2012-2013 Large Power User Self-Directed Program (Schedule 258) Impact and Process Evaluation Final Report

Contents:

This document contains Navigant's Large Power User Self-Directed Program Impact and Process Evaluation Final Report, and Puget Sound Energy's Evaluation Report Response (ERR). In accordance with WUTC conditions, all PSE energy efficiency programs are evaluated by an independent, third party evaluator.[1] Evaluations are planned, conducted and reported in a transparent manner, affording opportunities for Commission and stakeholder review through the Conservation Resource Advisory Group (CRAG) and reported to the UTC.[2] Evaluations are conducted using best-practice approaches and techniques.[3]

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.

Please note that this is an evaluation of the program as it operated during the 2012-2013 program years, and does not necessarily reflect the program as currently implemented, or measures currently deployed by the program.

This and all PSE evaluations are posted to Conduit Northwest. To view an electronic copy and to leave comments, visit **https://conduitnw.org/Pages/Welcome.aspx**

[1] (6)(c.) Approved Strategies for Selecting and Evaluating Energy Conservation Savings, Proposed Conditions for 2016-2017 PSE Electric Conservation.
[2] PSE 2016-2017 Biennial Plan, Exhibit 8: Evaluation, Measurement & Verification (EM&V) Framework, revised August 6, 2015.
[3] Ibid.

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COMMERCIAL ENERGY EFFICIENCY PROGRAM EVALUATION

Large Power User Self Directed Program; Schedule E258 for 2012 and 2013

Final Report

Prepared for:
Puget Sound Energy

PSE PUGET SOUND ENERGY

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Executive Summary

This report describes the process and impact evaluation activities related to Puget Sound Energy's (PSE) Schedule 258 Large Power User program. Process evaluation activities were limited to logic model development and brief, high level customer interviews. The large power user program provides large grants to schedule 258 commercial and industrial customers for energy improvements in their facility. Large Power Users are defined as those customers receiving electrical service from PSE under rate schedules 40, 46, 49, 448, 449, 458 or 459 of electric tariff G. The program is based on a four year cycle, where customers respond to PSE's RFP with custom project proposals for cost effective electric energy efficiency projects.

As per the direction provided in the RFP, Navigant assessed the program energy savings impacts during the 2012-2013 tariff years, based on a sample of the largest 30 sites in the program during the two years being evaluated. This represented 82% of program savings over that time period. Table 1 below shows the ex-ante performance of these programs during 2012 and 2013.

PSE's Large Power Users program during 2012-2013 contained only one prescriptive measure (lighting) with all other measures being classified as custom. The prescriptive measure was not included in the evaluation because it was not part of the largest 30 projects.

Table 1. Summary of PSE's Schedule 258 Retrofit Programs Performance, 2012-2013[1]

Program	# of Projects	Total Grants ($)	*Ex-Ante* Savings (kWh)
2012			
E258 HV Sch 449	8	$1,696,114	5,529,704
E258 HV Sch 40, 46, 49	54	$4,673,981	16,952,519
2013			
E258 HV Sch 449	6	$778,765	2,894,743
E258 HV Sch 40, 46, 49	60	$3,264,811	10,936,358
Total	128	$10,413,671	92,350,891

Source: Navigant analysis of PSE tracking database.

Process Evaluation

Key Process Evaluation Findings

Process evaluation activities consisted of logic model creation and limited site contact interviews. Logic models are developed as a graphic presentation of the (program) intervention – what occurs and clear steps as to what change the activities undertaken by the intervention are expected to bring about in the targeted population.

[1] Data provided by PSE in an Excel file: Clean commCSY.xlsx

Navigant relied upon PSE program documentation, marketing materials and application forms to create a logic model. The draft logic model was then reworked with program managers in a day-long meeting at PSE's Bothell facility to ensure it aligned with current program structure. The resulting logic model is shown in section 2.1. Through the process of program review, logic model creation and revision with PSE staff, four key insights emerged:

1. Not all eligible customers are participating in the program
2. Not all program funds are being expended
3. There is a need to identify activities beyond incentives to achieve further program savings
4. There is a need to review and possibly revise program structures to find a means to best balance program spending, program savings and cost efficacy

Formal customer interviews were not a part of the scope of Navigant's Large Power Users Program evaluation. Informally, PSE asked Navigant if the impact evaluation site visits would ask four questions of each of the 30 customer contacts during site visits as outlined in section 2.2. Findings are anecdotal in nature and include the following feedback:

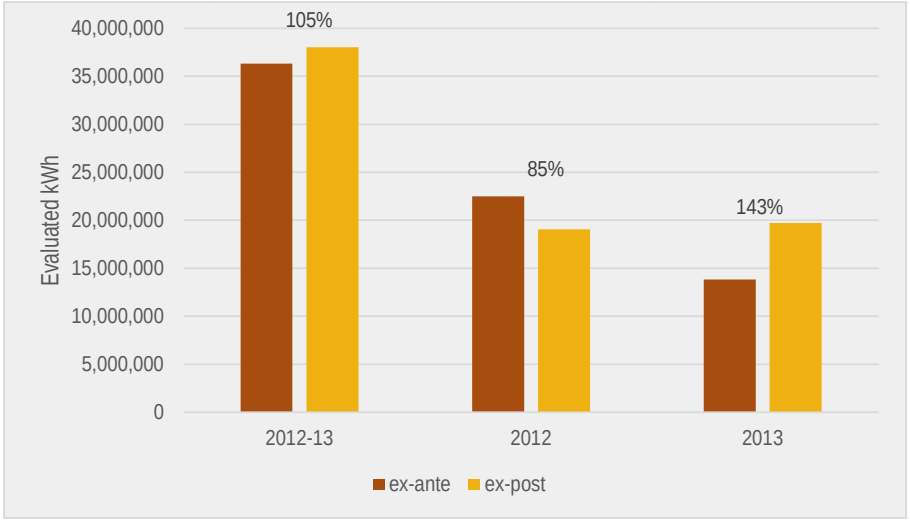
1. Respondents have an overall favorable view of PSE
2. The current four year program cycle provides adequate time to use their allocations
3. There are always more opportunities for energy efficiency projects
4. Gas projects are an area of interest for program expansion

Impact Evaluation

Key Impact Evaluation Findings

Figure 1 below shows the total Large Power Users *ex-post* gross program savings and realization rates for program years 2012, 2013, and 2012-2013 combined.

Figure 1. Total Schedule 258 Savings by Year



Source: Navigant analysis of M&V data

Overall realization rates for the top 30 projects over the two program years varied due to the impact of the biggest projects The largest project was in 2012 and had a 25% realization rate but the second largest was from 2013 with a 207% realization rate. While these effects cancel out in the combined sample, they are very noticeable in the individual years.

The main drivers of realization rate differences are both errors in the assumed baseline and efficient usage and changes in operations affecting the new equipment. While the former can be improved with better verification after installation, the latter is not something that the program can necessarily anticipate. Additionally a few sites showed inconsistencies between the ex-ante savings between the project files and the program's database.

