PUGET SOUND ENERGY

2014 Home Energy Reports Impact Evaluation

Contents:

- Home Energy Reports Program Impact Evaluation
- Evaluation Report Response

This document contains both the final Home Energy Reports Program Impact Evaluation 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.

DNV·GL

RESIDENTIAL ENERGY EFFICIENCY SPECIAL PROJECTS

2014 Impact Evaluation of Home Energy Reports Program

Puget Sound Energy

2015-07-13

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1 EXECUTIVE SUMMARY

Puget Sound Energy (PSE) implemented the Home Energy Reports (HER) Legacy Program in 2008. The HER Program delivers customized information on energy consumption to participating households and compares the household's energy consumption to that of similar neighboring homes. In addition, the report provides personalized tips on how to save energy based on the energy usage and house profile. The HER Program was designed to motivate households to reduce energy consumption through behavioral changes and participation on other PSE energy efficiency programs.

The program was structured as a randomized controlled trial wherein the eligible population was randomly assigned to the treatment and control groups. Around 40,000 dual fuel, single family homes were randomly selected to receive the report while 44,000 dual fuel, single family homes did not receive the report and were assigned as the control group. All households in the treatment group received the report either monthly or quarterly for two years. At the start of the third year of the HER Program, approximately 10,000 treatment group households were randomly selected to stop receiving the reports. This created a second treatment group (suspended) designed to test the persistence of report-based savings after the cessation of reports. The rest of the households in treatment group (current) still receive the home energy reports either monthly or quarterly.

In March 2014, PSE expanded the HER program to include 140,000 additional households. The HER Expansion program targeted three groups namely the High users group, Non-urban group and Electric only group. Similar to the HER Legacy program, the HER Expansion program follows an experimental design with 105,000 randomly selected treatment households and 35,000 households randomly selected in the control group.

1.1 Evaluation Objectives

The main goal of this impact evaluation is to estimate HER Legacy and Expansion Program savings for year 2014. Specifically, the main objectives are as follows:

1. Measure the reduction in electric and natural gas consumption between the control groups and the HER treatment groups.
2. Quantify joint savings from HER-related increased uptake of other PSE energy efficiency programs which may be present in the measured consumption reduction:
    - An increase in the number of participants and/or extent of participation in PSE rebate programs due to the HER
    - A HER-related increase in the number of purchased CFL or LED bulbs and fixtures supported by PSE and NEEA upstream lighting programs
3. Provide a final estimate of 2014 HER savings for Legacy and Expansion programs adjusted for double counted savings resulting from participation in PSE rebate and upstream lighting programs in previous HER years

This evaluation used historical consumption data to measure the difference in consumption between the treatment and control groups. Savings estimates were also measured for the different treatment sub-groups, such as the monthly and quarterly HER Recipient groups, the current and suspended groups for HER Legacy program and Relative High Users, Non-urban and Electric only groups for HER Expansion program.

This evaluation also quantified the potential for double counting energy savings due to participation in other PSE rebate and upstream programs. DNV GL used the PSE program tracking data to quantify joint savings due to participation in other PSE rebate programs. For the upstream programs where there is no tracking data we used a web-based participant survey to quantify joint savings.

1.2 Key Findings

The primary goal of this evaluation was to develop the 2014 PSE HER Program credited savings estimates free of joint savings due to participation in other PSE energy efficiency programs. Table 1-1 and Table 1-2 provide the wave-level and overall electric and gas savings estimates, respectively. The overall electric savings are estimated at 90/25 precision and the gas savings are estimated at 90/35 precision. The overall precision levels justify claiming savings for all waves despite the fact that some expansion waves are not yet individually statistically significant.

Table 1-1: Total Credited Electric Savings for 2014 HER Programs

HER Treatment Group	Electric (kWh)				
	Per Household	No. of treatment	Total Savings	Lower Limit 90% CI	Upper Limit 90% CI
Legacy - Current	305.8	15,648	4,785,860	3,894,729	5,676,991
Legacy - Suspended	116.3	7,796	906,507	320,019	1,492,995
Expansion - Electric only	103.7	26,341	2,731,692	818,830	4,644,555
Expansion - High Users	86.5	25,350	2,192,021	734,872	3,649,171
Expansion - Non Urban	34.9	34,994	1,220,729	-148,914	2,590,372
ALL	107.5	110,129	11,836,810	8,870,949	14,802,671

Table 1-2: Total Credited Gas Savings for 2014 HER Programs

HER Treatment Group	Gas (therms)				
	Per Household	No. of treatment	Total Savings	Lower Limit 90% CI	Upper Limit 90% CI
Legacy - Current	11.8	15,648	184,040	132,098	235,982
Legacy - Suspended	9.8	7,796	76,680	43,284	110,076
Expansion - High Users	5.9	25,350	149,680	42,978	256,382
Expansion - Non Urban	1.2	34,994	41,459	-57,886	140,803
ALL	5.4	83,788	451,859	293,530	610,187

There are three components to estimating credited savings. The first component is the HER measured savings which refers to the impact of HER on average household consumption. The second and third components are the rebate program and upstream retail lighting joint savings. These two joint savings components represent report-induced savings from the increased uptake of PSE tracked rebate programs

and increased purchase of CFL and LED bulb and fixtures through the PSE-supported "upstream" lighting program. To avoid double counting, credited savings are calculated by removing the rebate and upstream joint savings from the HER measured savings.

The summary of results for Legacy and Expansion programs are presented in Table 1-3 and Table 1-4, respectively. All treatment groups produced statistically significant electric and gas savings in 2014 except for the Non-urban group in HER Expansion. The Non-urban group only produced statistically significant measured electric savings while both measured and credited gas savings are not statistically different from zero.

Table 1-3: Summary of Annual Savings for PSE HER Legacy 2014

Treatment Groups	HER Measured Savings (per household)	Joint Savings (per household)	Credited Savings (per household)
Electric (kWh)			
Current	310.1* (253.2,367.1)	4.3 (-0.7,9.3)	305.8* (248.7,363.0)
Suspended	125.5* (50.3,200.8)	9.3 (-7.2,17.5)	116.3* (39.3,193.3)
Gas (therms)			
Current	13.2* (9.9,16.6)	1.5* (0.7,2.2)	11.8* (8.4,15.2)
Suspended	10.2* (5.9,14.50)	0.4 (-0.6,2.4)	9.8* (5.4,14.2)

* indicates statistically significant at 90% confidence level

Table 1-4: Summary of Annual Savings for PSE HER Expansion 2014

Treatment Groups	HER Measured Savings (per household)	Joint Savings (per household)	Credited Savings (per household)
Electric (kWh)			
Electric only	115.7* (43.1,188.3)	12.0 (-4.4,28.4)	103.7* (29.3,178.1)
High users	86.6* (29.1,144.0)	0.1 (-1.4,1.6)	86.5* (29.0,144.0)
Non-urban	48.4* (9.3,87.6)	13.5* (0.7,26.4)	34.9 (-6.3,76.1)
Gas (therms)			
High users	6.1* (1.9,10.3)	0.1 (0.0,0.4)	5.9* (1.7,10.2)
Non-urban	1.2 (-1.6,4.0)	0.0 (-0.1,0.1)	1.2 (-1.7,4.0)

** indicates statistically significant at 90% confidence level. Values in parentheses show upper and lower bounds at 90% confidence interval*

Table 1-5 summarizes the HER program results with respect to average consumption. The current treatment group produced credited savings at 3.0% and 1.6% for electric and gas, respectively. Even after four years of not receiving the report, the suspended treatment group still produced statistically significant savings but those savings were only just over a third of the electric savings of the current treatment group. This difference in savings between the current and suspended groups was statistically significant at 90% confidence level. With respect to gas savings, the suspended treatment group has maintained over three quarters of the gas savings of the current group and the difference in savings between current and suspended groups was not statistically significant.

Table 1-5: Credited Savings per Household as a Percent of Consumption

HER Treatment Group	Electric (kWh)			Gas (therms)		
	Consumption*	Savings	Percent	Consumption*	Savings	Percent
Legacy Program						
Current	10,299.0	305.8 (248.7,363.0)	3.0%	757.5	11.8 (8.4,15.2)	1.6%
Suspended		116.3 (39.3,193.3)	1.1%		9.8 (5.4,14.2)	1.3%
Expansion program						
Electric only	10,727	103.7 (29.3,178.1)	1.0%	N/A	N/A	N/A
High users	9,063	86.5 (29.0,144.0)	1.0%	531	5.9 (1.7,10.2)	1.1%
Non-urban	8,144	34.9 (-6.3,76.1)	0.4%	465	1.2 (-1.7,4.0)	0.3%

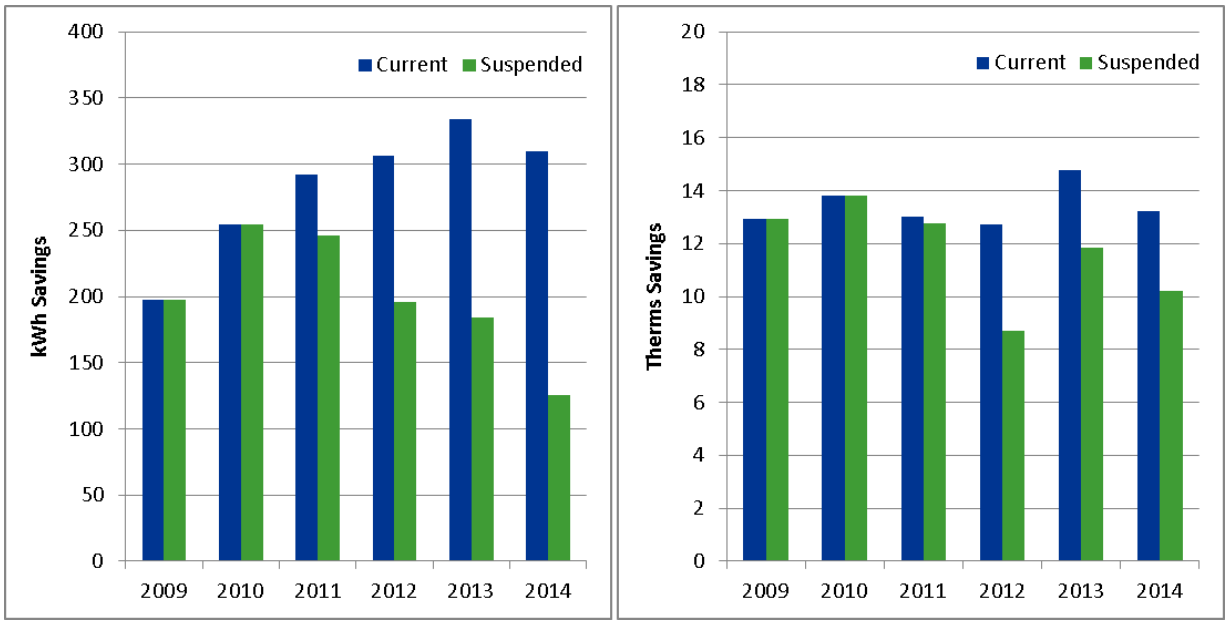
**Based on actual consumption of the control group in post year 2014*

The three HER Expansion groups started receiving the reports in March 2014 and savings only represent a portion of the year. The first year HER savings are generally lower than savings generated in the subsequent years.[1] Electric only and High users groups generated around 1% electric and gas savings while the Non-urban group only produced 0.4% and 0.3% electric and gas savings, respectively that are not statistically significant.

[1] This is the case for the PSE Legacy HER program, as seen in "HER Program 2013 Impact Evaluation" (http://www.utc.wa.gov/_layouts/CasesPublicWebsite/GetDocument.ashx?docID=83&year=2013&docketNumber=132043) or for all waves of Seattle City Light's HER Program (http://www2.opower.com/l/17572/2014-07-31/fbg5f/17572/81744/SLC_HER_Report_July2014.pdf). In fact a review of the library of reports at Opower will show that it takes time for savings to fully develop.

Figure 1-1 show the measured electric and gas savings for the Legacy program from 2009 to 2014. In 2014, DNV GL observed that measured electric savings decreased for the first time. However, this reduction in savings is not statistically significant. Compared to electric savings, gas savings are relatively flat and range from 13 to 15 therms per household in the last 6 years. Evaluation results show that both electric and gas savings for Legacy households still receiving the reports remain at a level similar to previous years.

Figure 1-1: Measured HER Electric and Gas Savings for Legacy, 2009-2014



The HER program exhibits two different kinds of persistence. Households in the current group that continued to receive reports through the sixth year generated savings at or above levels established in the first two years of the program. Households in the suspended group that were in their fourth year of not receiving reports still generated statistically significant savings and at least half of the first year savings of the current treatment group. Interestingly, measured electric savings of the suspended group showed a statistically significant drop in 2014 to almost a third of what the current treatment group was saving while measured gas savings of the suspended group were not statistically different from savings of the current treatment group.

The HER Legacy program also continued to promote other PSE gas rebate programs causing a statistically significant increase in gas joint savings among the current treatment group. On the other hand, gas joint savings continued to decrease since the cessation of reports for the suspended group. Joint savings analysis for the Expansion groups showed relatively higher rebate program participation levels especially for the Electric only group. Despite only covering 9 months of the program, the Electric only group generated joint savings higher than Legacy joint rebate savings in Year 5. Also, the Non-urban group generated small but statistically significant electric joint savings from rebate programs. Electric joint savings from rebate programs for the Legacy group have not been statistically different from zero over the last six years.

2 INTRODUCTION

2.1 Program Description and Objectives

In 2008, Puget Sound Energy (PSE) became the second utility in the U.S. to implement a comparative usage feedback program designed to conserve energy. The program, referred to as the Home Energy Reports (HER) Program, uses social normative techniques to encourage responsible energy behavior and choices. The

program, administered by Opower, provides comparative energy usage reports with feedback to household on their energy use as compared to energy usage of neighboring homes. The program applies the concept of behavioral "nudges" to motivate customers to achieve energy savings. In addition, the reports provide tips regarding steps households can take to reduce energy consumption through behavioral changes and participation in other PSE energy efficiency programs.

The program is structured as a randomized controlled trial experimental design to facilitate estimating precise and unbiased estimates of average per household savings that are small on a percentage basis. In October 2008, PSE launched the HER Legacy program with 83,881 households randomly assigned to the treatment and control groups. In 2010, a subset (approximately 10,000) of the HER Legacy treatment group were randomly selected to stop receiving the reports. This created a second treatment group designed to test the persistence of program-induced savings after the cessation of reports. PSE has continuously estimated savings for this group separately since the 2011 program year.

In March 2014, PSE launched the HER Expansion program targeting three different groups namely High users, Non-urban and Electric only groups. The High users group is composed of single family homes with high energy consumption. Households in the High users group receive the reports four times per year. The Non-urban group is composed of dual fuel households outside of PSE's major metropolitan core while the Electric only group is targeted to customers using electric space and water heaters. The HER Expansion program also follows an experimental design and includes approximately 140,000 households randomly assigned to the treatment and control groups.

This report focuses on energy savings due to the PSE HER program for calendar year 2014. The specific objectives are as follows:

1. Measure the reduction in electric and natural gas consumption between the control group and the HER treatment groups of the Legacy and Expansion programs
2. Quantify the savings from HER-related increased uptake of other PSE energy efficiency programs which may be present in the measured consumption reduction due to:
    - An increase in the number of participants and/or extent of participation in PSE rebate programs
    - An increase in the number of purchased CFL or LED bulbs and fixtures supported by PSE and NEEA upstream lighting programs
3. Provide a final estimate of 2014 HER savings for Legacy and Expansion programs adjusted for double counted savings resulting from participation in PSE rebate and upstream lighting programs in previous HER years

The remaining chapters of this report are organized as follows: Section 3 of the report presents the overall research design and data collection activities. Section 4 discusses the methodology used and Section 5 presents the results of the PSE HER program impact evaluation. Conclusions are offered in Section 6 with appendices appearing in Section 7.

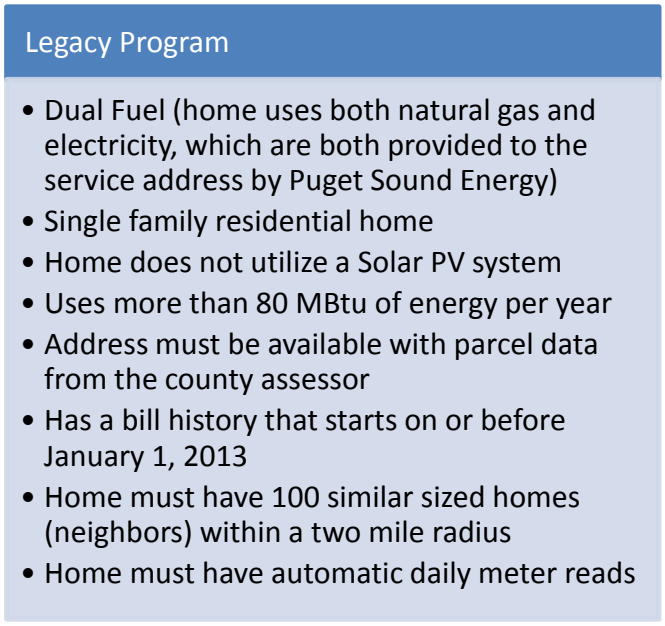
3 RESEARCH DESIGN AND DATA COLLECTION ACTIVITIES

3.1 Experimental Design

Legacy Program

In 2008, PSE established the Legacy program HER program. PSE selected a total of 83,881 single family homes located in PSE's combined gas and electric service territory based on the selection criteria in Figure 3-1.

