account Executive, Business Segment Manager, Energy Advisor, and Government/Community Relations staff to bring customers into DSM programs.
- Such plans would need to consider associated implications for staffing, training, compensation, and required skills.
- Further leverage existing trade ally relationships

Action: PSE will continue to work closely with the Major Accounts group, Government/community relations and Energy Advisors to promote energy efficiency programs. PSE will also continue to work with trade allies to enhance relationships.

PSE has recently announced a re-organization of many of its customer-facing business units. The intent of this re-organization is to provide a clear, consistent message and a more streamlined interaction with the many facets of PSE that work directly with the customer to provide energy solutions. By incorporating Business Energy Management into a larger Customer Solutions group, more customer interface points will have the opportunity to communicate Energy Efficiency program opportunities to the customer.

PSE's recently contracted 3rd party programs will leverage existing trade ally relationships by providing additional support and outreach to customers needing energy efficiency services.

In 2011 PSE participated in trade ally events to enable customers to easily take advantage of prescriptive lighting rebates. As part of this event, PSE Energy Management Engineers were on hand to discuss additional energy efficiency opportunities in their facilities that can be funded through the Custom Grant program and other offerings. PSE is discussing the merits of continuing these events in 2012.

Recommendation 7:

Navigant recommends that PSE continue to invest in enhancing its marketing materials and approach around market segments. PSE has already begun to do so with its EE website redesign and with some targeted marketing materials.

Action: PSE is continuing to develop marketing materials and activities that are targeted to particular segments such as lodging facilities, healthcare facilities, data centers and others. PSE has completed the re-organization of the website and is in the process of developing print materials that reflect the approach toward market segments. Business development/outreach tactics that target specific market segments are also under discussion. PSE included the marketing department in its 2012/2013 planning cycle in order to address marketing needs unique to Energy Efficiency. Case studies will be included in the marketing materials. Newly contracted 3rd party program information will be posted on the website also.

Recommendation 8:

Navigant recommends that PSE confirm and then develop specific strategies and tactics to address its target market segments, including potentially the following:

- Manufacturing
- Real estate
- Education
- National chains

Any confirmation should leverage related findings from Navigant's market assessment and could include a deeper review of program uptake to date or in combination a review of current baseline data. Strategies may include target marketing of programs, use of third parties for all or components of program delivery, and use of PSE marketing resources.

Action: Draft results from the Market Assessment provided by Navigant Consulting during the 2012-2013 program planning process influenced the incorporation of 3rd party contracted programs that address target markets that PSE believes have significant potential to generate energy savings.

The portfolio evaluation from Navigant Consulting on the C&I Custom Retrofit Grant program offers good insight into the potential and disposition of four market areas. Three of these, healthcare, food processing and commercial offices, appear to be areas that would benefit from more proactive marketing and outreach during 2012-2013. Additionally, the Commercial Rebates group has identified the lodging industry and the restaurant/commercial kitchen sectors as areas with potential for expansion. The fourth area studied by Navigant, the education/public sector/government facilities area, is one in which we would like to maintain a presence, but do not envision substantial growth for 12-13. All of these areas are likely to have value for both grants and rebates programs.

Recommendation 9:

PSE should ensure that its new program tracking system provides the functionality required for future program delivery.

- Best practice systems address needs for customer relationship management by engineering staff, maintaining records of past interactions and future opportunities.

- System functionality typically enables tracking of key program delivery metrics, such as application processing time, verification process time, grant payment processing time, and the like, as well as engineering resource commitments and availability.
- The tracking system content should be enhanced to include key trade ally contact information and standardized to ensure consistency in naming conventions to the degree feasible.
- To the extent possible, tracking system should be designed to support future reporting and evaluation requirements.

Action: PSE is in the beginning stages of upgrading its customer management system. Energy Efficiency Services currently has a representative on the committee in charge of developing the new Customer Information System (CIS). The long-term goal will be to incorporate many customer interactions into a single program.

Specific to Business Energy Management, PSE is continually improving its project tracking database (CSY). The project tracking database has the capability to list all projects at a customer site for which a grant was issued. Engineers can get a history of efficiency projects completed at the facility.