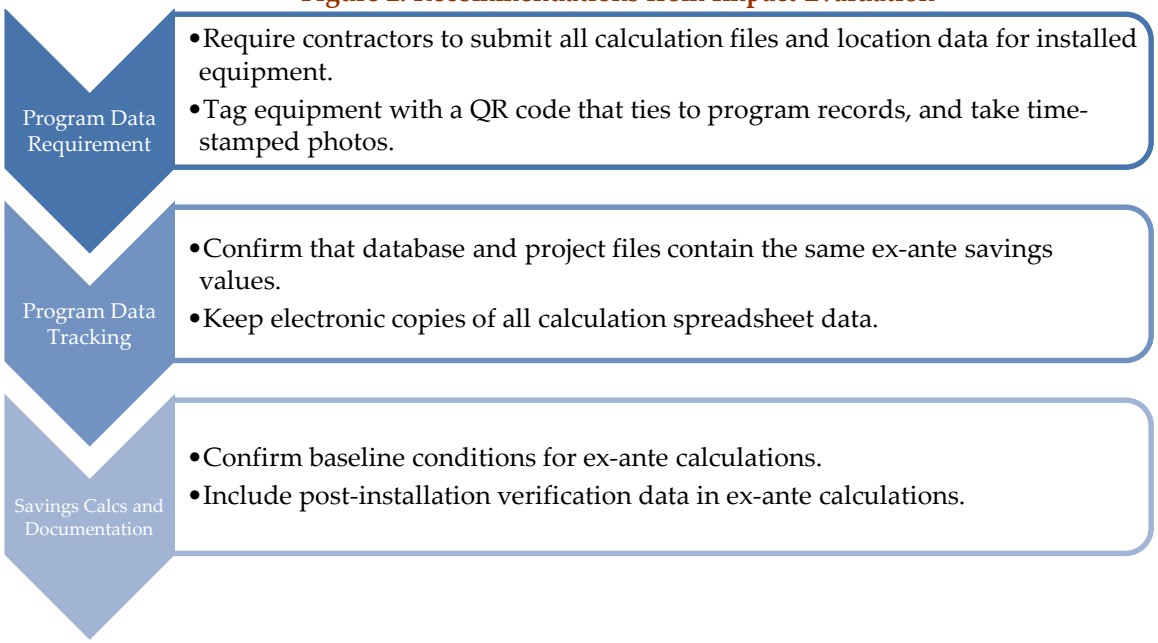
Since this study was designed as a census of the largest 30 projects by ex-ante savings, it did not have a specific confidence and precision target, and traditional confidence and precision terminology does not apply (i.e., we are 100% confident that the sample reflects the specified 30 sites, so the error margin is 0%).

Although this non-random census approach that focused on the top 30 projects cannot provide statistical confidence and precision results, we can say that from a "practical significance" standpoint that this program is very likely hitting at least a 100% realization rate overall. This is due to the fact that the studied sites represent 82% of the total ex-ante program savings during the evaluated period, and an overall realization rate of 100% would be achieved even if the realization rate for all other projects fell to 0.77 (1.05 * 0.82 + 0.77 * 0.18 = 1.00). No evaluation of this program has ever shown such a low realization rate.

Key Impact Evaluation Recommendations

Based on the study of the PSE C&I Program impacts, and lessons learned in the evaluation process, Navigant offers the following recommendations for PSE's consideration:

Figure 2. Recommendations from Impact Evaluation



1 Introduction

1.1 Scope of the Evaluation

PSE offers an array of energy efficiency (EE) services to their electric and natural gas customers in all market segments. The Company is committed to ensuring that all customers have access to these services by offering a mix of programs that address all major end uses. Navigant evaluated the Large Power User, E258 Large Power User Self-Directed program for 2012 and 2013.

The goal of these programs is to encourage existing large C&I customers to use electricity more efficiently by installing cost-effective Energy-Efficient (EE) equipment, using energy-efficient operations at their facilities and adopting energy-efficient designs. Incentives are available for various custom upgrades, including lighting, motor changes including variable frequency drives (VFDs), HVAC systems, and various process related upgrades.

As per the direction provided in the RFP, Navigant assessed the program energy savings impacts during the 2012-2013 tariff years, based on a sample of the largest 30 sites in the program during the two years being evaluated. This represented 82% of program savings over that time period.

1.2 Organization of This Report

This report is divided into four sections:

- **Executive Summary: Top line findings and key recommendations**
- **Section 1: Introduction** (this section) frames the research undertaken by outlining the scope of the evaluation activities
- **Section 2: Process** evaluation covers the following activities: logic model creation and site contact interviews. Methodologies and findings of the process activities are presented within each section. For the Logic Model Creation Navigant staff conducted a review of all program materials as well as in-depth interviews with program staff. Information gleaned from these reviews and discussions are summarized in the logic model. Site contact interviews were conducted during impact evaluation site visits and were limited to four questions.
- **Section 3: Impact** evaluation begins with a discussion of the methodology employed in the review of the tracking data and project files, then continues with a description of the sample design and finally presents the on-site measurement and verification data collection and analysis approach. Next the impact evaluation findings are presented at the annual, and project levels. This is followed by a discussion of the drivers of the realization rates, and the statistical validity of the findings. The section concludes with recommendations for PSE based on the impact evaluation findings.

2 Process Evaluation

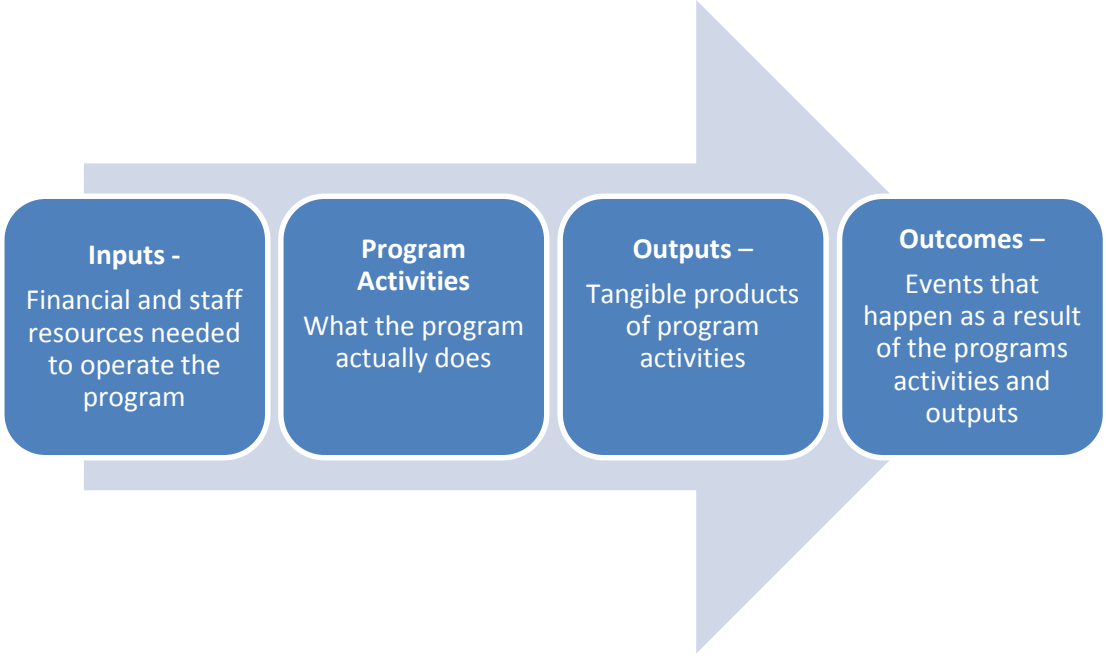
This section discusses Navigant's process evaluation methodology and findings regarding the program structure and customer feedback on PSE's Large Power Users energy efficiency program.