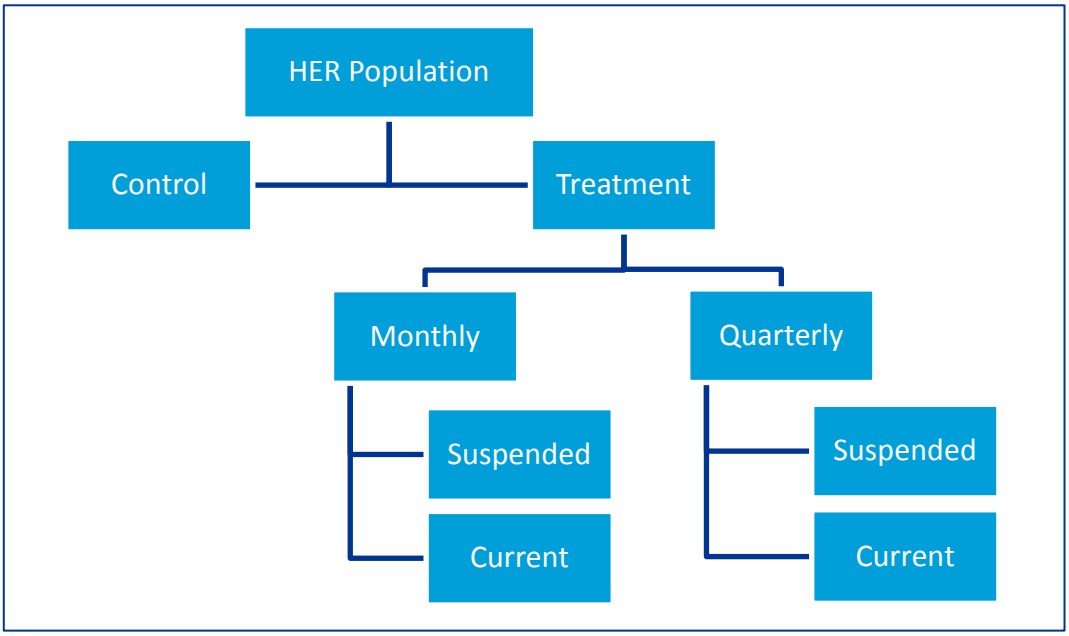
Figure 3-1: Selection Criteria for Legacy Program



After selection of participating households, PSE randomly assigned 39,757 homes to the treatment group and the remaining homes were used as a control group. Of the selected treatment homes, 25 percent were randomly selected to receive HER on a quarterly basis, while the remaining 75% percent homes received the report monthly. The random assignment of monthly and quarterly reports allows both PSE and Opower to test the effect of the frequency of receiving the report on energy savings.

PSE implemented the Legacy program from November 2008 to October 2010. Starting in November 2010, PSE suspended sending reports to 9,674 treatment homes. This treatment group is now referred to as the "suspended" treatment group; households that continued receiving reports are referred to as "current" treatment group. Figure 3-2 depicts the different HER groups used in this evaluation.

Figure 3-2: HER Control and Treatment Groups



Expansion Program

In 2014, PSE expanded the HER program to include a total of 140,000 single family households assigned to the High users, Non-urban and Electric only groups. Both High users and Electric only groups consist of 31,500 homes in the treatment group and 10,500 homes in the control group while the Non-urban group is composed of 42,000 homes in the treatment group and 14,000 homes in the control group. The household selection criteria used for the three groups in HER Expansion program are provided in Figure 3-3.

Figure 3-3: Selection Criteria for Expansion Program

High users	Non-urban	Electric only
• Dual Fuel (home uses both natural gas and electricity, which are both provided to the service address by Puget Sound Energy) • Single family residential home • Home does not utilize a Solar PV system • Address must be available with parcel data from the county assessor • Has a bill history that starts on or before January 1, 2013 • Home must have 100 similar sized homes (neighbors) within a two mile radius • Home must have automatic daily meter reads	• Must be in one of the selected 'non-urban' zip code population (outside PSE's major metropoiltan core) • Dual Fuel (home uses both natural gas and electricity, which are both provided to the service address by Puget Sound Energy) • Single family residential home • Home does not utilize a Solar PV system • Address must be available with parcel data from the county assessor • Has a bill history that starts on or before January 1, 2013 • Home must have 100 similar sized homes (neighbors) within a two mile radius • Home must have automatic daily meter reads	• Home uses electric for space and water heating • Single family residential home • Home does not utilize a Solar PV system • Address must be available with parcel data from the county assessor • Has a bill history that starts on or before January 1, 2013 • Home must have 100 similar sized homes (neighbors) within a two mile radius • Home must have automatic daily meter reads

3.2 Data Sources and Disposition

For the impact evaluations, the evaluators used information collected from consumption data, program tracking data and participant survey data for both the Legacy and Expansion program analyses. The evaluators reviewed all datasets for accuracy and completeness. Data sources and data preparation activities are described in the following subsections:

3.2.1 Data Sources

Program Participants

PSE provided premise numbers, customer account numbers, electric and gas meter numbers and treatment assignment of HER program participants. This data serve as the roster of program participants for the HER evaluation. For Legacy, PSE provided additional household information such as zip codes, house square footage, number of bedrooms/bathrooms and house value.

Daily Consumption Data

PSE's Meter Data Warehouse provided daily consumption data of PSE customers from January 2007 to December 2014 to facilitate the daily, pre and post period analyses. These datasets include meter numbers, daily consumption reads, read dates and the type of reading (actual reading/estimated reading).

Opower Data

PSE provides Opower with monthly data that Opower uses to generate comparative reports for HER Legacy and Expansion participants. Opower provided an extract of monthly consumption data with information on households that opted-out of receiving the reports to PSE for use in this analysis. The dataset provides monthly billing data through December 2014, and includes; participants, site location, treatment assignment, customers who opted out of the program, and dates when customer accounts became inactive. The inactive dates are used to identify participants that moved out during the analysis period.

Rebate Program Tracking Data

The program tracking data includes information on PSE customers who participated in other PSE rebate programs in 2014 and facilitates calculating rebate program joint savings for the HER program. The tracking data includes participant information, account numbers, program name, measures installed, installation dates, and claimed savings.

Cross Walk for Old to New PSE Database Systems

PSE provided mapping of old premise numbers, customer account numbers and meter number to new system IDs. The cross walk facilitates linking the old system data to new system data and allows for identifying meter numbers of program participants within the Expansion groups.

3.2.2 Billing Data Disposition

Daily consumption data is the primary data used for determining impacts from the HER Legacy and Expansion programs. The evaluators examine the consumption data for completeness and potential data issues such as duplicates, extreme values, missing observations and other inconsistencies.

Consistent with previous HER Legacy evaluations, data preparation steps include:

- Removal of duplicate reads. Duplicates are identified using the following criteria:
    - When meters produced two or more identical reads in one day, only one read was included in the analysis.
    - When a meter produced two or more different reads in a day, both reads were excluded from the analysis.
- Exclusion of negative reads
- Exclusion of extreme values. Extreme values, greater than 400kWh per day or 40 therms per day, were excluded from the analysis.
- Examine for missing observations. There are two causes of missing observations:
    1) Missing daily observations, caused by missed daily reads, were generally followed by a single read that covered the multiple missing days. Data imputation was employed by distributing energy consumption of that next non-missing meter read. Imputation was only done when the next non-missing read covered the missing period as indicated by start and end read dates.
    2) Incomplete daily consumption data. The number of missing days is very few and is not expected to make any substantial impact on the analysis.
- Exclusion of households with less than 122 days of data during the pre-treatment or post-treatment period.
- Removal of customers that moved out during the analysis period

Table 3-1 summarizes the original program population, counts of households removed from the analysis and final sample used in billing analysis for the Legacy program. Households where occupancy status changed during the analysis period were removed from the final HER population. Roughly 19% of the original population moved out as of 2014. The evaluators also excluded sites due to other data issues resulting in removal of only 1% of the original population.

Table 3-1: HER Legacy Data Disposition

Population	Control	Treatment	Total
Original population	**44,124**	**39,757**	**83,881**
Not in customer/billing data	35	42	
Not randomly assigned		4,864	
Other Opower Program	111		
Move outs (2007 – 2013)	11,724	10,070	
Inconsistent zip codes	72	70	
PSE sample	**32,182**	**25,426**	**57,608**
Other Data Issues (low number of data due to missing meter reads, inconsistent reads and outliers)	447	408	
Final Sample for 2013	**31,735**	**25,018**	**56,753**
Move outs in 2014	2,068	1,495	
Other data Issues	91	79	
Final Sample in 2014	**29,576**	**23,444**	**53,020**
Monthly – Current		11,182	
Monthly – Suspended		5,583	
Quarterly – Current		4,466	
Quarterly – Suspended		2,213	

Note: Some sites may have multiple issues.

The evaluators also excluded households without an assigned control group in the analysis. These non-random households comprise roughly 12% of the original treatment group and were located in zip codes that did not have an assigned control group. Table 3-2 shows the number of accounts that are still active in the non-random treatment group.

Table 3-2: No. of Active and Inactive Accounts in Legacy Non-random Sample

Population	No. of accounts
Treatment	**39,757**
Non-random accounts	**4,864**
Inactive as of Dec 2014	**1,331**
Active	**3,533**

3,533 of the households from the non-random sample continue to receive reports and likely generate some level of savings. These households are similar to the Legacy group treatment households in the duration and start point of the HER reports they have received. It is unknown whether these household have similar household characteristics with the treatment group. Savings for the non-random sample households cannot be directly estimated because there is no control group matching the exact characteristics of these households. In the absence of such an estimate, the Legacy group's savings estimate would be the best proxy estimate of savings for this non-random sample group.

The data disposition for HER Expansion program is provided in Table 3-3. Data processing steps applied are consistent with the steps applied to the HER Legacy program. Around 13.6% of the total population moved out during the analysis period. The evaluators again applied site exclusion criteria to capture missing consumption data and other data issues resulting in removing 3% of the original population more or less equally across the treatment and control groups.

Table 3-3: HER Expansion Data Disposition

Population	Control	Treatment	Total
Original population	**35,000**	**105,000**	**140,000**
Electric only	**10,500**	**31,500**	
High users	**10,500**	**31,500**	
Non-urban	**14,000**	**42,000**	
Missing consumption data	96	306	
Move outs	4,941	14,925	
Other Data Issues (low number of data due to missing meter reads, inconsistent reads and outliers, multiple accounts in same premise, no/wrong meter units)	1,065	3,078	
Final Sample in 2014	**28,897**	**86,685**	**115,582**
Electric only	8,777	26,341	
High users	8,404	25,350	
Non-urban	11,716	34,994	

Note: Some sites may have multiple issues

One percent or less of the households in the Legacy and Expansion treatment groups have opted to not receive the reports at some point during the treatment period. Unlike attrition due to move-outs, households that opted out of the program remain in the treatment group. Removing opt-out households would undermine the similarity between the two groups that is established by the program's experimental design. This is referred to as testing the "intent to treat" and is necessary in order to produce an unbiased estimate of the reports' effect.[2]

Overall, data issues identified were minimal and should not bias the results. Data issues are equally shared between the treatment and control groups and the proportion of sites excluded in the evaluation is approximately equal between the treatment and control groups of the Legacy and Expansion programs.

Appendix 8.1 presents the test of randomization using the final samples for Legacy and Expansion programs.

[2] The randomized controlled trial design creates treatment and control groups that are similar, on average, by design. The whole purpose of using the RCT approach is that it avoids the possible negative effects of self-selection on the savings estimates. It is the RCT approach, and it's associated un-biased savings estimates, that has made it possible for HER programs to flourish across the country. Only certain kinds of households can be removed from either treatment or control groups while maintaining the validity of the RCT. The key characteristic of these removable households is that the decision to leave is not correlated with the receiving of the treatment that is being tested (in this case, the reports). For instance, occupants who leave the address where they received the reports are dropped from the analysis. It is hypothesized that the home energy reports were unlikely to have affected the moving rate among households. In fact, moving rates are statistically similar across treatment and control groups. The opt-out of households who do not want the report is, by definition, correlated with receiving the report. Removing them would change the make-up of the treatment group and would undermine the RCT. Instead, they remain in the treatment group and will affect the results much the same way as people who ignore the reports (passively opt out). Savings estimates are average savings across all treatment group households, including opt-outs. Opt-outs are also included in the treatment group counts with which total savings are calculated.

3.2.3 Joint Savings Data Disposition

Program Tracking Data

PSE provided tracking data for HER households participating in other PSE rebate programs during the HER program period. The data included measure descriptions, estimated date of install, number of units bought and claimed savings. The program tracking data were used to avoid double counting savings by adjusting measured HER savings to account for savings already accounted for in other PSE rebate programs.

Participant Survey Data

The DNV GL team utilized an email web survey to collect data used in the analysis of upstream lighting program. The email web survey was a change from the prior three annual evaluations when a telephone survey was used. Email-solicited web surveys have a number of desirable characteristics. A web survey is faster than individual telephone calls, less expensive and may make it easier for a customer to provide high quality responses because they control the time and pace of their response. In this case, the web survey had the additional appeal of offering a novel approach that had not been tried before by PSE, and would offer PSE further insight into the use of web surveys for the purpose of gathering customer information.

On the other hand, web surveys have some potential drawbacks and biases, as will any data collection method. Response rates can be low and customers with valid email address on file at PSE may not be representative of the full HER Legacy and Expansion program populations. In fact, survey selection is a major challenge for all forms of surveys including both telephone and web-based. For telephone and web-based approaches, there are two processes at work; locating the subset of customers who have either telephone number or emails that are current, and then among that subset, identifying who is willing to complete the survey either on the phone or web. There is no reason to believe that respondents on the current web survey are any less representative of the HER population than were previous phone respondents. The overall response rate for this year was slightly lower than last year's telephone survey response rate (12% compared to 13%) but the combination of ease of delivery and improved clarity of questions (particularly the use of pictures for bulb vs fixture distinctions) recommend the web survey approach for future surveys of this kind.

Table 3-4 provides counts of surveyed households and response rates for HER Legacy program.

Table 3-4: HER Legacy Survey Dispositions

Legacy	Control		Current		Suspended	
	Number	Percent	Number	Percent	Number	Percent
Starting	6,015	100%	5,260	100%	2,631	100%
Known Not Eligible	67	1%	71	1%	31	1%
Valid Sample	5,948	99%	5,189	99%	2,600	99%
Full Completes	598	10%	600	12%	286	11%
No eligible purchases	109	2%	104	2%	44	2%
No Response	5,241	88%	4,485	86%	2,270	87%

DNV GL randomly selected 13,906 HER Legacy households with email addresses to survey. Around 1% of these households were determined to be ineligible because of the following reasons: respondent or respondent's relative works at an IOU, wrong address, or respondent is unfamiliar with household's purchases of light bulbs. Of the valid sample, DNV GL completed 1,484 surveys with households that had at least one CFL, CFL fixture, LED or LED fixture purchases. We also emailed 257 respondents who indicated they did not make any CFL, CFL fixture, LED or LED fixture purchases in the last year. The survey screened out these 257 respondents, but tracked their purchase answers for use as zeroes in the upstream participation analyses. Taken together, we obtained a response rate of 13 percent, which is a typical rate for this type of survey.

Table 3-5, **Table 3-6** and Table 3-7 summarize the survey disposition for HER Expansion Electric only group, High users group and Non-urban group, respectively. DNV GL randomly selected a total of 28,653 households in the HER Expansion program. Similar to HER Legacy, around 1% of these households were not eligible for the survey. DNV GL completed a total of 2,755 surveys with households that had at least one CFL, CFL fixture, LED or LED fixture purchases and 501 households with no eligible purchases. Overall response rate for HER Expansion survey is 11 percent.

Table 3-5: HER Expansion Survey Dispositions for Electric only Group

Electric only	Control		Treatment	
	Number	Percent	Number	Percent
Starting	2,696	100%	6,015	100%
Known Not Eligible	42	2%	94	2%
Valid Sample	2,654	98%	5,921	98%
Full Completes	281	11%	598	10%
No eligible purchases	69	3%	119	2%
No Response	2,304	87%	5,204	88%

Table 3-6: HER Expansion Survey Dispositions for High users Group

High users	Control		Treatment	
	Number	Percent	Number	Percent
Starting	3,475	100%	6,015	100%
Known Not Eligible	6	0%	67	1%
Valid Sample	3,469	100%	5,948	99%
Full Completes	273	8%	535	9%
No eligible purchases	35	1%	67	1%
No Response	3,161	91%	5,346	90%

Table 3-7: HER Expansion Survey Dispositions for Non-urban Group

Non-urban	Control		Treatment	
	Number	Percent	Number	Percent
Starting	4,437	100%	6,015	100%
Known Not Eligible	37	1%	83	1%
Valid Sample	4,400	99%	5,932	99%
Full Completes	470	11%	598	10%
No eligible purchases	96	2%	115	2%
No Response	3,834	87%	5,219	88%

3.3 Survey Data Collection

The web survey was open from March 18 to April 9, 2015. The survey was split into three waves: Wave 1 included a small sample to test the web survey system (n=135), Wave 2 contained the majority of the sample provided from PSE, and Wave 3 included additional numbers for some of the larger subgroups. Wave 1 was released on March 18, 2015 with reminders two days later. On March 24th, 2015 the Wave 2 email invitations were sent out. Because of an error in the sender name of the email invitation, revised reminders were sent out on April 1, 2015 to both Waves. The survey was able to reach required responses without additional reminders and without releasing Wave 3. The surveys asked about CFL, CFL fixture, LED or LED fixture purchases in the past year. For the questions common to previous years, wording was kept as consistent as possible.