Naming conventions have been added. For individual projects, projects are listed by facility name and measure for which a grant is being issued. For entities with multiple facilities, the entity is named first, followed by the specific location and the grant measure. Example: XXX School District – YYY Middle School – Lighting.

The current tracking system has the ability to track projects from inception to payment and includes many milestones which can be measured and evaluated for process improvement opportunities. Individual engineer's projects in progress are visible to all. Supervisors are able to review an engineer's workload and re-assign projects as necessary to balance engineering resources.

Impact Recommendations, pages 227-228

Recommendation 1: Standardize Participant Data Requirements

The accuracy of impact evaluation findings is dependent upon the availability and quality of participant measure data. Although a majority of the projects included comprehensive participation data that allowed for the calculation of both *ex ante* and *ex post* energy savings, some projects had insufficient data within the project application to plan evaluation activities. Specifically, projects within the ESG Program were difficult to contact and evaluate for the following reasons:

- Lack of available project documentation and supporting energy savings methodologies.
- Lack of participant support for the impact evaluation process.

The implementation contractor for the Energy Smart Grocer Program is PECI, and the savings estimates are universally calculated using their proprietary software tool. In response to this preliminary feedback during the Impact Evaluation, PECI presented an overview of the software suite used to generate savings estimates to Navigant. The software allowed for comprehensive energy audits of grocery sites by inputting facility equipment parameters into a spreadsheet based tool during site visits. Although Navigant found the software algorithms to be solid, it was not possible to fully review all of the inputs to the model during the presentation. However, the *ex post* realization rates for ESG projects in the evaluation sample were consistently above 90%, indicating that PECI's software tool is a reliable measure of achievable savings. These findings are consistent with those found in a previous review of an EnergySmart Grocer program administered by PECI for the Bonneville Power Administration.[1]

[1] *BPA EnergySmart Grocer Program: Process and Impact Evaluations*, September 28, 2009, Summit Blue Consulting, pp. 56-57;
http://www.bpa.gov/energy/n/reports/evaluation/commercial/pdf/BPA_ESGrocerProcess_Impact_Eval_9-28-09.pdf

However, in an effort to improve the efficiency of future impact evaluations, Navigant recommends standardizing data requirements on project application forms to support M&V activities. Navigant also recommends future evaluation efforts closely monitor the quality of project-level documentation provided to support the impact evaluation effort, along with the calculation of project-level realization rates. This information can be leveraged to develop measure-specific verification guidelines when low realization rates intersect with prioritized measure technologies (e.g., those measures outside of the ESG program).

Action: While all project documentation is not fully contained within a single comprehensive database readily available for automated query, project QC Review checklists, sufficient project documentation and energy savings calculation and verification methodologies are available to support program review & evaluation functions.3rd party program administrators also ensure information is available to support program review and evaluation functions.

Specifically regarding the Energy Smart Grocer Program, program data resides in PECI's Energy Smart Grocer Audit software. This software (Version 4.0), developed roughly at the same time of this evaluation, is approved by the RTF after an extensive vetting process in 2011, which included a detailed calibration plan to validate savings. By providing a rigorous evaluation and vetting process prior to deployment of the 2012-2013 program, the savings methodologies for this program are believed to be sound and consistent region-wide. Individual measure savings are entered into PSE's tracking database and all parameters required for cost-effectiveness evaluation are readily available.

As part of contracts for new programs offered in 2012-2013, PSE has required each 3rd party contractor to commit to providing evaluation support and has standardized reporting criteria for each installed measure to ensure ability to evaluation program cost effectiveness.

PSE recognizes that standardization of project data expedites the evaluation process and is continually making efforts to ensure project documentation is more uniform and databases are expanded to provide more data via automated query. The Enhanced Lighting spreadsheet and Excel-based Grant Input Form are examples of standardized data input that PSE currently employs. PSE will continue to develop additional standardized templates for project-specific data entry that will streamline future evaluation efforts.