2.1 *Program Management In-Depth Interviews, Document Review and Logic Model Creation*

Logic models are a specialized application of flow diagrams that map causal links from program activities to desired outcomes. The intention is not to illustrate a chronological sequence, as one might expect in a process flow diagram, but to disaggregate program components and evaluate their efficacy individually.

The nodes in a logic model represent a specific event, and arrows point from cause to effect. Nodes are typically arranged in four rows: activities, outputs, short-term outcomes and long-term outcomes, from top to bottom, and the causal logic flows downward. In this framework, an activity is any program component requiring allocation of the agent's resource. An output is a measurable consequence of primary programmatic activities. If a node describes an event that couldn't readily be enforced by contract, it's generally not an output. Outcomes describe the realized intentions of the program, and generally do not describe contractually enforceable events. A high level summary of the program aspects represented in logic model development are shown in Figure 2.

Figure 3. Logic Modelling



Navigant prepared a logic model to identify program interventions, the changes PSE should expect in targeted populations as a consequence, and the actors contributing to the desired outcome. Program documentation, marketing materials and application forms were reviewed to create the logic model. The

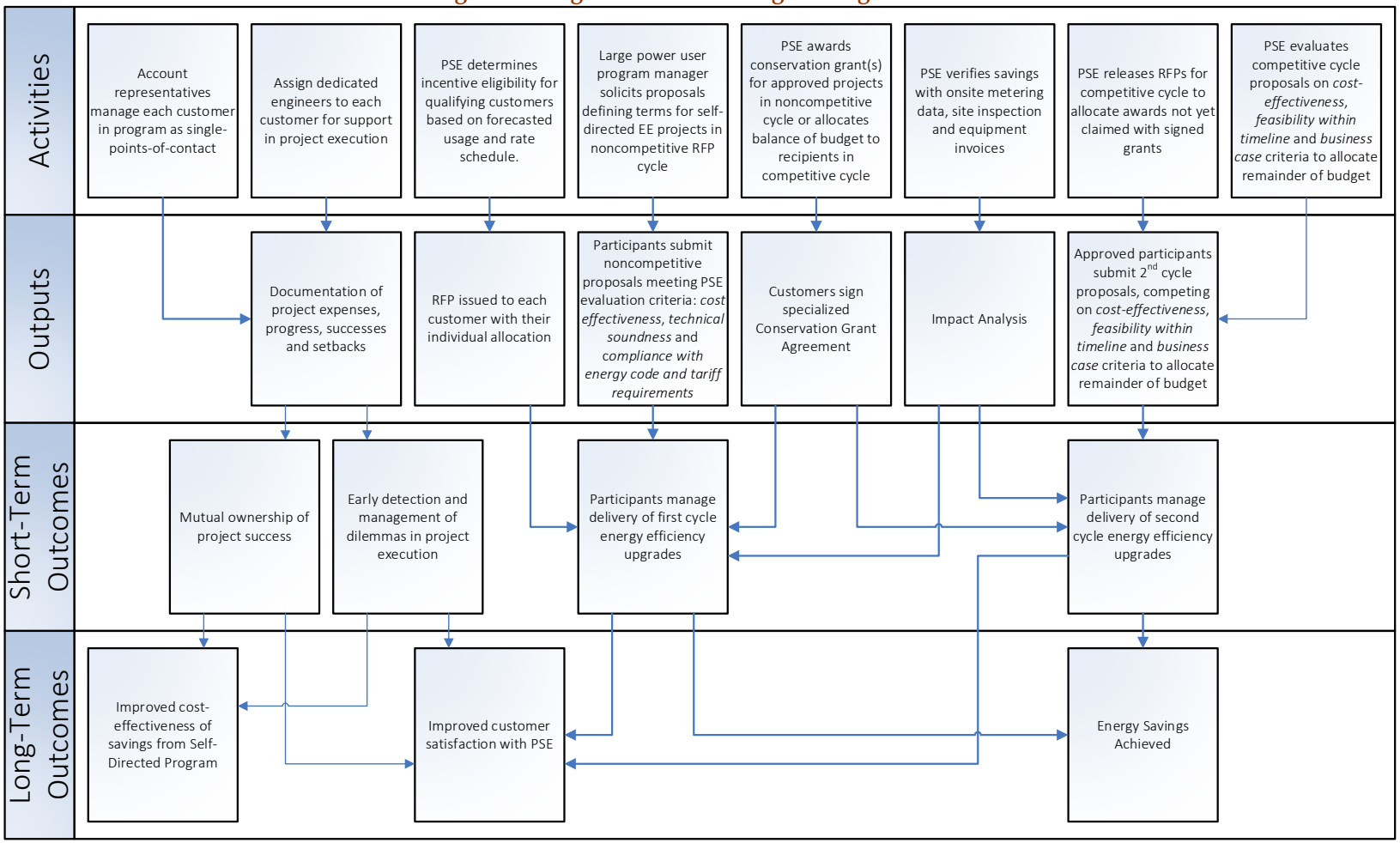
draft was then reworked with program managers in a day-long meeting at PSE's Bothell facility to ensure it aligned with current program structure.

Logic models are useful both for the evaluator to understand a program holistically; and also for program administrators to scrutinize the contributions of individual priorities within a complex program. The iterative process between PSE and Navigant of developing the Large Power Users Program Logic Model identified several areas for inquiry including:

1. Not all eligible customers are participating in the program
2. Not all program funds are being expended
3. There is a need to identify activities beyond incentives to achieve further program savings
4. There is a need review and possibly revise program structures to find a means to best balance program spending, program savings and cost efficacy

Figure 4 depicts the logic model developed in collaboration with PSE.

Figure 4. Large Power Users Program Logic Model



2.2 *Customer Site Contact Interviews*

Formal customer interviews were not a part of the scope of Navigant's Large Power Users Program evaluation. Informally, PSE asked if the impact evaluation site visits could include the following questions during each site visit:

1. Taking into consideration all aspects of your utility service experience, please rate PSE overall (1=unacceptable, 5=average, 10=outstanding)
2. How difficult is it for customers to use their allocations in the 4 year RFP cycle? (i.e., is the timeline too short?)
3. How many more opportunities does the customer have for further cost-effective and feasible efficiency projects?
4. What other types of energy projects would they like to be able to use their allocation, for which they currently cannot?

Navigant was not able to contact the appropriate person to address the questions at one-third of the sites, therefore, this survey represents two-thirds of the visited sites. Additionally, in many cases multiple sampled projects were completed at the same site and shared a single contact person, further reducing the number of surveys. As a result, ten informal customer surveys were completed as a part of this evaluation.

Figure 5 below summarizes responses to the first question.