Table 3-8 provides response rates for by program for the final section of the web survey.

Table 3-8: Total Responses by Program

Treatment Groups		PSE 2014 Total Sample	Web Survey Sample	Total Responses	Response Rate (%)
Legacy	Control	29,576	6,015	707	12%
	Current	15,648	5,260	704	13%
	Suspended	7,796	2,631	330	13%
Expansion	Electric-Only Control	8,777	2,696	350	13%
	Electric-Only Treatment	26,341	6,015	717	12%
	High User Control	8,404	3,475	308	9%
	High User Treatment	25,350	6,015	602	10%
	Non-Urban Control	11,716	4,437	566	13%
	Non-Urban Treatment	34,994	6,015	713	12%

The primary goal of the online survey was to support an estimate of upstream joint savings. Screening questions were asked regarding awareness of the upstream lighting products. Respondents with no awareness of CFLs or LEDs were terminated from the survey prior to being asked the remaining HER report-related questions. The terminated results were valid zeroes for the joint savings analysis, but did not provide results for this aspect of the analysis. A total of 4,239 respondents completed the final section across all programs.

4 METHODOLOGY

This evaluation used daily household energy consumption data to estimate the reduction in energy consumption resulting from HER. This consumption reduction is the full measure of savings caused by mailing of reports and is referred to here as measured savings. Savings were estimated using a difference-in-differences approach. Measured savings were compared for the following groups:

Legacy Program

- Control vs Current and Suspended treatment groups,
- Current vs. Suspended treatment groups, and
- Monthly recipients vs. Quarterly recipients.

Expansion Program

- High users: Control vs Treatment groups,
- Non-urban: Control vs Treatment groups, and
- Electric only: Control vs Treatment groups.

The HER program has a secondary objective of promoting other energy efficiency programs within PSE. If this promotion is successful, the measured consumption reduction will include the savings from any increased uptake of these other energy efficiency programs. We refer to this as joint program savings because credit for these savings is shared by both the HER program and other PSE rebate programs.

To account for joint savings, DNV GL utilized PSE tracking data and end-use load shape data to quantify the potential for double counting of energy savings with PSE rebate programs. Also, DNV GL used the household survey to address joint savings potential due to participation in upstream CFL/LED and fixture programs, for which there is no tracking data.

Joint savings are discussed in the subsequent sections and are ultimately removed from the 2014 savings estimate to avoid double counting. The measured savings with joint savings removed will be referred to as "credited savings" in this report.[3]

4.1 Difference-in-Differences

The difference-in-differences approach is a simple, robust approach to measuring program-related savings in a randomized experimental design framework. The approach compares mean energy consumption between the pre- and post-report periods for both the treatment and the control groups.

A simple pre-post comparison of treatment group consumption, without a control group, does not account for systemic effects (economic factors, fuel prices, etc.) that impact all households' consumption patterns during the measurement periods. It is possible that these systemic effects will increase or decrease consumption in the post-report period unrelated to the effects of the reports. This would bias the estimate of consumption reduction, a particular concern when expected reduction is relatively small. The difference in consumption between pre- and post- period of the control group is unrelated to the HER program and provides a robust estimate of the non-program, systemic effects on consumption that are observed in the post-report period. Because the control group was randomly assigned, their response to the systemic effects is representative of the treatment group response. The term "difference-in-differences" refers to the removal of the control group difference (systemic effects only) from the treatment group difference (program effects and systemic effects).

The methods used for this year's evaluation were chosen to remain consistent with prior year evaluations. This explains the use of the difference-in-difference approach rather than pooled approaches that are more commonly used now. Similarly, only households that were still active at the end of the calendar year were included in the difference-in-difference calculation. This approach does not count partial year savings for households that move out during the program year.

[3] We explicitly avoid using the gross/net terminology here to avoid confusion with the more typical free-ridership/spillover usage of those terms. It is important to note that because of the experimental design framework of the HER program, free-ridership is not an issue.

A full discussion of the difference-in-differences approach can be found in Appendix 8.3.

4.2 Joint Savings Analysis

DNV GL conducted a joint savings analysis for rebate program and upstream lighting programs to assess the impact of the HER program on the uptake of other PSE programs and to avoid double counting of savings. The PSE rebate programs included purchases of energy efficient measures such as heating and cooling system, water-heating systems, insulation and appliances. The rebated measures are all tracked at the household level so it is possible to directly calculate the number installed and savings claimed for all of the treatment and control groups. The goal of the joint savings[4] analysis is to quantify savings that are included in the measured HER program savings but have already been credited to other PSE energy efficiency programs. These joint savings are deducted from the HER measured savings to avoid double counting.

4.2.1 Rebate Program Joint Savings

Energy efficiency purchases that occur directly through a Puget Sound Energy rebate programs are tracked in PSE data systems. DNV GL analyzed PSE rebate program tracking data to identify possible increased uptake of other PSE energy efficiency programs by the two treatment groups and the control group. These programs include clothes washers, energy efficient heating systems, etc. In these program tracking data systems, rebate program participation and associated savings are tied directly to the customer within the HER program treatment and control groups. The experimental design framework makes it possible to accurately measure any increased activity in programs by the HER treatment groups.

For this analysis, DNV GL added 2014 data to the compiled data on all rebated installations, for both treatment and control groups. Savings were assigned on a daily basis starting with the installation date and carrying forward to the measure life.[5] Savings are apportioned across the days of the year based on measure-level load shapes so that savings occur during the year approximately when they would be captured in the difference-in-differences calculations. For the 2014 rebate program joint savings calculation, the total accumulated savings of the control group in 2014, for all installations since the beginning of the program, is removed from the total accumulated savings of the treatment group in 2014. The difference is the effect of HER on rebate program activity. These are savings that would not occur if the HER Program was not operating. Because the savings are already being claimed by the rebate programs that facilitate the participation, this difference will be removed from the overall measured consumption reduction caused by the HER Program.

4.2.2 Upstream Program Joint Savings

DNV GL uses a similar process to estimate joint savings associated with the upstream CFL/LED bulb and fixture programs. DNV GL utilizes the survey data in place of the rebate program tracking data. The survey was conducted to gather information on the purchase and installation of CFLs and LEDs for HER program treatment and control groups for calendar year 2014. The survey gathered store-specific information

[4] Sometimes referred to as uplift in other evaluations.

[5] All measure lives are at least as long as the five years the HER Program has been in place.

associated to respondent's CFL and LED purchases (bulbs or fixtures). Data on participating retailers were used to calculate the number of purchased program CFL bulbs and fixtures.

DNV GL calculated the difference in PSE-sponsored CFLs and LEDs between the treatment and control group households to determine the average number of additional CFL or LED bulbs or fixtures per treatment household. The number of bulbs or fixtures is multiplied by the average claimed savings for bulbs or fixtures of that type to determine the amount of additional savings associated with CFLs and LEDs purchased in 2014 due to the HER program.

Table 4-1 provides the average claimed savings per bulb and fixture type. The numbers are a weighted average of the different specific bulb and fixture types in each category using the program-level counts of bulbs and fixtures claimed under PSE retail lighting programs in 2014.

Table 4-1: Weighted Average Claimed Savings per Bulb or Fixture Type

Bulb or Fixture Type	Weighted Average Claimed Savings (kWh/unit)
CFL Bulb	16.3
CFL Fixture	64.4
LED Bulb	17.0
LED Fixture	34.0

DNV GL assumed these bulbs were all installed on the first day of each program year (January 1st) and the joint savings carried forward on a load shape-weighted basis. The 2011 upstream purchase data were used as a proxy for purchases prior to 2011 before an upstream survey was conducted. It is assumed the bulbs and fixtures stay in place for the full five year measure life. The upstream joint savings are cumulative through the sixth year.

Appendix 8.4 provides the web survey instrument used to gather CFL and LED purchase and installation data for the HER program 2014.

5 IMPACT EVALUATION RESULTS

Results of the impact evaluation are provided for calendar year 2014. These results can be used to support PSE savings claims for the 2014 HER Program. Section 5.1 provides the overall actual savings achieved in calendar year 2014. The results include average household and total savings for the different treatment groups in Legacy and Expansion.

5.1 Consumption Analysis - Legacy Program

5.1.1 2014 Program Savings

Table 5-1 provides the household- and program-level savings for the HER Legacy program for calendar year 2014. These results are calculated separately for current and suspended treatment groups. The three components to estimating credited savings are the following:

- **Measured savings** is the average difference in consumption between HER treatment groups and the control group. It is calculated using a difference-in-differences approach that compares treatment and control group consumption in the pre- and post-report periods.
- **Rebate program joint savings** represents the increased activity in PSE rebate programs as a result of receiving, or having received, the report. This is the difference in PSE rebate program savings between the two PSE HER treatment groups (current and suspended) and the control group.
- **Upstream program joint savings** represents the increased use of PSE-supported CFL and LED bulbs and fixtures as a result of receiving the Home Energy Report. This is the difference in PSE upstream program savings between the two PSE HER treatment groups (current and suspended) and the control group.

Table 5-1: HER Savings per Household Based on Actual Consumption in 2014

Treatment Groups	HER Measured Savings (per household)	Joint Savings (per household)		Credited Savings (per household)
		PSE Rebate Program	Upstream Program	
Electric (kWh)				
Current	310.1 (253.2,367.1)	4.3 (-0.7,9.3)	-	305.8 (248.7,363.0)
Suspended	125.5 (50.3,200.8)	1.2 (-5.0,10.5)	8.1 (-7.2,23.3)	116.3 (39.3,193.3)
Gas (therms)				
Current	13.2 (9.9,16.6)	1.5 (0.7,2.2)	n/a	11.8 (8.4,15.2)
Suspended	10.2 (5.9,14.50)	0.4 (-0.6,2.4)	n/a	9.8 (5.4,14.2)

[1]*Values in parentheses are based on 90% confidence interval, two-tailed test.*

To estimate credited savings per households, joint savings from rebate and upstream programs were subtracted from the measured savings derived from consumption analysis. Credited savings per household may be expanded to the full population for the current and suspended groups using the final number of treatment households in

Table 3-1. The total program savings for electric and gas would be composed of savings generated by current and suspended treatment groups.

Table 5-2 summarizes the HER program results with respect to average consumption. The current treatment group produced credited savings at 3.0 and 1.6 percent for electric and gas, respectively. The suspended treatment group generated only a third as much electric savings when compared to current treatment group. This difference was statistically significant at 90% confidence level. In contrast, the suspension of treatment still generated more than three quarters of gas savings when compared to the current treatment group. The PSE HER reports for the Legacy program have consistently produced greater electric savings as a percent of consumption than gas savings. Research has not been able to definitively identify the varied sources of HER program end-use savings, but it is hypothesized that the greater number of electric end-uses and the more discretionary aspect of many electric end-uses (lighting, electronics) makes savings more feasible.[6]

Table 5-2: Credited Savings per Household as a Percent of Consumption

HER Treatment Group	Electric (kWh)			Gas (therms)		
	Consumption*	Savings	Percent	Consumption*	Savings	Percent
Current	10,299.0	305.8 (248.7,363.0)	3.0%	757.5	11.8 (8.4,15.2)	1.6%
Suspended		116.3 (39.3,193.3)	1.1%		9.8 (5.4,14.2)	1.3%

**Based on actual consumption of the control group in 2014*

5.1.2 Measured Program Savings

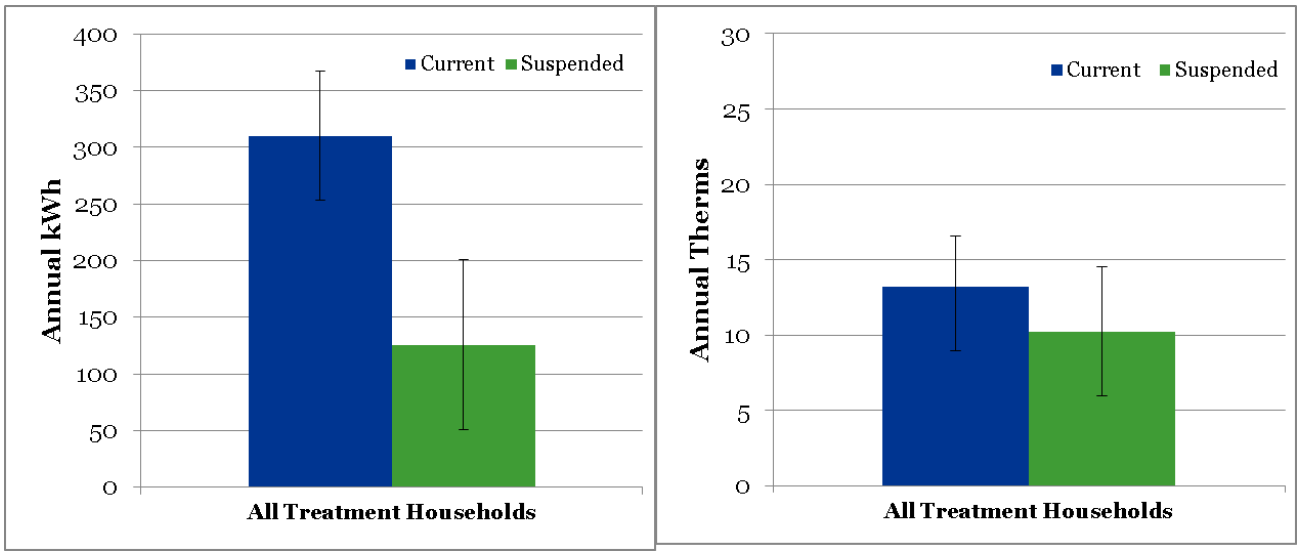
This section provides a comparison of measured electric and gas savings per household by the different treatment groups in the HER Legacy program.

Current vs Suspended Treatment Groups

Figure 5-1 summarizes the calendar year 2014 measured savings for the current and suspended treatment groups. Savings for both current and suspended report groups were significantly different from zero based on a 90% confidence interval, two-tailed test.

[6] The research indicates that small savings are spread across a wide range of end-uses. DNV GL's report 'Puget Sound Energy's Home Energy Reports Program: Three Year Impact, Behavioral and Process Evaluation' actually pointed toward water heating savings as an area with statistically significant evidence of savings actions. Other evaluations of other HER-type programs have found limited and inconsistent evidence of specific end-use savings. The RCT design allows for a highly precise estimate of the small overall savings estimate, but getting definitive estimates of the varied sources of savings within those overall savings has not been possible.

Figure 5-1: Average Annual Measured Savings for Current and Suspended Treatment Groups



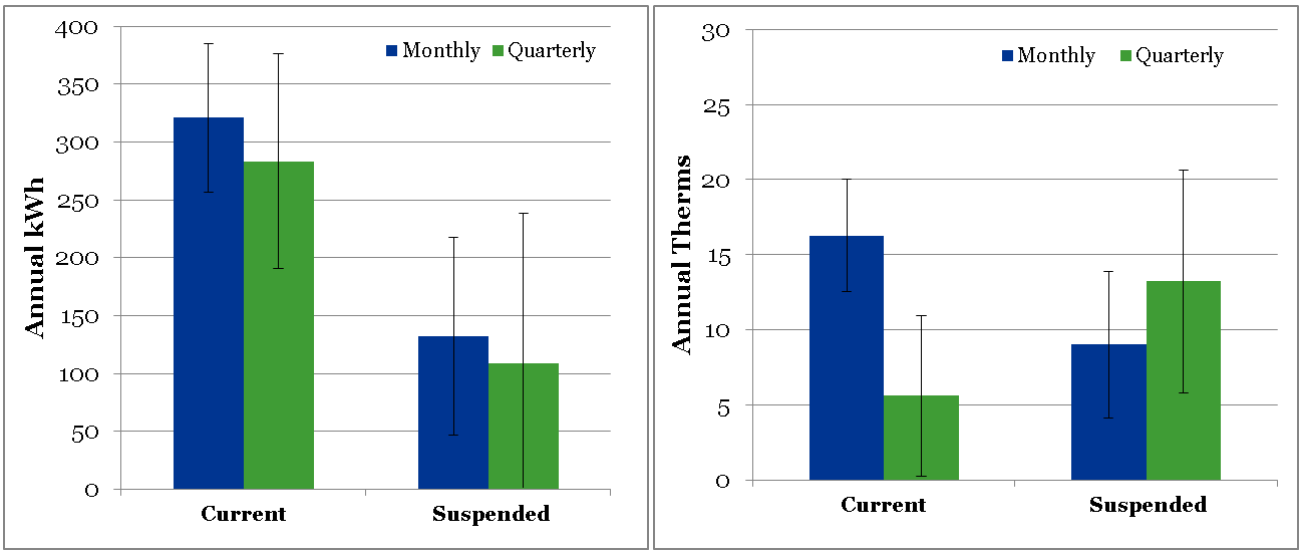
The difference in electric savings between the two groups was statistically significant at the 90% confidence level while difference in gas savings between the suspended and current treatment groups was not statistically significant. These findings are consistent with results from earlier PSE HER impact evaluation.