Recommendation 2: Request Participants with Energy Management Systems Provide Pre-/Post-Trend Data

Due to the seasonality of HVAC-related measures, an annual energy usage profile is essential for properly correlating savings to changing weather profiles. A majority of projects involving complex technologies (e.g., VFD retrofits on supply and return fans, chiller retrofits, etc.) have both the technology and capacity to store pre-/post-trend data in support of evaluation efforts. This information will serve as an additional data source to consider / contrast during the Impact Evaluation process, thereby improving the accuracy and validity of convergent savings estimates calculated from different resources (e.g., historical billing records, spot measurements, etc.)

Action: All PSE retrofit grant analyses include a review of facility annual energy usage profiles and validation of measure baseline energy use against the annual consumption analysis. PSE typically requests pre–installation trend logging if it is available and the system is capable of providing trend logs. In many situations, the system being replaced lacks the capability to provide meaningful trend logs. PSE routinely requests post installation trend data for weather-dependent measures and projects involving complex technology.

Data logging duration is sufficient to verify proper equipment and system operation, but not unduly affect prompt incentive payment to the customer. In addition to trend logging, PSE verifies that stated setpoints, schedules and the design intent of the measure installation are met.

Recommendation 3: Normalize Program Schedule Tracking Databases to Enhance Reporting and Evaluation Integrity

Through a review of evaluation *Best Practices*[2] and the Memorandum of development principles designed to guide the construction and integration of a Future Evaluation Database,[3] Navigant identified four industry-accepted standards governing the design of an effective evaluation database. They include:

- The data must be complete enough to accurately describe and quantify what measures and technologies were installed, and what they replaced (if applicable).
- The data must include additional explanatory variables needed to characterize how the measures are applied and their respective operating characteristics.
- Quality Control (QC) metrics must be developed to ensure the integrity of information collected; both computational and manual review processes may drive these metrics.
- The data collection process must be systematic to ensure consistency across the dataset. This will also ensure that the evaluation database(s) seamlessly integrates with PSE's internal data systems.

Adherence to these principles will minimize the potential for data entry error while maximizing the efficiency of data storage. These characteristics will reduce the amount of time and resources spent reviewing and/or correcting any database discrepancies in future evaluation efforts, while yielding more accurate findings.

Action: While the CSY database does not currently include "explanatory variables" and baseline condition documentation to allow an automated query of all parameters required to conduct impact evaluation activities, PSE currently maintains all of the information mentioned above in its project files and employs QC procedures to ensure information integrity. Existing and new 3rd party energy efficiency programs are also required to submit standardized data in a manner that aligns with internal project data sets. PSE is continually working to improve its project tracking database and most recently has made significant advances in capturing additional data required to calculate program cost-effectiveness at higher resolution. As database capabilities are enhanced and expanded, evaluation activities will be streamlined through more comprehensive data being readily available for automatic query.

Additionally, PSE is investigating the possibility of employing a standardized project file system on the network drive to ensure consistency in organization of project documentation in electronic format to allow easier extraction and transfer of individual project information to reviewers and evaluators.

[2] See Appendix L - Best Practices for Impact Evaluation Measurement and Verification (EM&V) Cycles

[3] See Appendix L – Memorandum: Evaluation Database Guidelines

Recommendation 4: Incorporate an Economic Analysis Component for Future Evaluations

The economic malaise is a significant *non-programmatic* factor driving realization rates. By incorporating an economic analysis component in future evaluation efforts, PSE will be able to distinguish between reduced energy consumption achieved through improved controls and efficient measure installations, relative to a decrease in production as a result of economic influencers. Navigant recognizes that economic volatility occurs periodically, and it is no more valid to choose an “up cycle” than a “down cycle” when evaluating Program Schedule performance. By providing a clear distinction between programmatic and non-programmatic factors affecting the realization rate, future evaluation results will ensure a fair assessment of Program Schedule performance over the EUL of incented measures.

Action: PSE recognized that the economic downturn was likely to alter the output and operations of participating businesses during this evaluation and requested Navigant to expand their realization rate analysis. Navigant responded by producing three realization rates; As Evaluated, As Installed, and Economically Adjusted, to provide a clearer distinction between programmatic and non-programmatic factors affecting energy savings. The results of this exercise are included in the Evaluation Report. To the extent possible and when warranted PSE will request similar treatment in future evaluations.