Figure 5. Responses to "Taking into consideration all aspects of your utility service experience, please rate PSE overall (1=unacceptable, 5=average, 10=outstanding)"

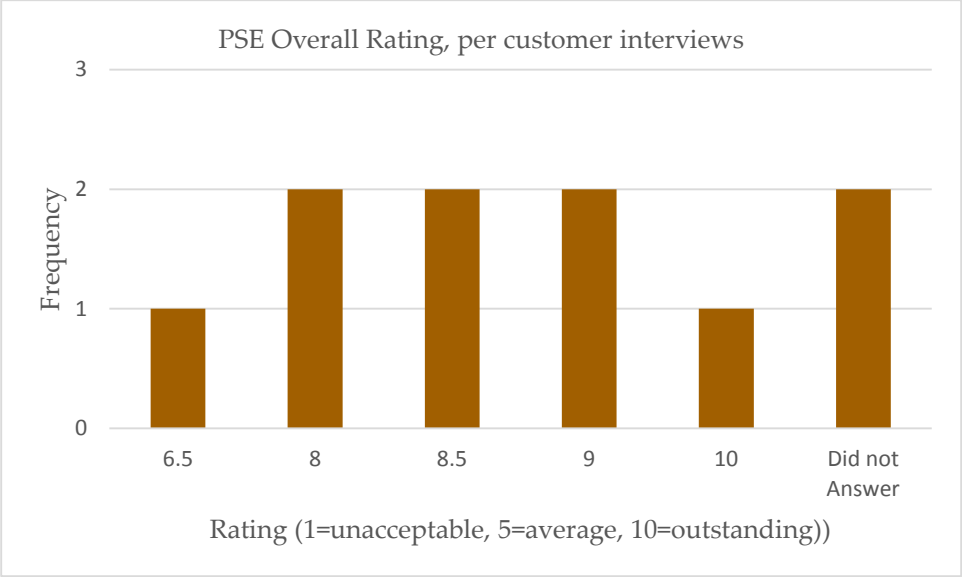
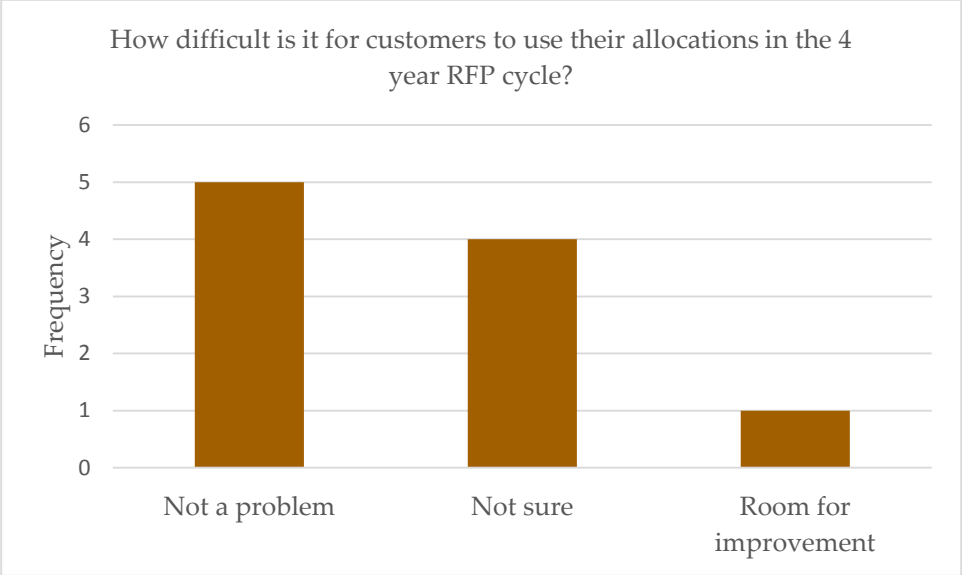


Figure 6 below shows the responses to the second question.

Figure 6. Responses to "How difficult is it for customers to use their allocations in the 4 year RFP cycle? (i.e., is the timeline too short?)"

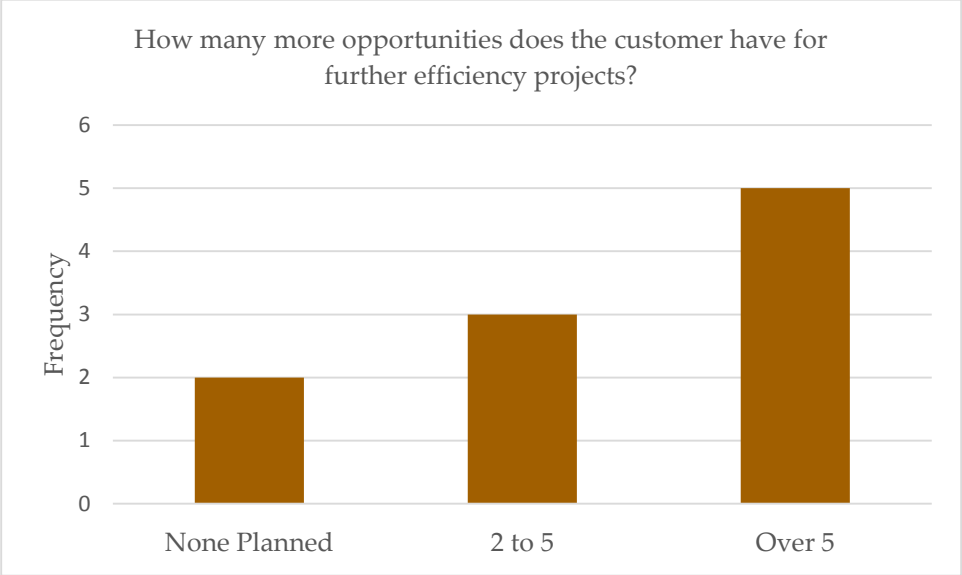


The "room for improvement" response called for more consistency in the program. This site contact found changes to the four year program cycle problematic for their planning.

One of the "not sure" responses said that "a longer cycle might be better. It can be problematic due to 1-5 year maintenance cycle to take some equipment offline." Another "not sure" response mentioned needing more internal staffing. One site contact was new but mentioned that there had been a problem finishing a project on time because it was the end of the cycle.

Figure 7 below shows the responses to the third question.

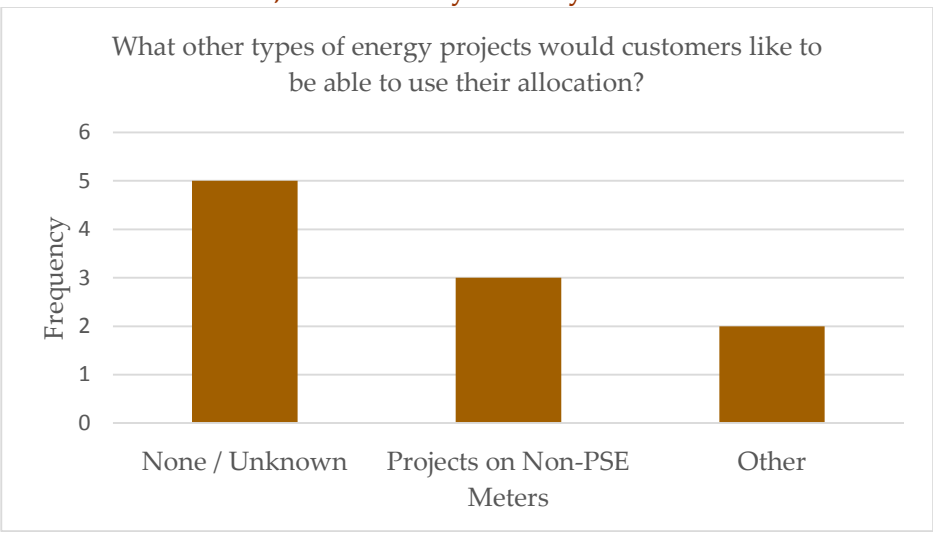
Figure 7. Responses to "How many more opportunities does the customer have for further cost-effective and feasible efficiency projects?"