Monthly vs Quarterly Treatment Groups

provides the 2014 program savings for the monthly and quarterly recipients. The measured electric savings results for the current and suspended treatment groups for monthly and quarterly recipients generally conform to the expectation that monthly recipients should generate more savings than quarterly recipients. However, the difference is small and not statistically significant. Given the quarterly households only receive a third as many communications, the difference may point to the additional reports as being unnecessary.

Figure 5-2 provides the 2014 program savings for the monthly and quarterly recipients. The measured electric savings results for the current and suspended treatment groups for monthly and quarterly recipients generally conform to the expectation that monthly recipients should generate more savings than quarterly recipients. However, the difference is small and not statistically significant. Given the quarterly households only receive a third as many communications, the difference may point to the additional reports as being unnecessary.

Figure 5-2: Average Annual Measured Savings for Monthly vs Quarterly Current Recipients



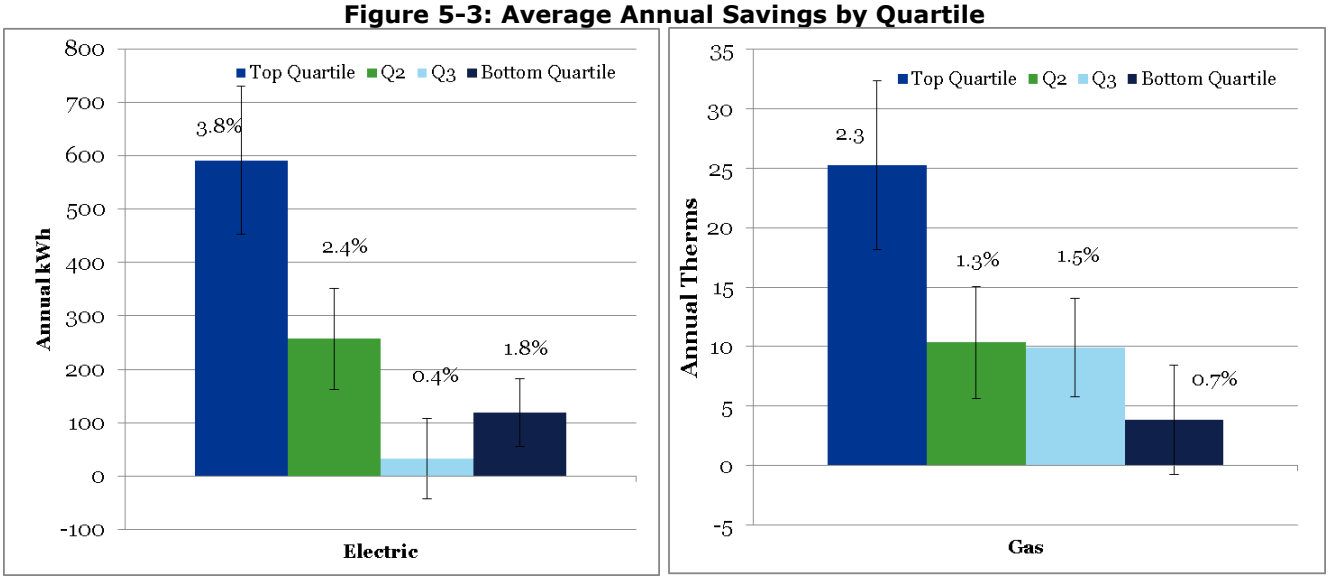
The gas savings results are harder to interpret. For the current treatment group receiving the reports quarterly, results show a statistically significant reduction in gas savings when compared to monthly recipients. This result could indicate that, in contrast to electric savings, the monthly reports are more important for maintaining a higher level of gas savings. Gas results from the suspended treatment group offer no support for this theory and make little sense. These results are not statistically significantly different and in this case the monthly savings results appear to be a statistical outlier.

Annual Savings by Consumption Quartile

This program and similar programs have found that there is a correlation between higher household consumption and higher savings. For the case of Legacy program, the savings are higher even on a percentage basis. Figure 5-3 shows the savings in energy consumption (kWh and therms) versus energy consumption for the same consumption quartiles from the control group. The top consumption quartile households save electricity at a rate of around 3.8 percent compared to an overall rate of 3.0 percent.[7] For gas, top quartile households save at a rate of 2.3 percent compared to 1.6 percent rate overall.

[7] These overall percentages are based on measured savings of the current treatment group prior to netting out double counting (Table 1)

Figure 5-3: Average Annual Savings by Quartile



In general, customers in the highest quartile generated the most savings. Similar to last year's findings, we note a trend where electric savings in the third quartile are less than the electric savings generated by the bottom quartile. While not statistically significant, this apparent trend is in contrast to earlier evaluations indicated that savings generally decreased from top to bottom quartile.

Starting from 2008, consumption across the different quartiles has decreased for both electricity and gas.

Table 5-3 provides the percentile cut-offs and the mean consumption within each quartile. For both electric and gas, the top quartile households use more than twice the energy of the bottom quartile households.

Table 5-3: Average Annual Savings by Quartile - Average Consumption and Cut-offs

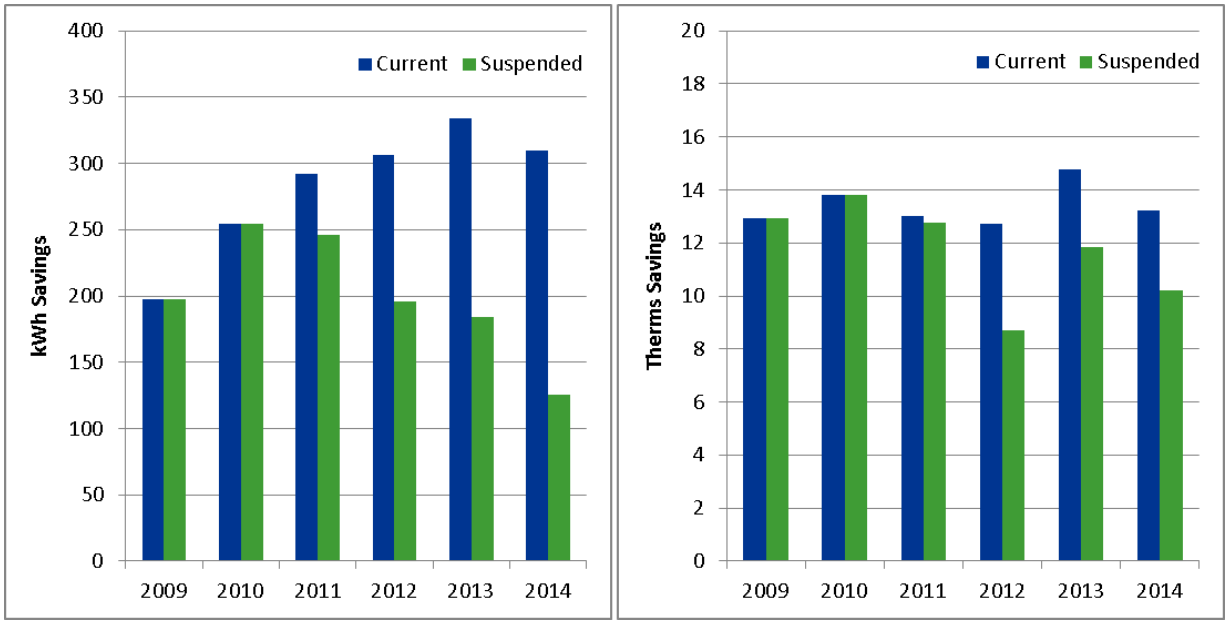
Quartile	Percentile Cut-offs	Electric		Gas	
		Lower Bound (kWh)	Quartile Mean	Lower Bound (Therms)	Quartile Mean
Top	75th Percentile	13,353	15,473	1,173	1,078
Q2	Median	10,069	10,690	959	813
Q3	25th Percentile	7,730	8,494	787	682
Bottom		-	6,532	-	527

HER Measured Savings from 2009 to 2014

The HER program generated statistically significant electric and gas savings from 2009 to 2014.

Figure 5-4 provides the historical measured savings for the HER Legacy program since the first year of inception.

Figure 5-4: HER Measured Savings for Current and Suspended Treatment Groups



The HER program also continues to generate savings from the suspended treatment group but at a reduced rate. Electric and gas savings from the suspended group decreased by 32% and 14%, respectively from 2013 to 2014. In addition, per household electric savings (126 kWh) from suspended group is 59% less than electric savings of the current treatment group in 2014 and per household gas savings (10.22 therms) is 23% less than gas savings from the continued treatment group in 2014.

Appendix 8.2 provides the historical measured savings along with the upper and lower bounds at 90% confidence interval

5.2 Consumption Analysis - Expansion Program

The Expansion program was launched in March 2014 and targeted three different groups namely Electric only, Relative High users and Non-urban groups. The analysis period covers March 2013 to February 2014 (pre period) and March 2014 to December 2014 (post period). This section presents billing analysis results for the HER Expansion program.

5.2.1 2014 Program Savings

Table 5-4 and Table 5-5 summarizes the HER program measured and credited savings for the different groups in the Expansion program. Both Electric only and High users groups produced measured and credited savings that are statistically significant at 90% confidence level. However, savings from the Non-urban group are not statistically significant except for measured electric savings.

Table 5-4: HER Savings per Household Based on Actual Consumption in 2014

Treatment Groups	HER Measured Savings (per household)	Joint Savings (per household)		Credited Savings (per household)
		PSE Rebate Programs	Upstream Programs	
Electric (kWh)				
Electric only	115.7 (43.1,188.3)	2.2 (-0.7,5.1)	9.1 (-6.8,25.0)	103.7 (29.3,178.1)
High users	86.6 (29.1,144.0)	0.1 (-1.1,1.2)	-	86.5 (29.0,144.0)
Non-urban	48.4 (9.3,87.6)	0.7 (0.0,1.4)	12.6 (-0.2,25.5)	34.9 (-6.3,76.1)
Gas (therms)				
High users	6.1 (1.9,10.3)	0.1 (0.0,0.4)	n/a	5.9 (1.7,10.2)
Non-urban	1.2 (-1.6,4.0)	0.0 (-0.1,0.1)	n/a	1.2 (-1.7,4.0)

Table 5-5: Credited Savings per Household as a Percent of Consumption

HER Treatment Group	Electric (kWh)			Gas (therms)		
	Consumption*	Savings	Percent	Consumption*	Savings	Percent
Electric only	10,727	103.7 (29.3,178.1)	1.0%	N/A	N/A	N/A
High users	9,063	86.5 (29.0,144.0)	1.0%	531	5.9 (1.7,10.2)	1.1%
Non-urban	8,144	34.9 (-6.3,76.1)	0.4%	465	1.2 (-1.7,4.0)	0.3%

**Based on actual consumption of the control group in post year 2014*

The Non-urban measured savings are well below those of the High users group and Electric only groups. The Electric only and High users groups have similar credited savings as a percentage of average consumption.

Overall, the HER Expansion program generated around 0.4% to 1.0% electric savings and 0.3% to 1.1% gas savings. All of the results for Electric only and Relative High users groups are statistically significant while the Non-urban results are mixed. The Non-urban measured electric savings were statistically significant but the unexpectedly high upstream joint savings reduced the credited savings by about one-third to a level that is no longer statistically significant. The reduced electric credited savings from Non-urban group should still count toward savings because these savings became only non-significant after applying adjustments in upstream joint savings which is relatively less reliable than the rebate program joint savings.

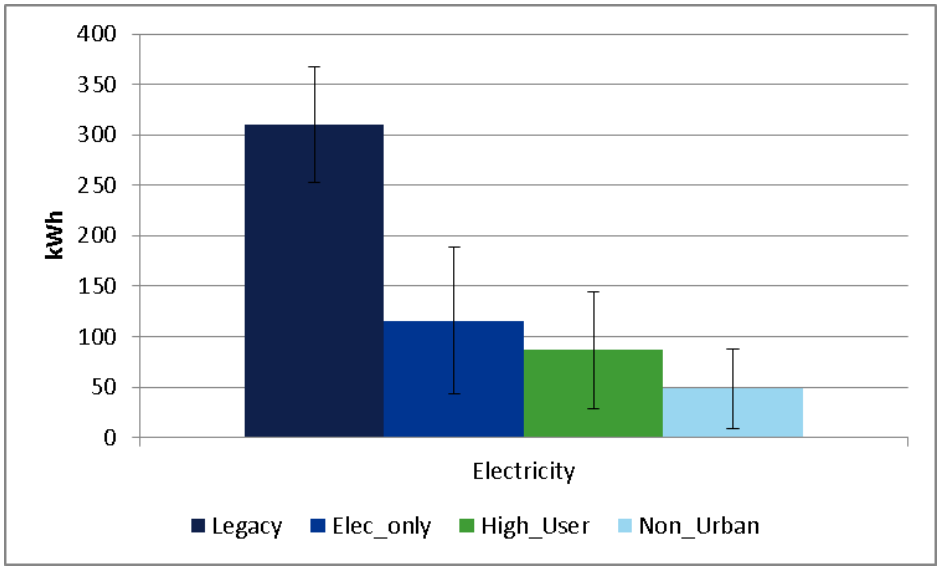
5.2.2 Measured Savings

This section provides a comparison of measured electric and gas savings per household between the Expansion groups and Legacy program.

Electric Savings

Figure 5-5 presents a comparison of measured electric savings of the three different Expansion groups relative to the measured savings of Legacy group that still receives reports. Legacy group savings represent a full year of savings for a mature program. The Expansion groups just started receiving the reports and savings are only for a partial year (March 2014 to December 2014). As documented in most HER evaluations for PSE and other programs, the first year HER savings are generally lower than savings generated in the subsequent years. From a percentage perspective, the measured electric savings for the Legacy group are 3% of consumption, while the Electric only, High users and Non-urban groups are 1.1%, 1.0% and 0.6% respectively.

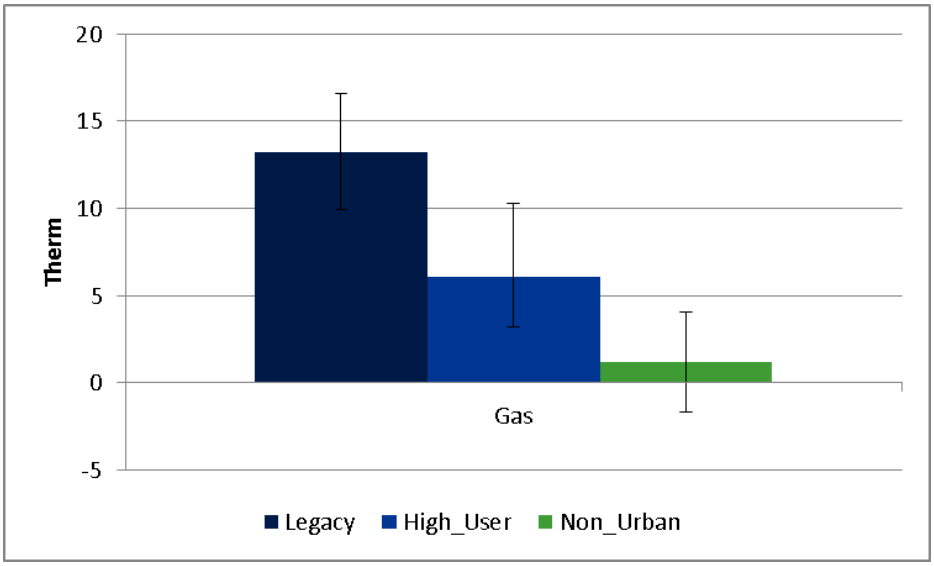
Figure 5-5: Comparison of Measured Electric Savings across Legacy and Expansion Groups



Gas Savings

Figure 5-6 presents a comparison of gas savings of the two Expansion groups relative to the Legacy savings. Again, similar to the findings for electric savings, gas savings from the two Expansion groups are less than the savings for the Legacy participants. From a percentage perspective, the measured gas savings for the Legacy group are 1.7% of consumption, while the High users and Non-urban groups are 0.7% and 0.2%, respectively.

Figure 5-6: Comparison of Measured Gas Savings across Legacy and Expansion Groups



Among the Expansion groups, the Electric only group has the highest measured electric savings on both magnitude and percentage basis. However, customers in the High user and Non-urban groups generate not only electric but also gas savings. Taking into consideration both electric and gas savings, High users have higher combined percentage savings, 1.7%, than the percentage savings generated by Electric only group. The two dual fuel findings, High user and Non-urban, are consistent with the results in quartile analysis in Section 5.1.2 where savings percentages generally increase with higher consumption. However, at this early point of the program, the evidence does not point to that being the case more generally with the high-consuming Electric only group.

5.3 Joint Savings Analysis

This section presents the results of the rebate program and upstream lighting joint savings analysis for the different treatment groups in HER Legacy and Expansion programs.

5.3.1 Rebate Program Joint Savings

Table 5-6 presents the PSE rebate program joint savings analysis for current and suspended treatment groups across all HER post-treatment years for the HER Legacy program. Joint savings are cumulative and last for the life of the measure. Only measures with remaining useful life should be considered when calculating joint savings. None of the electric savings were significant at the 90% level, while several of the gas joint savings were found significant at 90% confidence level.

Table 5-6: Annual Joint Rebate Savings per Household for Electric and Gas, Current and Suspended Groups, HER Legacy

Fuel	Year	HER Groups			Joint Rebate Savings per household			
		Control	Current	Suspended	Current	+/-	Suspended	+/-
Electric (kWh)	2009	3.8	4.1	4.6	0.3 (-0.7,1.3)	1.0	0.8 (-0.6,2.2)	1.4
	2010	14.1	15.3	15.7	1.2 (-1.5,4.0)	2.8	1.6 (-2.1,5.4)	3.8
	2011	25.8	25.6	27.4	-0.2 (-3.5,3.1)	3.3	1.5 (-3.1,6.2)	4.6
	2012	40.9	41.5	41.6	0.6 (-3.4,4.5)	3.9	0.7 (-4.6,5.9)	5.2
	2013	53.2	54.7	52.4	1.5 (-2.8,5.9)	4.4	-0.8 (-6.4,4.8)	5.6
	2014	68.5	72.7	69.7	4.3 (-0.7,9.3)	5.0	1.2 (-5.0,7.4)	6.2
Gas (Therms)	2009	1.2	1.5	1.4	0.3* (0.1,0.5)	0.2	0.2* (0.0,0.4)	0.2
	2010	4.8	5.6	5.5	0.8* (0.4,1.2)	0.4	0.7* (0.1,1.2)	0.6
	2011	8.0	9.1	8.8	1.1* (0.5,1.6)	0.6	0.8* (0.1,1.6)	0.8
	2012	10.1	11.3	10.6	1.2* (0.6,1.9)	0.7	0.5 (-0.3,1.4)	0.8
	2013	11.5	12.8	12.0	1.3* (0.6,2.0)	0.7	0.5 (-0.4,1.3)	0.9
	2014	13.5	15.0	13.9	1.5* (0.7,2.2)	0.8	0.4 (-0.6,1.3)	0.9

**Indicates statistically significant at 90% confidence level*

Table 5-7 presents the PSE rebate program joint savings analysis for the different HER Expansion groups in 2014. Based on the results, electric joint savings were not statistically significant except for the Non-urban group while gas savings were statistically significant only for the High user group.

Table 5-7: Annual Joint Rebate Savings per Household for Electric and Gas, HER Expansion

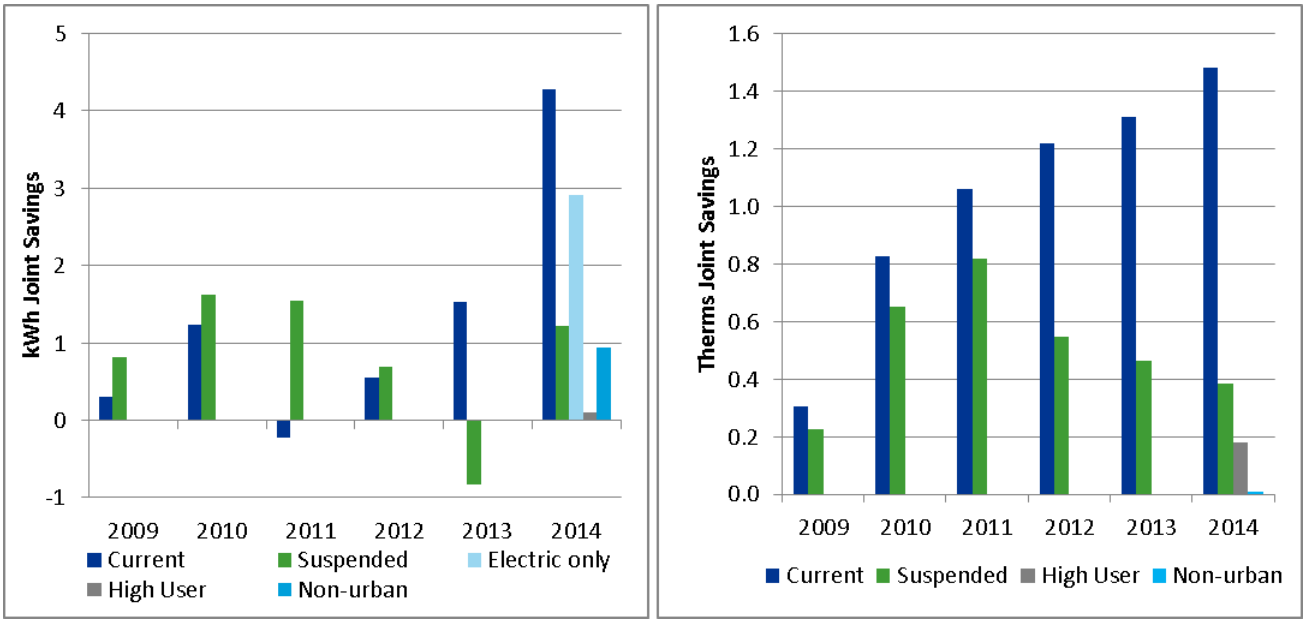
Fuel	Group	HER Groups		Joint Rebate Savings per household	
		Control	Treatment	Savings	+/-
Electric (kWh)	Electric only	22.6	25.5	2.9 (-1.0,6.8)	3.9
	High users	6.5	6.6	0.1 (-1.4,1.6)	1.5
	Non-urban	5.2	6.1	0.9 (0.0,1.9)*	0.9
Gas (Therms)	High users	0.7	0.9	0.2 (0.0,0.3)*	0.2
	Non-urban	0.5	0.5	0.0 (-0.1,0.1)	0.1

**Indicates statistically significant at 90% confidence level*

Figure 5-7 provides a historical rebate joint savings per household for Legacy and Expansion groups. Electric joint savings have always been relatively small and not statistically significant for the Legacy group. In comparing joint savings between the Legacy and Expansion groups, results show that Expansion groups already have some different characteristics and may prove to be quite different over time. The Electric only

households from both treatment and control are participating in rebate programs at a relatively high level. Control group electric rebate savings after only 9 months are close to second year levels for the Legacy group. In addition, the 2.9 kWh estimated joint savings for the Electric only group, though not statistically significant, is bigger than the Legacy joint savings estimates through 2013. In other words, the Legacy group has taken six years to accumulate as much HER program effect in rebate program activity as the Electric only group accumulated in 9 months.

Figure 5-7: Annual Joint Rebate Savings per Household for Legacy and Expansion Groups, 2009-2014



The other unusual result is the statistically significant joint electric savings for the Non-urban group. This is the first statistically significant electric joint savings ever measured in the PSE HER program. The mean treatment and control savings estimates and the joint rebate savings per households for Non-urban are all smaller than the Electric only joint savings, but the joint savings estimate from Non-urban is statistically significant. This finding indicates wider adoption of smaller savings measures across the Non-urban treatment and control groups.

5.3.2 Upstream Program Joint Savings

The upstream joint savings measures the effect of the HER program on reduced-price retail sales of CFL and LED bulbs and fixtures. LED bulbs and fixtures were included in the estimated upstream joint savings for the first time in 2013 evaluation.[8]

Table 5-8 provides the number of CFL and LED bulbs and fixture purchases for the control, current treatment and suspended treatment groups in 2014 HER Legacy program.

[8] LED sales prior to 2013 were small. They were not included in the 2012 upstream survey.

Table 5-8: Count of CFL and LED Bulbs and Fixture Purchased per Household in 2014

Upstream Lighting Measures	HER Groups		
	Control	Current	Suspended
CFL Bulbs	4.2	4.2	3.7
CFL Fixtures	0.3	0.2	0.1
LED Bulbs	3.7	3.4	4.0
LED Fixtures	0.3	0.4	0.4

The survey work indicates that the household across all groups purchased an average of over three LED bulbs. LED purchases remains slightly below CFL levels in 2014. Also, there was no consistent evidence that the HER reports increased the uptake of reduced-price LED bulbs or fixtures.

Table 5-9 provides the joint rebate counts per household for the current and suspended treatment groups. Joint rebate counts per household measures the increased uptake in upstream lighting due to HER and are calculated as the difference in CFL and LED purchases between the treatment group and control group. To estimate upstream savings, the joint rebate counts per household for each lighting measure are multiplied by the corresponding average bulb savings. There was almost no difference in the purchase of upstream program-supported CFLs or LEDs due to the HER program. Overall, results show that total upstream lighting purchases of the control group is higher than the treatment groups.

Table 5-9: Savings from CFL and LED Bulbs and Fixture Purchased per Household in 2014

Upstream Lighting Measures	Joint Rebate Counts per household[1]		Weighted Average Deemed Savings (kWh per unit)	Current Group Upstream Savings	Suspended Group Upstream Savings
	Current	Suspended			
CFL Bulbs	0.0 (-0.6,0.5)	-0.5 (-1.1,0.1)	16.3	-0.8	-8.5
CFL Fixtures	-0.1 (-0.2,0.1)	-0.2 (-0.3,0.0)	64.4	-5.3	-9.8
LED Bulbs	-0.3 (-0.9,0.2)	0.3 (-0.5,1.0)	17.0	-5.9	4.4
LED Fixtures	0.1 (-0.1,0.2)	0.1 (-0.1,0.4)	34.0	2.0	4.2
Purchased CFL Saving				-6.1	-18.3
Purchased LED Savings				-3.9	8.6
Total Upstream Lighting Savings				-9.9	-9.7

[1]*Not statistically significant at 90% confidence level*

The small and negative joint savings indicate that in this year the program did not increase uptake of the upstream program offerings with any kind of discernable pattern. A negative savings result means that, during this period, treatment household installed fewer bulbs than the control group. This would be

consistent with HER programs initially causing an acceleration of such installations in early years with an eventual return to equilibrium. Both positive and negative results are integrated into the cumulative calculations of upstream joint savings weighted by bulb-type savings. The individual and combined joint savings results are not statistically significant.

Table 5-10 provides the estimates of the annual joint savings from CFL and LED bulbs and fixture purchases across all post years. Each year is additive on the prior year until year six when the first year savings drop out because the measure life for CFLs was 5 years.

Table 5-10: Annual Joint Upstream Savings per Household for Current and Suspended Treatment Groups

Program Year	Treatment Group	
	Current	Suspended
Year 1*	0.86	
Year 2	1.59	
Year 3	2.32	15.26
Year 4	5.47	10.49
Year 5**	7.32	17.99
Year 6**	-3.26	8.05

**Includes last two months of 2008*
***Includes LEDs*

In the case of current treatment group where joint savings are negative, no upstream savings deductions will be made to measured electric savings. In prior years, it has been the practice for the PSE HER evaluation to remove positive upstream joint savings from measured savings, despite being non-statistically significant, as they provide some evidence of possible double counting. Now that cumulative upstream joint savings for the current treatment group have become negative, they will not be added to measured savings to increase the overall savings. Despite the possibility that a negative joint savings could, in fact, be a true representation of an accelerated adoption process, in this direction careful avoidance of double counting argues for not increasing the credited savings without full statistically significant evidence.

The joint savings analysis was used to provide an estimate of credited savings for PSE HER. Combining both rebate and upstream joint savings, the current treatment group shared around 4.3 kWh and 1.5 therms savings per household between HER and other PSE programs. For the suspended group, HER and other PSE programs share 9.3 kWh and 0.4 therms savings per household. These joint savings were deducted from the HER measured savings to avoid double counting of savings with other PSE programs. The HER Legacy credited savings for 2014 were based on savings with these joint program savings netted out.

Upstream joint savings were also calculated for the three groups in the HER Expansion program. Table 5-11 presents the number of CFL and LED bulbs and fixture purchases for the Expansion control and treatment groups in 2014. Similar to Legacy findings, LED purchases remain below CFL levels for all Expansion groups. The average number of LEDs purchased per household is a little over half the average of CFL purchase per household across all groups. In contrast to findings in for the Legacy groups, the total number of CFL and LED purchased by the treatment group is higher than the total number of upstream lighting purchased by the control group except for the High users group.

Table 5-11: Count of CFL and LED Bulbs and Fixture Purchased per Household in 2014, HER Expansion

Upstream Lighting Measures	Electric only		High users		Non-urban	
	Control	Treatment	Control	Treatment	Control	Treatment
CFL Bulbs	3.9	4.1	4.8	4.2	4.4	4.5
CFL Fixtures	0.1	0.2	0.1	0.1	0.1	0.2
LED Bulbs	2.4	2.6	3.0	3.1	2.4	2.8
LED Fixtures	0.3	0.2	0.4	0.3	0.2	0.3

Table 5-12 provides the joint rebate counts per household for the different Expansion groups. There was almost no difference in the purchase of upstream program-supported CFLs or LEDs due to the HER program. Overall, results show that total upstream lighting purchases of the treatment group are higher than the control groups for Electric only and Non-urban while the reverse is observed for High users.

Table 5-12: Savings per Household from CFL and LED Purchases in 2014, HER Expansion

Upstream Lighting Measures	Joint Rebate Counts per household[1]			Bulb type savings[2]	Upstream Savings		
	Electric only	High users	Non-urban		Electric only	High user	Non-urban
CFL Bulbs	0.2 (-0.5,0.8)	-0.7 (-1.4,0.1)	0.1 (-0.5,0.7)	13.7	2.3	-9.0	1.9
CFL Fixtures	0.1 (0.0,0.2)	-0.1 (-0.2,0.0)	0.0 (-0.1,0.1)	54.0	4.2	-3.5	1.9
LED Bulbs	0.2 (-0.5,1.0)	0.1 (-0.6,0.8)	0.4 (-0.1,0.9)	14.2	3.5	1.8	5.6
LED Fixtures	0.0 (-0.2,0.2)	-0.1 (-0.4,0.2)	0.1 (-0.1,0.3)	28.5	-0.9	-2.1	3.2
Purchased CFL Saving					6.5	-12.5	3.8
Purchased LED Savings					2.6	-0.3	8.9
Total Upstream Lighting Savings					9.1	-12.8	12.6

[1] *All joint rebate counts per household are not statistically significant at 90% confidence level*
[2] *Average bulb saving are scaled by 306/365 to only reflect savings during the Expansion post period, March to December 2014.*

Table 5-13 provides the estimates of the annual joint savings from CFL and LED bulbs and fixture purchases in 2014. Joint savings between HER program and upstream programs amounted to 9.1 kWh, -12.8 kWh and 12.6 kWh for Electric only, High users and Non-urban groups, respectively. Because High users upstream savings are negative, only measured savings for the Electric only and Non-urban groups will be adjusted with upstream savings to avoid double counting. Measured savings are adjusted with joint savings despite statistical significance to provide the most conservative savings estimates that are free of potentially double counted savings.

Table 5-13: Annual Joint Upstream kWh Savings per Household for HER Expansion

Program Year	Treatment Group		
	Electric only	High user	Non-urban
Year 1	9.1	-12.8	12.6

5.4 2014 Total Program Savings

Table 5-14 and Table 5-15 provide the wave-level and overall electric and gas credited savings estimates, respectively. The overall electric savings are estimated at 90/25 precision and the gas savings are estimated at 9/35 precision. The overall precision levels justify claiming savings for all waves despite the fact that one expansion wave was not yet individually statistically significant for this evaluation. Overall, the Legacy program Current and Suspended groups together generated around 5.7 GWh and 261 thousand therms while the Expansion program generated around 6.1 GWh and 191 thousand therms. Overall, PSE HER program produced 11.8 GWh and 452 thousand therms savings in 2014.