Two sites do not have additional projects planned. Three sites are planning on implementing 2-5 new energy efficiency projects. Two more sites have 8-10 projects planned. The three remaining sites expect to complete many efficiency projects—Reponses include "hundreds" and "lots and lots". The other site said that there's "Always something out there" and continues to look over opportunities at their 100+ buildings in the Puget Sound area.

Figure 8 below shows the responses to the fourth question.

Figure 8. Responses to "What other types of energy projects would they like to be able to use their allocation, for which they currently cannot?



Five of the sites did not have any ideas for other types of energy projects for which they would like to use their allocation. Two sites wished to take on gas energy projects. One site wished to perform a lighting retrofit, but their lights are not on PSE supplied meters. Another site wished for flexibility to spend allocation on slower return projects. The last site wished to implement gas projects such as heat recovery on boilers and steam eyes for steam traps.

3 Impact Evaluation

This section presents the methodology, findings and statistical validity of the impact evaluation of PSE's Large Power Users Schedule 258 Programs. Specifically, the impact evaluation aimed at characterizing program-specific energy savings impacts for commercial and industrial retrofit measures by:

- Quantifying the impacts of all projects on annual gross energy consumption.
- Establishing post-implementation performance for installed projects.
- Defining realization rates between *ex-ante* assumptions and *ex-post* findings
- Explaining discrepancies between the results of this study and the *ex-ante* savings estimates.

Results are presented at the project level, as well as at the level of the entire sample. Results from the sample are applied to the entire program.

3.1 Impact Evaluation Methodology

Review of the C&I Program Tracking Database

Navigant completed a thorough review of PSE's Program Databases which store contextual project data along with ex-ante project savings estimates. In addition to verifying the consistency and quality of the information within these data files, the data was used to prioritize projects by their ex-ante savings.

Navigant reviewed the database of all the projects in the schedule 258 programs during the 2012-13 program years, and worked closely with PSE to determine which projects to include in the evaluation. Navigant then employed a detailed quality control (QC) process to screen out projects from other programs, and to ensure that all measures within each project were included. A summary of the schedule 258 projects by measure category is presented in Table 3. The program included a total of 126 projects representing over 36 million kWh of annual savings.

Table 2. Schedule 258 Projects by Measure Category

Measure Category	Number of Projects	*Ex-Ante* kWh Savings	Percent of Program Savings
HVAC	50	12,591,213	34.7%
Lighting	41	10,317,785	28.4%
Motors	26	7,277,676	20.0%
Process	9	6,126,650	16.9%
Total	**126**	**36,313,324**	**100%**

Source: Navigant analysis of PSE tracking database.

Impact Evaluation Sample

In accordance with PSE's request, Navigant selected the largest 30 projects by savings for impact analysis in the Large Power Users program. Navigant determined the evaluation sample using unique projects, as defined by the Project Number in the tracking database, as the sampling unit. This represents 82% of program ex-ante savings, and 24% of program projects. Yet, as shown in Figure 9 and Figure 10 the top 30 projects have a very similar breakdown of project types as the program overall.

Figure 9. Program Breakdown by Measure Type

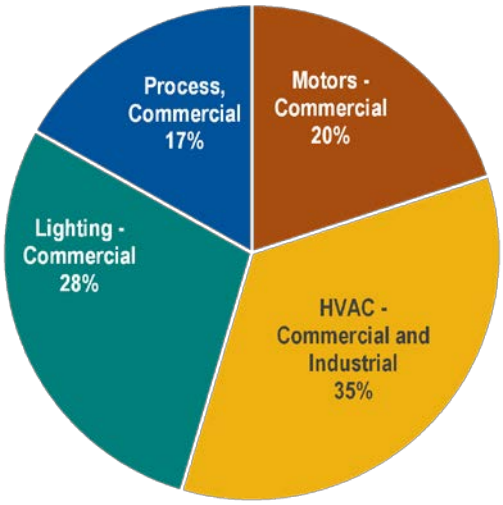
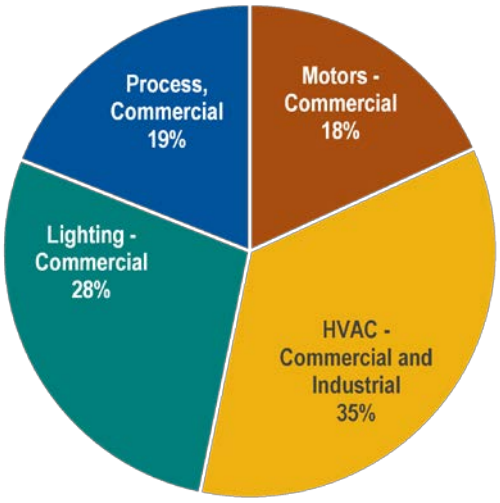


Figure 10. Breakdown of Top 30 Projects by Measure Type



Sample Design

As requested by PSE, Navigant's evaluation focused on the largest 30 projects by ex-ante savings during the 2012-13 program years. Since this represented 82% of program savings it was deemed to be

representative of overall program savings during that time. Table 4 presents the breakdown of the sample by program year.

Table 3. On-Site Verification Sample Sizes

Program Year	Population (# of Projects	Total Savings (kWh)	Sample Size	Sample Savings (kWh)
2012	61	22,482,223	18	19,057,190
2013	65	13,831,101	12	10,676,876
Overall	126	36,313,324	30	29,734,066

Source: Navigant analysis of PSE tracking database.

Project File Reviews

Navigant completed a thorough review of the project file for each project selected as part of the sample. For each project file reviewed, Navigant characterized any data gaps, consistency issues, and the accuracy of the information used to estimate project-level savings. For example, checks were made for possible biases in the data, either because some customers were not included or because there was an absence of eligibility data for a particular group of customers.

Navigant compiled a detailed tracking database from the project files for the sampled sites, extracting all relevant data for each project and wrote a site specific measurement and verification plan (SSMVP) for the evaluation of each project. Navigant completed a detailed QC of the project file savings, identifying and fixing any errors in the data entry, and making notes of any line items for which the savings were calculated incorrectly. Comments on this process were included in the SSMVPs which also include site findings and results and are provided in confidential Appendix A.

Finally, Navigant cross-checked the total savings calculated from the line-item data with the totals tracked in the project files and the tracking database and found differences for two of the sampled projects. This is discussed further in the results section of this report.

On-Site Measurement & Verification Analysis

Navigant collected on-site measurement and verification data from all sites selected in the sample, employing the IPMVP Protocols to guide the on-site data collection and evaluation strategies used. Table 5 provides an overview of these IPMVP Options:

Table 4. Overview of M&V Options

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

Due to the wide variety of projects and available data within the sample Navigant used primarily Options A, B, and C, with a few sites also using Option D, to evaluate the projects included in this evaluation.