Table 5-14: Total Credited Electric Savings for 2014 HER Programs

HER Treatment Group	Electric (kWh)				
	Per Household	# Households with Reports	Total Savings	Lower Limit 90% CI	Upper Limit 90% CI
Legacy - Current	305.8	15,648	4,785,860	3,894,729	5,676,991
Legacy - Suspended	116.3	7,796	906,507	320,019	1,492,995
Expansion - Electric only	103.7	26,341	2,731,692	818,830	4,644,555
Expansion - High Users	86.5	25,350	2,192,021	734,872	3,649,171
Expansion - Non Urban	34.9	34,994	1,220,729[ns]	-148,914	2,590,372
ALL	107.5	110,129	11,836,810	8,870,949	14,802,671

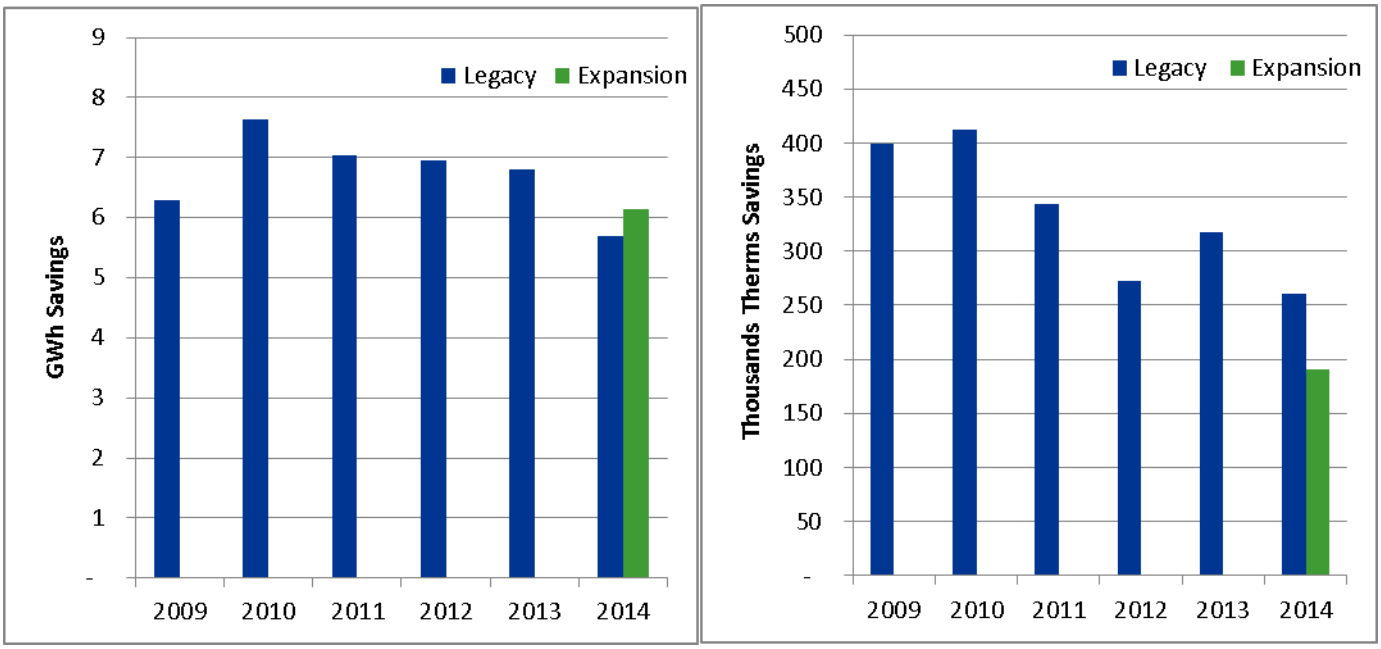
Table 5-15: Total Credited Gas Savings for 2014 HER Programs

HER Treatment Group	Gas (therms)				
	Per Household	# Households with Reports	Total Savings	Lower Limit 90% CI	Upper Limit 90% CI
Legacy - Current	11.8	15,648	184,040	132,098	235,982
Legacy - Suspended	9.8	7,796	76,680	43,284	110,076
Expansion - Electric only					
Expansion - High Users	5.9	25,350	149,680	42,978	256,382
Expansion - Non Urban	1.2	34,994	41,459[ns]	-57,886	140,803
ALL	5.4	83,788	451,859	293,530	610,187

[ns] means not statistically significant at 90% confidence level

Figure 5-8 provides the total credited program savings for the HER Legacy and Expansion program from 2009 to 2014. Total program savings for electric started to decline in 2011 despite increasing per household savings rate from 2009 to 2013. Similarly, total program savings for gas were at its peak in 2010 and started declining in 2011. The decrease in total savings over the years is expected for this kind of program due to customer attrition. In 2014, total program electric savings from Legacy were 9% below first year savings while gas savings were 35% below first year savings. As the Expansion groups start ramping up savings, the addition of the three HER Expansion groups will compensate for the diminishing savings from the HER Legacy program.

Figure 5-8: Total Program Credited Savings from 2011 to 2014



6 SURVEY RESULTS

This section presents the analysis of the final part of the web survey that included six questions on awareness, experience, and satisfaction with PSE programs. These questions were included at PSE's request in order to collect additional information to compare with other data collection initiatives.

The HER program randomized controlled trial experimental design is designed to highlight report-related changes in a particularly accurate fashion. This is true of the impact estimates and is also true for survey questions. To assess the impact of the reports, we look at the difference between treatment and control within the different groups – the Legacy group, with two different levels of treatment, and the three expansion groups. The control group represents the background response level, while any statistically

significant deviation from that level is explained by the report. All statistically significant survey results are at the 90% confidence level.[9]

The background response levels may be of interest to PSE and therefore are included in the following analysis. These generally differ across the four HER program groups. The defining characteristics of each group, such as High user or Non-urban, mean that inter-groups have different demographic characteristics (unlike intragroup comparisons between treatment and control subsets in the same group where demographic differences are non-significant because of RCT) and in turn may have quite different answers to survey questions.[10] For this analysis, we can note where these inter-group differences are statistically significant. These results are not specifically related to the report and the implications of these differences across groups are primarily outside of the scope of this analysis.

A final perspective compares report-related effects across the different groups. This goes beyond the first question, "Is there a convincing effect from the reports?" and asks "Is the report effect different for different groups?" This question is particularly interesting when comparing the Legacy group to the Expansion group. The Legacy group is in its sixth year, while the Expansion surveys were completed before a full year of reports. When looking at the consumption impacts, we look at the level achieved as well as the persistence of those savings, with and without reports. We take a similar perspective with the survey results.

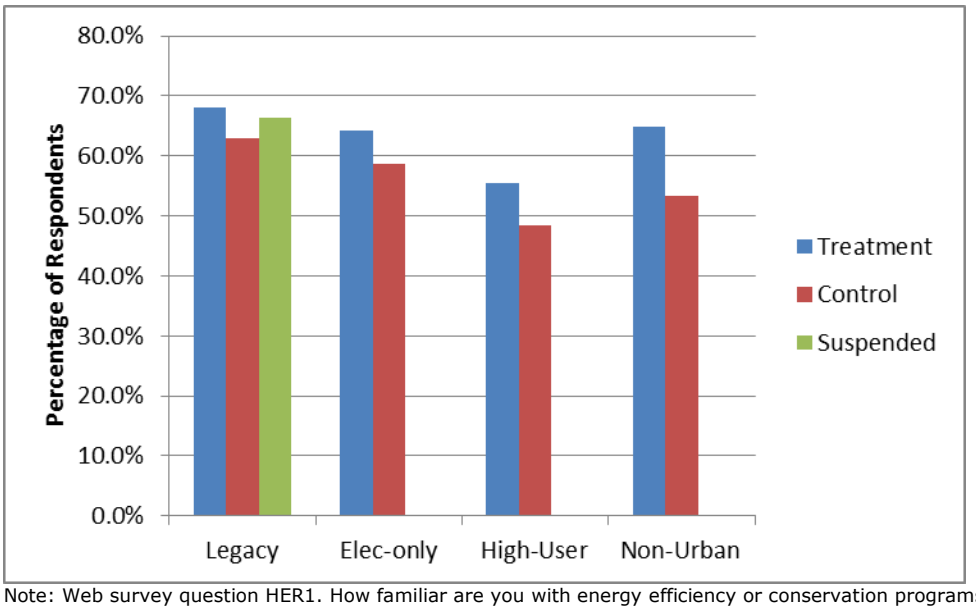
6.1 Familiarity with PSE Efficiency Programs

The survey asked respondents to rate how familiar they were with energy efficiency or conservation programs from Puget Sound Energy (on a scale of 1 - "Not at all familiar" to 4 - "Very Familiar"). The questions were asked of both treatment and control groups for all HER waves. Figure 6-1 provides a bar graph of the combined "Somewhat" and "Very" familiar responses for all waves.

[9] When looking at estimated values, it is essential to determine with what confidence one can believe those values given the underlying variation in the data. Generally, an estimate has an associated confidence interval that indicates that we are, for instance, 90% confident the true answer is within that interval. When we say an estimate is not statistically significant (or more specifically not statistically significantly different than zero) we are saying that the confidence interval includes zero. This indicates that we cannot be 90% confident that the estimate is not zero. We use the same approach for measuring whether the difference between two values should be considered real or just a possible random outcome. Two estimates may appear to be different, or the difference is greater than zero, but given the underlying variation in the data, we may not be able to say with 90% confidence that the true underlying difference is not zero.

[10] Inter-group (High user, Non-urban etc.) have different demographic characteristics because the groups were created based on meaningful differences, unlike intragroup or sub-group comparisons between treatment and control subsets in the same group where demographic differences are non-significant because of RCT.

Figure 6-1: Somewhat or Very Familiar with Puget Sound Energy Efficiency Programs, All Waves



Note: Web survey question HER1. How familiar are you with energy efficiency or conservation programs from Puget Sound Energy to help you with ways to use less energy and lower your bill?

The control group results provide the baseline level of familiarity with other PSE energy efficiency programs within the different HER waves. The levels vary from just below 50% for the High users to just above 60% for the Legacy wave. These differences are solely due to the make-up of the populations in each of these waves. For instance, Legacy wave customers have been in their present location since late 2007. Their average time in PSE service territory is probably higher than any of the newer groups which include customers who have only been in territory for just two years.

All four waves show an increase in familiarity with PSE energy efficiency programs due to the Home Energy Reports. The report-related increases for the treatment groups relative to the control groups range from 5.1% to 11.5%. All differences are statistically significantly different from their respective control groups at the 90% confidence level except for the Electric-only group. These results strongly support the hypothesis that HER reports increase familiarity with PSE energy efficiency programs. The inconclusive result for the Electric Only group does not imply there was no effect, only that the effect was too small to measure with statistical confidence.

The results for the Suspended group indicate that this increased familiarity does not last after HER reports are suspended. The Suspended group percentage is no longer statistically significantly different than the Legacy control group.

Table 6-1 compares all of the results in **Error! Reference source not found.** Figure 6-1 and indicates whether each comparison is statistically significantly different from zero. The values in the third column are the percentages represented in Figure 6-1. The same values are repeated across the top. The intersection of the columns and rows give the difference (column results minus top row result) while the dark shading indicates that the result is statistically significant. For instance, the intersection of Legacy treatment with Legacy control shows a difference of 5.1% (or -5.1%) and that difference is statistically significant at 90% confidence. The cells with heavy outlines contain the results that measure the increase in familiarity due to the reports.

Table 6-1: Results Comparisons and Statistical Significance

			Legacy			Elec-only		High user		Non-Urban	
			T	C	S	T	C	T	C	T	C
			68.2%	63.0%	66.4%	64.2%	58.7%	55.5%	48.4%	64.9%	53.4%
Legacy	Treatment	68.2%		5.1%	1.7%	4.0%	9.4%	12.7%	19.8%	3.3%	14.8%
	Control	63.0%	-5.1%		-3.4%	-1.2%	4.3%	7.5%	14.7%	-1.8%	9.6%
	Suspended	66.4%	-1.7%	3.4%		2.2%	7.7%	10.9%	18.1%	1.6%	13.0%
Elec-only	Treatment	64.2%	-4.0%	1.2%	-2.2%		5.5%	8.7%	15.9%	-0.7%	10.8%
	Control	58.7%	-9.4%	-4.3%	-7.7%	-5.5%		3.2%	10.4%	-6.2%	5.3%
High user	Treatment	55.5%	-12.7%	-7.5%	-10.9%	-8.7%	-3.2%		7.2%	-9.4%	2.1%
	Control	48.4%	-19.8%	-14.7%	-18.1%	-15.9%	-10.4%	-7.2%		-16.5%	-5.1%
Non-Urban	Treatment	64.9%	-3.3%	1.8%	-1.6%	0.7%	6.2%	9.4%	16.5%		11.5%
	Control	53.4%	-14.8%	-9.6%	-13.0%	-10.8%	-5.3%	-2.1%	5.1%	-11.5%	

We considered the familiarity results for "Somewhat" and "Very" familiar separately as well. The increased familiarity for the Non-Urban group is driven by respondents saying they were "Somewhat" familiar. The increased familiarity for the Legacy and High user groups is driven by respondents saying they were "Very" familiar.

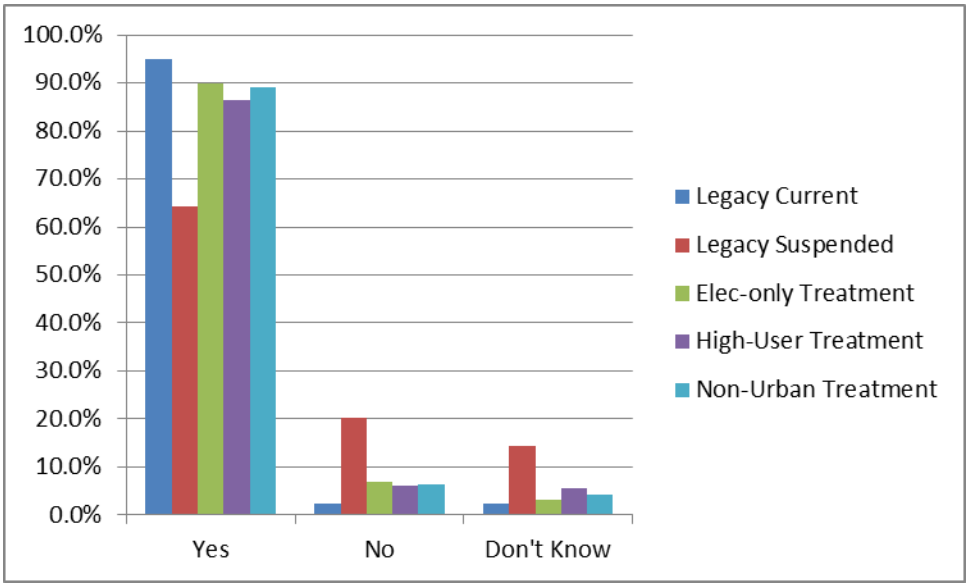
Given that there is evidence that the reports do increase familiarity with PSE energy efficiency programs, it is interesting to compare that increase across the four groups. The Legacy treatment group's increase in familiarity with PSE programs is actually smaller than either the High user or the Non-Urban groups' increases despite the substantial number of years the Legacy group has been receiving the reports. Given the longevity of the Legacy program, it could be reasonable to expect a report effect that was both greater than the newer expansion groups and statistically significant. Therefore, the small magnitude of the Legacy report effect is noteworthy. This result implies that additional reports do not necessarily continue to increase awareness in a group. On the other hand, the suspended group result appears to indicate that without ongoing reports, awareness will revert to background levels.

6.2 Receiving the Home Energy Report

All respondents, from both treatment and control groups, were asked whether their household received a Home Energy Report. As expected, the majority of treatment respondents stated that they did receive the Home Energy Report. A small proportion of the control groups (8% - 13% across programs) responded that they also received the Home Energy Report. This is a useful check to show the variability in respondents' memory.

Figure 6-2 provides awareness of the Home energy report by different treatment groups. At least 86% of the households in the current treatment groups said that they had received a report. In this case, the longevity of the Legacy program makes a slight difference. Around 95% of current Legacy treatment households said yes, and this is statistically significantly different than all of the Expansion group results. For the suspended Legacy treatment group, the four year break from reports has reduced substantially the number of households that remember receiving reports. This confusion is echoed in the high level of "Don't Know" answers for this group.

Figure 6-2: Awareness of the Home Energy Report

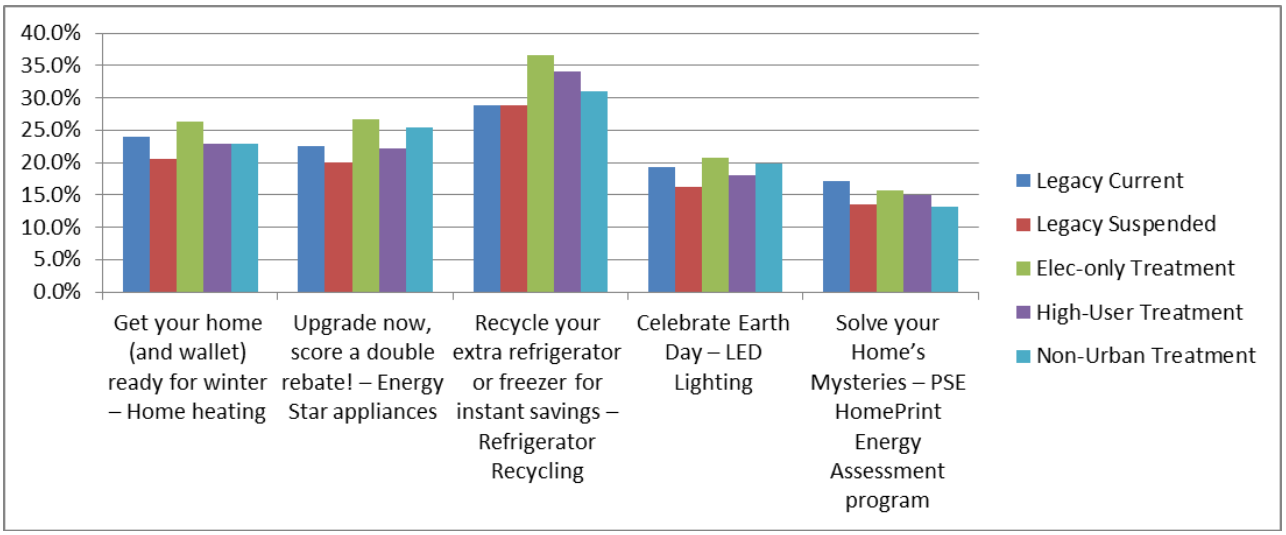


Note: Has your household received a Home Energy Report listing your home's energy use and comparing it with similar homes in the area?

6.3 Recognizing Specific Messages

PSE staff expressed interest in understanding if specific advertising messages were remembered by those customers receiving Home Energy Reports. The direct way to assess this awareness is to look at customers who both said they received reports and did actually receive reports. Figure 6-3 provides the percentage of message-aware customers out of these report-aware recipients. The results show some differentiation across the five messages. Refrigerator recycling is clearly the most remembered program across all treatment groups, while HomePrint is at the opposite extreme. The recentness and frequency of these messages may be one of the drivers of the differentiation. In addition, while the question is specifically seeking memory of these programs as they appeared in the Home Energy reports, it is difficult to disentangle this memory from general awareness. In fact, general awareness is likely to be an important factor in reported memory of the specific instances of the messaging in the reports.

Figure 6-3: Message Awareness across Groups



Note: Web survey question: Do you remember seeing any of the following advertisements or messages in your Home Energy Report? [Check all that apply]
a. Get your home (and wallet) ready for winter – Home heating
b. Upgrade now, score a double rebate! – Energy Star appliances
c. Recycle your extra refrigerator or freezer for instant savings – Refrigerator Recycling
d. Celebrate Earth Day – LED Lighting
e. Solve your Home's Mysteries – PSE HomePrint Energy Assessment program

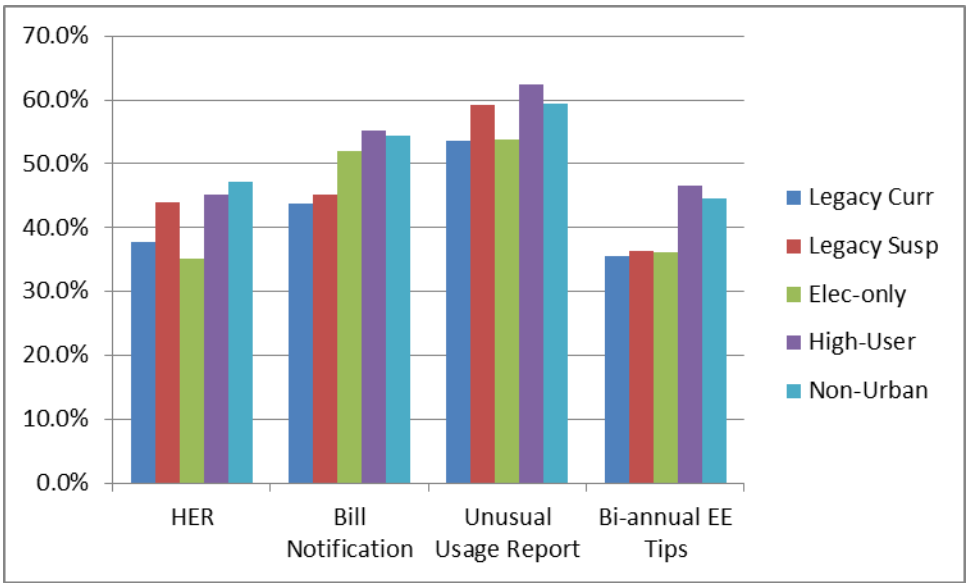
Comparing different levels of awareness within each message across the different HER groups results in a couple of findings. First, the long-term exposure of the current Legacy group has had a limited positive effect on Legacy group awareness of any these messages. Compared to the three Expansion groups, the only statistically significant result is for refrigerator recycling where Legacy group reported less awareness of the message than all of the Expansion groups. Second, the more distant exposure to these messages of the suspended Legacy group has not diminished their awareness substantially. The suspended Legacy group is lower across the board, but like the current Legacy group, the only statistically significant result is for refrigerator recycling where it is smaller than all of the Expansion groups individually. For all other messages, the suspended Legacy level of awareness is not statistically distinguishable more than one of the other groups.

Finally, the Electric-Only group has the highest awareness for each of the messages. This result is not statistically significant for any individual message but is consistent across all five messages.

6.4 Interest in Email Notifications

Current treatment sub-group respondents who acknowledged that they received a Home Energy Report were also asked to provide feedback on the preferred methods of receiving the report and other notifications. They were asked to rate their interest on a seven-point scale where 1 is Very uninterested and 7 is Very interested in receiving the Home Energy Reports, email notifications for bills, unusual increase in energy usage, and bi-annual tips about making a home more energy efficiency. Figure 6-4 shows the proportion of respondents across all groups who rated their interest high or very high (at a 6 or 7 out of a 7 point scale). The notification level results indicate that unusual usage reports have the highest degree of interest while the bi-annual energy efficiency tips have the lowest interest, just below the interest level in receiving the HER by email.

Figure 6-4: Interest in Email Notification across Programs



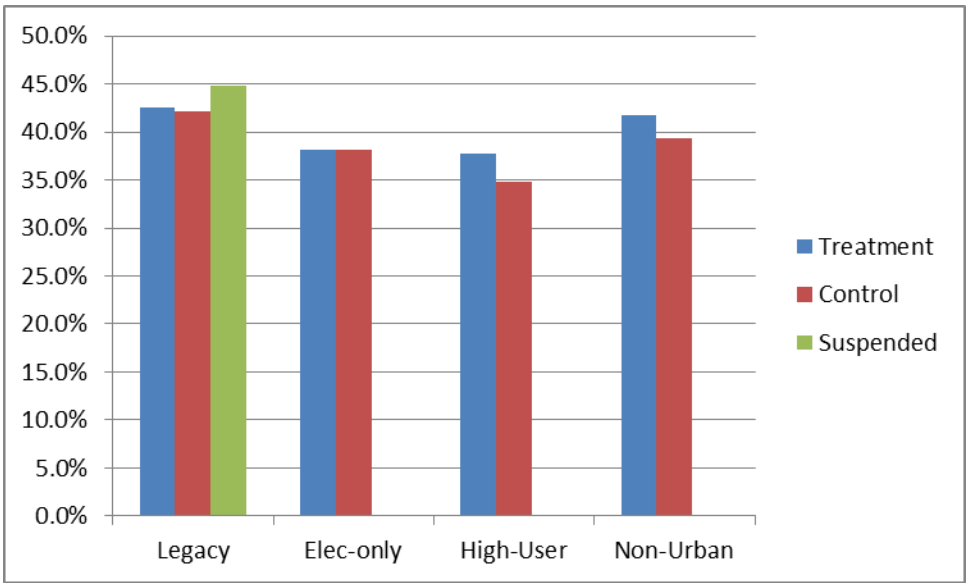
Note: Web survey question: Please rate your interest in receiving the following: 1 is very uninterested and 7 is very interested. a. Home Energy Reports by email? b. Bill notifications by email? c. Email notice when home has unusual increase in energy usage? d. Bi-annual email about seasonal tips to make your home more efficient?

The variation across groups within each notification option is relatively high, with differences as greater than 10 percentage points in the case of the energy efficiency tips. A difference greater than approximately 5 percentage points is statistically significant. Once again, there are suggestive patterns. The High user and Non-Urban groups consistently have the highest interest across the four notification options. In all but one instance, the current Legacy group has the lowest interest across the four notification options.

6.5 Awareness of Lighting Discounts

All respondents were asked whether they were aware that PSE offers discounts in energy efficient lighting in retail stores. The Suspended group had the highest percentage of respondents saying that they were aware (45%), but there was no statistically significant difference between program treatment and control groups. In addition, the differences between treatment customers across groups are also not statistically significant.

Figure 6-5: Awareness of Puget Sound Energy Lighting Discounts

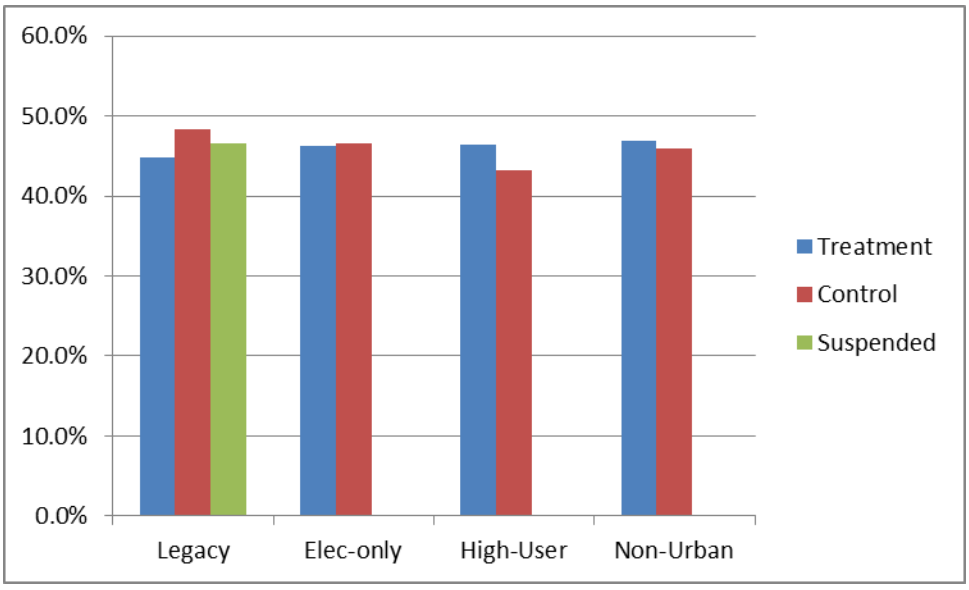


Note: Web survey question HER5. Are you aware of Puget Sound Energy offering discounts on energy efficient lighting in retail stores?

6.6 Overall Satisfaction with PSE

Finally, the web survey asked respondents to rate their overall experience with Puget Sound Energy on a ten point scale where 1 is Unacceptable and 10 is Outstanding. Slightly less than half of the respondents, across all groups, rated themselves as highly satisfied (with a rating of 8, 9, or 10). There was no statistically significant treatment effect across any of the different groups. In fact, the Legacy control group has the highest level of satisfaction of all sub-groups. These results are notable because some implementers of HER Programs market these programs as a path to improved customer relations. There is limited evidence in these results of an increase in the level of stated overall satisfaction among customers due to the presence of the HER programs.

Figure 6-6: Satisfaction with Puget Sound Energy Experience Overall (rating of 8, 9, or 10)



Note: Web survey question HER6. Taking into consideration all aspects of your utility service experience, please rate PUGET SOUND ENERGY overall

7 CONCLUSIONS

The PSE HER Program combines a Legacy group that began receiving reports in late 2008 and three new Expansion groups that started to receive reports in Spring 2014.

PSE HER Program Legacy group was one of the first programs of its kind implemented in the US. This program has a long track record of savings results and has been one of the programs that has served as a proof of concept for this kind of behavioral program as they have become widespread in the industry. Because the Legacy program is unique in its long tenure, it provides evidence of the persistence of HER program savings both with and without reports.

The PSE Program Expansion groups represent an extension of the HER concept into three new populations of PSE customers: High user customers, Electric only customers and Non-urban customers. The 2014 results for these groups reflect a new implementation that only started in March and, if the Legacy experience is informative, is still ramping up to full savings.

The primary focus of this report is an impact evaluation of the PSE HER program. As with any evaluation, it would be preferable to have a better understanding of what drives the savings and that is usually accomplished with a process evaluation. As discussed below, HER programs are actually difficult to evaluate from a process perspective. In particular, it is extremely difficult to establish, with any confidence, what actions are being pursued that produce the savings that impact evaluations consistently identify. In addition, the vendor, in this case Opower, is clear that they are constantly trying to improve the messaging in their reports, so it could be that the activities or even the subset of active customers are evolving from year to year.

In 2012, DNV GL conducted a retrospective review of HER performance for the prior three years for a better understanding of what drives HER program[11]. The conclusions, however, were mixed. The number and range of potential savings activities are large with a combined savings effect of just a couple of percentages. Even with substantial sample sizes in both the treatment and control groups, only a handful of results were statistically significant and informative. For this year's evaluation, the upstream joint savings survey made it possible to ask some customer response and satisfaction questions, but these do not replace a full-blown process evaluation. A more comprehensive study of the drivers of savings was outside of the scope for this impact evaluation.

Legacy Group with Reports

Results confirm that savings for Legacy households still receiving reports remain at a level similar to previous years. HER program savings have been assigned a measure life of one year because this kind of year over year persistence, with ongoing reports, was unknown. Furthermore, there are only a few programs of longer duration than the PSE program[12], so this consistency was not a foregone conclusion. The results in this evaluation indicate that savings for the Legacy group households that continue to receive the reports have remained at a high level for a fourth year.

Rebate program joint savings show strong evidence that the Legacy HER program motivated additional activity in gas energy efficiency programs for the group continuing to receive reports. The cumulative gas rebate program joint savings have increased gradually each year to 1.5 therms for 2014 and have been statistically significant every year. As of 2014, about 11% of the gas savings that we measure with the savings regression was actually due to this increased activity among the gas rebate programs. As these savings are claimed by the rebate programs, they are removed for the final credited savings estimates. There is limited evidence that the Legacy HER program motivated additional electric energy efficiency savings for the group continuing to receive reports relative to the control group. The estimates have always been small and non-statistically significant.

Past survey results from a sample of treatment and control households for upstream joint savings have suggested that the HER reports did increase the purchase of reduced-price retail lighting for the group continuing to receive reports relative to the control group. That effect is no longer present in 2014.

Total credited savings for the Legacy program have decreased year over year due to customer move-outs. This kind of attrition is to be expected for a program where the experimental design is set and cannot be altered. As the new, Expansion groups get up to speed, they will compensate for the dwindling savings from the Legacy group.

Legacy Group - Suspended Reports

The PSE HER program suspended reports to a randomly assigned portion of the Legacy group as a test of savings persistence after cessation of reports. This 2014 evaluation was the fourth year since the suspended treatment group stopped receiving the reports. Measured electric savings have dropped to almost a third of

[11] Puget Sound Energy's Home Energy Reports Program: Three Year Impact, Behavioral and Process Evaluation. April 20th, 2012.

[12] Opower programs that were implemented prior to PSE's program have some key dissimilarities with the PSE program. Most importantly, the PSE program was the first to be randomized at the household level as all Opower programs are now organized.

what the continuing treatment group is saving. Measured gas savings, on the other hand, remain at about three quarters of continuing group savings levels.

The gas rebate program joint savings for the suspended group show a consistent reduction since the reports were suspended while the electric rebate program joint savings have been small and inconsistent for the suspended group over the last four years. Similarly, the upstream program joint savings have also been inconsistent. Unexpectedly, the suspended group upstream joint savings have outpaced the continued group's levels ever since the reports were suspended. We have no reasonable hypothesis of what could cause this other than random variation in the data.

The total credited savings for the suspended group are falling rapidly through the combined effects of customer attrition through move-outs and the falling household-level savings. The household-level savings appear to be falling at a faster rate than the natural move-out related attrition.

Expansion Groups

The three HER Program Expansion groups are only nine months into the program and generated statistically significant electric and gas savings except for the Non-urban group. Savings are consistent with the typical ramp up these programs experience. Even with the relatively low first year savings, the combined savings from the three Expansion groups already produce savings that exceed the combined savings from the two Legacy treatment groups.

The Electric only treatment and control groups are showing a substantial amount of rebate program activity but the report-related difference is relatively small considering there are no gas effects. The High users have the highest combined rebate program joint savings when considering both electric and gas, which is not a surprise as they are the greatest energy consumers when considering both electric and gas.

The upstream joint savings results provide an unexpected result indicated that Electric only and Non-urban households are taking greater advantage of the upstream program due to the HER program while the High users are taking less advantage of the upstream programs due to the reports. As these estimates are not statistically significant, they likely simply reflect random variation in the data.

Overall, the PSE HER Legacy and Expansion programs produced a total of 11.8 GWh and 452 thousand therms savings in 2014.

8 LIST OF APPENDICES

8.1 Randomization Test

DNV GL applied statistical t-tests to the final sample to test the randomness of the treatment and control group allocations. For Legacy, the pre-program period is from Oct 2007 to September 2008. DNV GL compared the Electric and gas consumption for each month in the pre-program period. The test of differences in consumption is presented in Table 8-1 while Table 8-2 presents the test of differences in various household characteristics for participants in the Legacy program.

Table 8-1: Test of Differences in Pre-period Consumption Between Legacy Treatment and Control Groups.