The on-site data collection effort focused on the following key elements:

- Verification of equipment installation and operation
- Confirmation of the equipment type and details of installed equipment
- Confirmation of the presence and type of equipment controls
- Run-time data logging or trend data acquisition of equipment or a sample of equipment
- Confirmation of baseline conditions (as possible)
- Interview with building operators about equipment operation and schedule

Verification Data Analysis

During the site visits Navigant verified operation and installation of the equipment and discussed baseline and current operations with facility staff. At each site Navigant obtained data showing its operation, either by installing data loggers or by obtaining trend or billing data showing operation at the site. At sites where energy use was production dependent, Navigant also obtained production data in order to normalize process related savings to production levels. In some cases, Navigant encountered delays in obtaining trend data because of limited personnel who could extract information from the systems. In one case a facility wanted a specific non-disclosure agreement (NDA) in order to provide production data. For HVAC measures Navigant obtained weather data to normalize operation to weather in a typical meteorological year (TMY) using the most recent version of these data, known as TMY3.

Navigant then analyzed the data from the run-time data loggers and trend data to determine savings for each site. Since projects varied greatly in type and analysis methodology used, this is discussed

independently for each site in the SSMVPs located in confidential Appendix A. Two lighting sites had their incentives split between the Large Power Users and Lighting programs and the analysis was done as part of the Lighting program as discussed in that report[2]. Navigant applied the ex post project savings proportionally to the Large Power Users and Lighting programs according to the ex ante savings.

Once the data was analyzed for each site Navigant applied a quality control process and checked the calculations and results. These results are shown in Section 3.2 as well as in detail in the SSMVPs in Appendix A.

Realization Rate Calculations

Navigant calculated a project realization rate for each project, by taking the ratio of verified savings to the claimed savings from the project file, for all measures:

$$\underset{Realization\ Rate}{Project} = \frac{Verified\ Ex\ Post\ Energy\ Savings}{Project\ File\ Ex\ Ante\ Energy\ Savings}$$

The program-level realization rate was calculated by taking the ratio of the total verified savings to the total tracking database savings, for all sites in the evaluation:

$$\underset{Realization\ Rate}{Program} = \frac{\sum_{i=1}^{n} Project\ Verified\ Ex\ Post\ Energy\ Savings_i}{\sum_{i=1}^{n} Tracking\ Database\ Ex\ Ante\ Energy\ Savings_i}$$

HVAC Interactive Effects Methodology

The current methodology for assigning lighting HVAC interaction factors accounts for heating fuel type and presence, as well as refrigerated spaces. Only two of the lighting projects were in conditioned spaces and so interactive effects were only applied for these. Unconditioned spaces are common in manufacturing facilities so this not an atypical breakdown of conditioned and unconditioned spaces for lighting projects. As part of the lighting program evaluation, Navigant reviewed the values for each of these categories and compared them to the range of values in the RTF interactive effects workbook for all building types, as discussed in that report3. One of the two lighting sites with interactive effects was analyzed as part of the lighting program and the other was analyzed separately but utilizing the same methodology.

[2] Navigant Consulting, "Commercial Energy Efficiency Program Evaluation: Commercial Lighting", Rep. Puget Sound Energy, December 2015.

[3] Navigant Consulting, "Commercial Energy Efficiency Program Evaluation: Commercial Lighting", Rep. Puget Sound Energy, December 2015.

3.2 *Impact Evaluation Findings*

Program-Level Savings

Table 6 below shows the total ex-post gross program savings and realization rates for program years 2012-2013 based on the sampled sites.

Table 5. Total Program Savings by Program Year

Program Year	*Ex-Ante* Savings (kWh)	Realization Rate	*Ex-Post* Savings (kWh)
2012	22,482,223	85%	19,044,960
2013	13,831,101	143%	19,710,525
2012-13	36,396,602	105%	38,028,464

Source: Navigant analysis of M&V data

The 2012 and 2013 combined realization rate was slightly greater than 100%, indicating that PSE's tracking database is providing a reasonably good indication of overall program savings, but wide variation in site-by-site and year-to-year realization rates indicate estimates could be improved. The large difference between the 2012 and 2013 results is due to the two largest projects in the program. The largest project was in 2012 and had a realization rate of 25% due to the closure of two of the three affected buildings. The second largest project was in 2013 and had a realization rate of 207% due to production increases at the site because its savings are on a per unit production basis. PSE could not have anticipated either of these circumstances easily. More detail on individual projects is provided in Table 8.

Verified Savings by Sampled Project

Table 7 below shows the verified savings for each of the 30 projects which were included in the sample:

Table 6: Verified Savings by Sampled Project

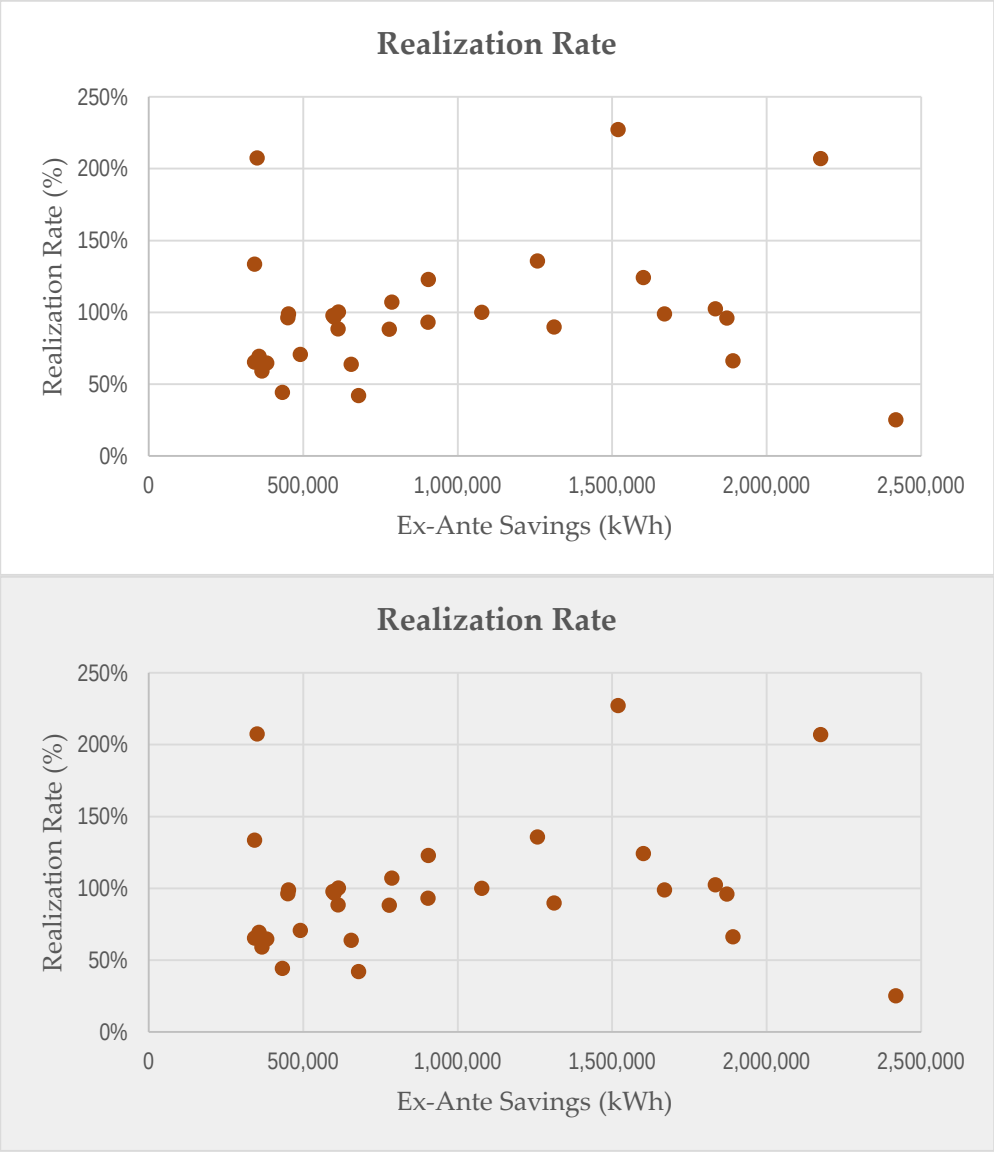
Project Number	Project Type	*Ex-Ante* Savings (kWh)	*Ex-Post* Savings (kWh)	Realization Rate
849103	HVAC controls only	2,418,310	608,221	25%
847815	Process Modification	2,175,058	4,500,000	207%
870669	HID Luminaires, Controls	1,983,107	2,234,501	113%
849104	HVAC controls only	1,891,722	1,252,643	66%
851292	HID Luminaires	1,871,977	1,797,098	96%
854112	Lighting fixtures plus controls	1,833,931	1,879,619	102%
881136	VFD - fans	1,669,648	1,650,355	99%
890662	Motors, Efficient	1,519,466	3,452,351	227%

Project Number	Project Type	*Ex-Ante* Savings (kWh)	*Ex-Post* Savings (kWh)	Realization Rate
868061	Chiller	1,311,907	1,178,278	90%
868060	Chiller	1,258,020	1,707,832	136%
828904	Lighting Controls Only	1,078,098	1,078,098	100%
868064	Chiller	904,909	1,110,828	123%
872169	Lighting fixtures plus controls	904,180	841,917	93%
871820	Other Process	787,524	843,957	107%
868059	Chiller	778,997	686,587	88%
846494	VFD - fans	679,142	285,024	42%
868062	Other Process	655,202	417,282	64%
867886	Chiller	614,493	615,686	100%
890124	Other Process	613,377	542,316	88%
832574	Other Process	601,005	580,329	97%
881672	Lighting	596,565	583,675	98%
845119	VFD - fans	491,215	346,484	71%
894574	Other Process	452,241	446,726	99%
869869	HVAC Central Equip	450,557	433,212	96%
869327	HVAC controls only	432,965	191,346	44%
868058	Chiller	366,549	216,814	59%
845115	VFD - fans	357,247	247,270	69%
890987	Other Process	351,261	729,012	208%
847048	Motors, Efficient	343,031	224,299	65%
873116	VFD - fans	342,362	456,697	133%
Total	All	29,734,066	31,138,456	105%

Source: Navigant analysis of M&V data

Despite the overall realization rate being fairly consistent and close to 100%, the individual projects showed considerably more variability in their realization rates as shown in Figure 11.

Figure 11. Realization Rate by Project Size



The variability in realization rates is due to a combination of factors, including issues with the ex-ante baseline or efficient case estimates, discrepancies between the project file and database, and changes in operations at the facilities. These exceptional findings are summarized in Table 8:

Table 7: Exceptional Findings by Project

Project Number	*Ex-Ante* Baseline Wrong	Efficient *Ex-Ante* Wrong	File-Database Discrepancies	Operational Conditions Changed	Finding
849103	-36%			-39%	Ex-ante model used 100% baseline fan power instead of measured data showing lower usage. Also 2 of 3 buildings were gutted and project no longer operates there.
847815				+107%	Normalized for increased production
849104	-34%				Ex-ante model used 100% baseline fan power instead of measured data showing lower usage.
890662				+127%	Production has increased.
868060				+36%	Building was gutted and usage completely changed.
868064				+23%	Operational hours were higher than expected. Unclear if due to operational changes or incorrect ex-ante assumptions.
846494		-58%			Less fan HP affected and operating at higher partial speed than ex-ante.
868062				-36%	IT load has not grown as much as predicted.
890124				-12%	One of the new units cannot run in efficient mode due to load type.
845119		-29%			Less fan HP affected operating at higher partial speed than estimated
869327			-56%		Ex-ante in database does not match file, which is close to ex-post value.
868058				-41%	Operational hours were lower than expected.
845115		-31%			Less fan HP affected operating at higher partial speed than estimated.
890987			+108%		Ex-ante in database does not match file, which is close to ex-post value.
847048				-35%	Production has increased significantly.
873116		+33%			More fan HP upgraded than listed in project file.

Source: Navigant analysis of M&V data

3.3 Factors Influencing Program Realization Rates

Other than the exceptional findings noted above, the main drivers of realization rates variations from unity were differences in ex-ante and ex-post baselines, incorrect estimates of usage after the project, and changes at the facilities. Additionally a few files contained ex-ante savings values which did not match the program database, so that although the ex-post values were close to those in the project files they varied significantly from database values used to calculate realization rates.

Verified quantities of equipment were relatively consistent with what was reported for most projects, with a few variations which are discussed in detail in the site write-ups in the confidential Appendix A.

However operations varied at a number of sites compared to what was expected based on project files details. These operational differences, consisting of both unexpected changes and some which should have been allowed for in ex-ante calculations, accounted for most of the variations from ex-ante values.

3.4 Validity and Reliability of M&V Findings

Since this study was designed as a census of the largest 30 projects by ex-ante savings, it did not have a specific confidence and precision target, and traditional confidence and precision terminology does not apply (i.e., we are 100% confident that the sample reflects the specified 30 sites, so the error margin is 0%).

Although this non-random census approach that focused on the top 30 projects cannot provide statistical confidence and precision results, we can say that from a "practical significance" standpoint that this program is very likely hitting at least a 100% realization rate overall. This is due to the fact that the studied sites represent 82% of the total ex-ante program savings during the evaluated period, and an overall realization rate of 100% would be achieved even if the realization rate for all other projects fell to 0.77 (1.05 * 0.82 + 0.77 * 0.18 = 1.00). No evaluation of this program has ever shown such a low realization rate.

3.5 Impact Evaluation Recommendations

Based on the study of the PSE Large Power Users Program impacts, and lessons learned in the evaluation process, Navigant offers the following recommendations:

Program Data Requirements

- ***Require customers or contractors to submit all calculation files and location data for installed equipment.*** Some of the project files did not include locations for installed equipment, particularly lights. This made verification difficult since in several cases entire areas had been retrofitted in stages and only one stage was part of the evaluation but it was difficult to differentiate which fixtures were actually covered by the program. We also recommend that PSE consider requiring the installer to put a QR code on the project equipment that ties to program records, and take time-stamped photos of the installed equipment.

Program Data Tracking

- ***Confirm that database and project files contain the same ex-ante savings values.*** Although most of the project files examined as part of this evaluation contained consistent savings values with the program database, two contained values that deviated significantly from those reported in the program database, resulting in low realization rates. Generally the program files appear more reliable than the database values since they accompany the ex ante calculations, but Navigant calculates realization rates based upon the program data base since it is used for reporting. Additionally one of the projects which received incentives under both the Schedule 258 and Lighting programs reported different savings under each of the programs.
- ***Keep electronic copies of all calculation spreadsheet data.*** Although many of the project files included detailed calculations files, some had only scanned copies of data showing installation

locations, calculations, or raw data. This significantly increases the difficulty of verification and evaluation.

Energy Savings Calculations and Documentation

- ***Confirm baseline conditions for ex-ante calculations.*** Some of the variability in the evaluated realization rates could be mitigated by confirming baseline conditions, particularly loading of fans and other motors. Several projects used 100% load or operation for baseline conditions even though data were available showing reduced operation during the baseline period.
- ***Include post-installation verification data in ex-ante calculations.*** Some of the projects used post-installation data in determining the efficient case ex-ante usage, but other projects did not appear to have obtained any trend or other operational data post-installation, which could decrease variation in realization rate for some projects.
- ***Statistical significance.*** If PSE wants to verify statistical significance for the entire program while still focusing on the largest projects this can be accomplished by a stratifying savings based on size while not excluding the smallest projects (e.g., those outside the top 30).

PUGET SOUND ENERGY

Evaluation Report Response

PUGET SOUND ENERGY

Evaluation Report Response

Program:	Large Power User Self-Directed (Schedule 258)
Program Manager:	Peter Lillesve
Study Report Name:	2012-2013 Large Power User Self Directed Program Impact and Process Evaluation
Report Date:	February, 2016
Evaluation Analyst:	Michael Noreika
Date of ERR:	March, 2016

Evaluation Overview, Key Findings, Recommendations and Program Responses:

Overview:
This evaluation report documents the results of the impact and process evaluation of the PSE 2012-2013 Large Power User Self-Directed Program. This program is designed to increase the installation of selected cost-effective energy efficient measures in existing commercial and industrial buildings. The program is based on a four year cycle, where customers respond to PSE's RFP with custom project proposals for cost effective electric energy efficiency projects.

Navigant assessed the program energy savings impacts during the 2012-2013 tariff years, based on a sample of the largest 30 sites (by energy savings) in the program during the two years being evaluated. These projects represented 82% of program savings over that time period.

The study's goals were to verify measure installations, quantify program level energy savings, collect feedback from trade allies, and present best practices for similar programs. Navigant developed the following as part of the process and impact evaluations of the 2012-2013 program years:

- Sample design of the largest 30 sites (by energy savings)
- Logic model development
- Project sponsor interviews

Key Findings:

Impact Evaluation –

- The analysis yielded the following electric gross savings realization rates:
    - PY 2012: 105%
    - PY 2013: 85%
    - Combined PY 2012/2013: 143%

- Although this non-random census approach that focused on the top 30 projects cannot provide statistical confidence and precision results, we can say that from a "practical significance" standpoint

that this program is very likely hitting at least a 100% realization rate overall. This is due to the fact that the studied sites represent 82% of the total ex-ante program savings during the evaluated period, and an overall realization rate of 100% would be achieved even if the realization rate for all other projects fell to 0.77 (1.05 * 0.82 + 0.77 * 0.18 = 1.00).

- The main drivers of realization rate differences are both errors in the assumed baseline and efficient usage and changes in operations affecting the new equipment. While the former can be improved with better verification after installation, the latter is not something that the program can necessarily anticipate. Additionally a few sites showed inconsistencies between the ex-ante savings between the project files and the program's database.

Process Evaluation –

Formal customer interviews were not a part of the scope of Navigant's evaluation. Informally, PSE asked Navigant if the impact evaluation site visits would ask four questions of each of the 30 customer contacts during site visits. Findings are anecdotal in nature and include the following feedback:

1. Respondents have an overall favorable view of PSE
2. The current four year program cycle provides adequate time to use their allocations
3. There are always more opportunities for energy efficiency projects
4. Gas projects are an area of interest for program expansion

Impact Evaluation Recommendations and Program Responses

The evaluation was looking back at the program as implemented in 2012 and 2013. The program team strives to ensure that the program is operating at a high level of efficiency and maximizes all opportunities to improve. Still, there are ample opportunities to improve the customer interactions, track & report savings and program outreach/education. As the team plans and implements the 2016-2017 program we will address the evaluation report's additional recommendations. This section presents the specific recommendations made in the evaluation report, and program responses.

1. ***Require customers or contractors to submit all calculation files and location data for installed equipment.*** *Some of the project files did not include locations for installed equipment, particularly lights. This made verification difficult since in several cases entire areas had been retrofitted in stages and only one stage was part of the evaluation but it was difficult to differentiate which fixtures were actually covered by the program. We also recommend that PSE consider requiring the installer to put a QR code on the project equipment that ties to program records, and take time-stamped photos of the installed equipment (p. 22).'*

Program Response: Documenting all locations of retrofit equipment and lights is difficult for very large projects. PSE will consider ways to to improve such documentation with evaluation in mind. Additionally, PSE will consider QR codes that tie to program records, but currently no plans are in place to do so.

2. ***Confirm that database and project files contain the same ex-ante savings values.*** *Although most of the project files examined as part of this evaluation contained consistent savings values with the program database, two contained values that deviated significantly from those reported in the program database, resulting in low realization rates. Generally the program files appear more reliable than the database values since they accompany the ex ante calculations, but Navigant calculates realization rates based upon the program data base since it is used for reporting. Additionally one of the projects which received incentives under both the Schedule 258 and Lighting programs reported different savings under each of the programs (p. 22).'*

Program Response: Some projects are not required to have a QC review prior to the payment stage, so yes there could be instances of mismatched values. We do not think this is a systemic concern. However, PSE will consider changing the threshold for QC prior to the payment stage.

3. ***Keep electronic copies of all calculation spreadsheet data.*** *Although many of the project files included detailed calculations files, some had only scanned copies of data showing installation locations, calculations, or raw data. This significantly increases the difficulty of verification and evaluation (p. 22).'*

Program Response: Beginning in 2015, PSE implemented a system to ensure electronic QC packages (including calculation spreadsheets) are archived appropriately.

4. ***Confirm baseline conditions for ex-ante calculations.*** *Some of the variability in the evaluated realization rates could be mitigated by confirming baseline conditions, particularly loading of fans and other motors. Several projects used 100% load or operation for baseline conditions even though data were available showing reduced operation during the baseline period (p. 23).'*

Program Response: PSE program staff use the best available data to determine baseline conditions and ex ante savings. In order to ensure transparency of assumptions, PSE project staff will work closely with the quality control staff to ensure that all projects are held to the same standard quality control parameters.

5. ***Include post-installation verification data in ex-ante calculations.*** *Some of the projects used post-installation data in determining the efficient case ex-ante usage, but other projects did not appear to have obtained any trend or other operational data post-installation, which could decrease variation in realization rate for some projects (p. 23).'*

Program Response: Post-installation verification is a function of project size (in terms of energy savings), complexity, and uncertainty and data availability. In order to address this recommendation, PSE will continue to review projects to determine whether additional data are needed and will include any additional data in the project folders.

6. ***Statistical significance.*** *If PSE wants to verify statistical significance for the entire program while still focusing on the largest projects this can be accomplished by a stratifying savings based on size while not excluding the smallest projects (e.g., those outside the top 30) (p. 23).'*

Program Response: In the initial Request for Proposal documents, PSE asked for a purposive sampling strategy, such that the evaluation would include the 30 projects with the highest individual ex ante savings. These 30 projects represented 82% of the ex ante savings for the program. In future evaluations, PSE will consider using a stratified sampling method.

Process Evaluation Recommendations

The process evaluation provided key findings and suggestions for program enhancements. However, the process evaluation was intentionally designed without statistical significance, thus the findings are informational, not actionable.