Fuel	Month	Treatment			Control			Control-Treatment	
		Count	Mean	Std Error	Count	Mean	Std Error	Difference	Pr > |t|
Electric Consumption (kWh)	Oct-07	23,444	917.1	2.77	29,576	917.1	2.5	-0.02	1.00
	Nov-07	23,444	996.3	3.07	29,576	996.4	2.7	0.10	0.98
	Dec-07	23,444	1,217.2	3.91	29,576	1,218.3	3.4	1.10	0.83
	Jan-08	23,444	1,102.0	3.56	29,576	1,100.9	3.1	-1.13	0.81
	Feb-08	23,444	942.8	3.00	29,576	942.7	2.6	-0.06	0.99
	Mar-08	23,444	975.6	3.08	29,576	977.4	2.7	1.84	0.65
	Apr-08	23,444	874.3	2.74	29,576	875.5	2.4	1.15	0.75
	May-08	23,444	837.1	2.58	29,576	838.1	2.3	0.97	0.78
	Jun-08	23,444	809.4	2.52	29,576	811.3	2.3	1.89	0.58
	Jul-08	23,444	811.1	2.65	29,576	814.6	2.4	3.50	0.33
	Aug-08	23,444	845.7	2.71	29,576	849.6	2.5	3.81	0.30
	Sep-08	23,444	794.3	2.45	29,576	796.4	2.2	2.04	0.54
Gas Consumption (therms)	Oct-07	23,444	78.8	0.20	29,576	78.7	0.2	-0.11	0.68
	Nov-07	23,444	113.8	0.25	29,576	113.7	0.2	-0.07	0.83
	Dec-07	23,444	147.6	0.31	29,576	147.5	0.3	-0.06	0.89
	Jan-08	23,444	161.8	0.34	29,576	161.7	0.3	-0.11	0.81
	Feb-08	23,444	118.9	0.26	29,576	118.7	0.2	-0.21	0.54
	Mar-08	23,444	122.5	0.27	29,576	122.5	0.2	-0.03	0.93
	Apr-08	23,444	94.7	0.22	29,576	94.6	0.2	-0.13	0.65
	May-08	23,444	51.3	0.15	29,576	51.1	0.1	-0.15	0.43
	Jun-08	23,444	42.2	0.14	29,576	42.1	0.1	-0.05	0.78
	Jul-08	23,444	20.8	0.11	29,576	21.0	0.1	0.13	0.41
	Aug-08	23,444	20.9	0.11	29,576	21.0	0.1	0.14	0.38
	Sep-08	23,444	28.9	0.12	29,576	28.8	0.1	-0.03	0.86

*Indicates statistically significant at 90% confidence interval

Table 8-2: Test of Differences in Household Characteristics Between Legacy Treatment and Control Groups.

Characteristics	Treatment			Control			Control-Treatment	
	Count	Mean	Std Err	Count	Mean	Std Err	Diff	Probt
age	23,444	30.9	0.101	29,576	30.9	0.091	-0.01	0.94
bathrooms	23,444	2.3	0.004	29,576	2.3	0.003	0.00	0.89
bedrooms	23,419	3.6	0.005	29,522	3.6	0.004	-0.01	0.27
fireplace	23,444	1.0	0.001	29,576	1.0	0.001	0.00	0.60
house_value ($)	23,443	347,297	1,113	29,575	347,880	996.88	584	0.70
num_occ	20,647	2.3	0.007	25,947	2.3	0.007	0.00	0.82
sqft	23,444	2,162.3	4.118	29,576	2,160.7	3.682	-1.63	0.77

Overall, consumption differences in each month in the pre-program period and household characteristics are not statistically significant at 90 percent confidence. These results indicate that pre-period consumption and household characteristics are balanced between the treatment and control groups and site exclusion criteria applied to the Legacy program should not bias savings estimates.

DNV GL performed the randomized selection of treatment and control groups for PSE HER Expansion program. At that time, PSE only provided information on annual combined usage and square footage. To test randomness of the treatment allocation, DNV GL applied statistical test on consumption for the 12 months before the first report was sent which was March 2014. Results from the tests for High users, Non-urban and Electric only Group are presented in Table 8-3, Table 8-4 and Table 8-5, respectively.

Table 8-3: Test of Differences in Pre-period Consumption between Treatment and Control Groups, Expansion Program High users.

Fuel	Month	Treatment			Control			Control-Treatment	
		Count	Mean	Std Err	Count	Mean	Std Err	Difference	Pr > |t|
Electric	Mar-13	25,192	988.2	3.83	8,343	983.8	6.55	-4.44	0.56
	Apr-13	25,204	884.1	3.38	8,353	882.5	5.82	-1.67	0.80
	May-13	25,215	822.8	3.23	8,355	821.7	5.57	-1.07	0.87
	Jun-13	25,234	794.4	3.25	8,363	792.1	5.55	-2.36	0.72
	Jul-13	25,220	857.5	3.64	8,362	851.0	6.20	-6.53	0.37
	Aug-13	25,237	861.9	3.65	8,361	854.3	6.26	-7.67	0.29
	Sep-13	25,270	830.4	3.27	8,375	827.8	5.73	-2.61	0.69
	Oct-13	25,276	937.1	3.65	8,384	935.3	6.28	-1.82	0.80
	Nov-13	25,303	1012.2	3.93	8,390	1008.6	6.75	-3.53	0.65
	Dec-13	25,334	1231.9	4.88	8,392	1230.1	8.47	-1.81	0.85
	Jan-14	25,321	1105.6	4.42	8,390	1100.9	7.51	-4.73	0.59
	Feb-14	25,320	1023.0	4.15	8,381	1016.0	7.05	-7.00	0.40
Gas	Mar-13	24,552	98.0	0.30	8,121	97.9	0.52	-0.05	0.94
	Apr-13	24,624	73.9	0.25	8,146	73.9	0.42	0.04	0.93
	May-13	24,766	40.1	0.18	8,204	40.1	0.29	0.00	0.99
	Jun-13	24,822	24.3	0.15	8,229	24.4	0.25	0.06	0.83
	Jul-13	24,886	19.6	0.15	8,241	19.8	0.25	0.16	0.58
	Aug-13	24,985	19.0	0.15	8,282	19.3	0.28	0.32	0.29
	Sep-13	25,086	29.1	0.16	8,320	29.2	0.26	0.18	0.56
	Oct-13	25,200	75.8	0.26	8,354	75.4	0.44	-0.35	0.50
	Nov-13	25,223	104.3	0.32	8,363	103.9	0.54	-0.41	0.52
	Dec-13	25,237	146.8	0.42	8,368	146.3	0.72	-0.49	0.55
	Jan-14	25,301	123.6	0.36	8,384	123.4	0.62	-0.17	0.81
	Feb-14	25,310	130.1	0.37	8,389	130.0	0.63	-0.17	0.81

*Indicates statistically significant at 90% confidence interval

Table 8-4: Test of Differences in Pre-period Consumption Between Treatment and Control Groups, Expansion Program, Non-urban.

Fuel	Month	Treatment			Control			Control-Treatment	
		Count	Mean	Std Err	Count	Mean	Std Err	Difference	Pr > |t|
Electric	Mar-13	34,729	840.4	2.82	11,610	849.7	5.07	9.37	0.10
	Apr-13	34,775	752.2	2.48	11,635	758.1	4.46	5.94	0.23
	May-13	34,831	713.2	2.35	11,647	719.4	4.23	6.17	0.19
	Jun-13	34,838	707.1	2.40	11,647	713.9	4.33	6.81	0.16
	Jul-13	34,840	787.3	2.77	11,653	795.8	4.99	8.46	0.13
	Aug-13	34,864	793.9	2.77	11,665	800.2	4.99	6.33	0.26
	Sep-13	34,886	744.8	2.43	11,675	748.3	4.36	3.44	0.48
	Oct-13	34,894	812.9	2.61	11,676	818.1	4.77	5.17	0.33
	Nov-13	34,923	883.7	2.87	11,685	888.3	5.20	4.52	0.44
	Dec-13	34,945	1090.2	3.70	11,705	1097.0	6.66	6.86	0.36
	Jan-14	34,930	963.8	3.28	11,701	967.9	5.84	4.12	0.53
	Feb-14	34,949	890.1	3.08	11,705	895.5	5.49	5.46	0.38
Gas	Mar-13	34,296	83.1	0.21	11,485	83.7	0.37	0.59	0.16
	Apr-13	34,384	62.1	0.17	11,516	62.6	0.30	0.48	0.16
	May-13	34,523	34.7	0.12	11,572	35.2	0.20	0.46	0.05*
	Jun-13	34,555	22.6	0.10	11,590	23.0	0.17	0.43	0.03*
	Jul-13	34,613	19.0	0.09	11,602	19.5	0.17	0.46	0.01*
	Aug-13	34,734	18.3	0.09	11,633	18.8	0.17	0.46	0.01*
	Sep-13	34,807	26.0	0.09	11,657	26.6	0.19	0.64	0.00*
	Oct-13	34,850	64.8	0.18	11,672	65.3	0.31	0.56	0.12
	Nov-13	34,880	90.2	0.23	11,672	90.9	0.39	0.64	0.16
	Dec-13	34,871	128.5	0.30	11,672	129.6	0.52	1.09	0.07
	Jan-14	34,911	107.9	0.26	11,683	108.5	0.46	0.62	0.24
	Feb-14	34,940	112.9	0.27	11,697	113.7	0.47	0.82	0.13

*Indicates statistically significant at 90% confidence interval

Table 8-5: Test of Differences in Consumption Between Treatment and Control Groups, Expansion Program Electric only.

Fuel	Month	Treatment			Control			Control-Treatment	
		Count	Mean	Std Err	Count	Mean	Std Err	Difference	Pr > |t|
Electric	Mar-13	26,081	1357.8	5.35	8,715	1368.6	9.25	10.78	0.31
	Apr-13	26,113	1131.7	4.39	8,719	1139.5	7.59	7.74	0.38
	May-13	26,127	907.8	3.47	8,715	909.3	5.95	1.47	0.83
	Jun-13	26,136	799.4	3.12	8,711	798.5	5.40	-0.88	0.89
	Jul-13	26,129	824.2	3.31	8,714	824.1	5.74	-0.18	0.98
	Aug-13	26,150	822.7	3.30	8,716	821.3	5.61	-1.40	0.83
	Sep-13	26,188	846.9	3.19	8,735	846.3	5.42	-0.59	0.93
	Oct-13	26,218	1166.3	4.48	8,737	1171.0	7.74	4.73	0.60
	Nov-13	26,238	1415.0	5.48	8,745	1425.6	9.55	10.56	0.34
	Dec-13	26,316	1872.5	7.39	8,772	1886.7	12.87	14.15	0.34
	Jan-14	26,299	1637.8	6.50	8,769	1647.6	11.27	9.80	0.45
	Feb-14	26,316	1619.4	6.52	8,774	1626.9	11.29	7.48	0.57

The test of randomization showed that differences in electric and gas consumption between treatment and control groups are not statistically significant for High users Group and Electric only Group. The results from Non-urban Group showed similar electric consumption between treatment and control but the differences in gas consumption for months of May to September in the pre-program period are statistically significant at 90% confidence interval.

Further tests were applied on gas consumption of the Non-urban group. Overall t-test also showed that annualized gas consumption of the control group is relatively higher by around 7.1 therms (1.0%) than that of treatment group and the difference is statistically significant at 90% confidence level. The difference-in-differences approach used to estimate savings should control for any imbalance between the treatment and control groups with respect to consumption. While it is unfortunate that the sample is not balanced for some months, this fact does not undermine savings estimates produced in this evaluation.

8.2 HER Measured Savings from 2009 to 2014

Table 8-6: HER Measured Savings Based on Actual Consumption from 2009 to 2014

Year and Group	Electric (kWh)	+/-	Gas (therms)	+/-
2009	197.7* (173.7,221.7)	23.99	12.9* (11.3,14.6)	1.65
2010	254.9* (223.5,286.2)	31.34	13.8* (11.7,15.9)	2.13
2011- Current	292.2* (250.0,334.4)	42.20	13.0* (10.3,15.7)	2.68
2012 - Current	306.0* (258.1,353.9)	47.87	12.7* (9.8,15.6)	2.89
2013 - Current	334.3* (280.9,387.7)	53.37	14.8* (11.6,17.9)	3.16
2014 - Current	310.1* (253.2,367.1)	56.95	13.2* (9.9,16.6)	3.32
2011- Suspended	246.4* (190.9,301.9)	55.48	12.8* (9.3,16.2)	3.43
2012- Suspended	196.0* (132.8,259.3)	63.26	8.7* (5.0,12.4)	3.72
2013- Suspended	184.3* (113.5,255.2)	70.85	11.9* (7.8,15.9)	4.04
2014 - Suspended	125.5* (50.3,200.8)	75.23	10.2* (5.9,14.5)	4.28

*Indicates statistically significant at 90% confidence interval

8.3 Impact Methodology

Difference-in-differences

The difference-in-differences approach is the most direct and simple way of leveraging the experimental design of the HER program. The approach compares the difference in the average consumption of the treatment group between pre- and post-report period with the same difference for the control group. The treatment group pre-post difference captures all changes between the two periods including those related to receiving the reports. The control group captures all changes with the exception of those related to the report, because the control group did not receive the reports. The random selection of the treatment and control groups ensures that, on average, the control group will appropriately reflect the non-report related changes experienced by treatment and control group alike between the pre-and post-report periods. Removing the non-report differences, as represented by the control group difference, from the treatment difference produces an estimate of the report's isolated effect on consumption.

The average energy consumption is calculated for both treatment and comparison group in both pre- and post-report periods. The difference-in-differences estimate is then produced with the following equation.

$$\Delta C_i = \alpha + \beta T_i + \varepsilon_i$$

where:

ΔC_i	=	Pre-post difference in annual consumption for household i;
α	=	Intercept
T	=	Treatment indicator (value of 1 if treatment and 0 otherwise)
β	=	Treatment effect or savings estimate
ε	=	error term

The difference-in-differences approach can be applied on a monthly or seasonal basis. As long as time periods are balanced in the pre- and post-report periods, the savings estimate will be consistent for that time period.[13]

[13] This analysis uses the two-stage, difference in difference approach to maintain consistency with prior PSE HER evaluations. We estimate savings at the annual level, thus there is no need to cluster errors.

8.4 Survey Instrument

Puget Sound Energy

Home Energy Report Program 2014

Web Survey

Pacific Market Research Web Survey Procedures

- All Pacific emails sent, must use the Confirmit domain in the "from" address display (@euro.confirmit.com), otherwise we risk being tagged as spam. However, we can use a custom user name. Just an example of what we could use: PSE_Survey@euro.confirmit.com, PMR@euro.confirmit.com or anything else you would prefer.
- support@pacificmarketresearch.com is the tech support and reply to email for Pacific.
- We suggest all email correspondence go through Pacific, an unsubscribe list will be accumulated from the unsubscribe link and any reply emails received with this request. All replies with information requests, complaints etc. will be reviewed daily by Pacific employees and any requiring escalation to DNV-GL or PSE will be passed on daily to the correct recipient.
- All email bounce backs, invalid email addresses or any other unsuccessful email outcomes will be listed and sent at the end of the survey.
- Though it is possible to include links at every step of the survey, including in the email, we would recommend that you do not insert links to client web sites in the beginning or mid-way through the survey. This is likely to distract the respondent from completing the survey. Any redirection or link is recommended to be supplied on the last screen once the respondent has progressed fully through the survey.

INTRODUCTION EMAIL [Subject line: PSE Energy Use - Short Survey]

We'd Like to Hear From You

To help us make improvements to existing programs and rebates, we would like to hear from you about how you use energy.. The survey should only take 5 minutes, and your responses are completely anonymous.

Please click the link ***[here*]**, or copy and paste it into your browser to complete the survey. This link is specific to you, so please do not forward to others.

If you have any questions about the survey, please contact: ***support@pacificmarketresearch.com***

We really appreciate your input!

If you no longer wish to receive these emails, you may unsubscribe by clicking the link below.
^insert_unsubscribe_link^

Reminder email:

Recently Puget Sound Energy invited you to participate in a survey. We would greatly appreciate your input, please see the message below:

[Introduction Email]

INTRODUCTION SCREEN

We'd Like to Hear From You

To help us make improvements to existing energy efficiency programs and rebates, we are surveying you and other customers to learn more about your energy use. The survey should only take 5 minutes, and your responses are completely anonymous.

Please do not use your browser buttons to navigate the survey. Instead use the buttons at the bottom of each screen.

Please answer all questions as completely and accurately as possible.

If you have any questions about the survey, please contact: ***support@pacificmarketresearch.com***

Please click on the "next" button below to begin and maximize your window when you take the survey.

SURVEY SCREENING

Any terminate points in the screening portion of the survey can be redirected to a link or to a screen asking if they would like more information and offer a link or multiple links to PSE programs or the main PSE site.
Screening termination points:

- Work or someone in household works for PSE or other utility – *Generic end screen with thank you.*
- Wrong address - *Generic end screen with thank you or screen offering more program information.*

- Unfamiliar with household light bulb purchases - *Generic end screen with thank you or screen offering more program information.*
- Unfamiliar with CFL and LED light bulbs – *Most likely to want a screen offering more program information.*

I WEB SURVEY

Customer Questions

I1. CUT

*** I2.** Do you or anyone else in your household work for a gas or electric utility, including Puget Sound Energy?

1 Yes SPECIFY:_____ ➔**THANK & TERMINATE**
2 No

*** PS1.** Do you live at <**ADDRESS**>?

1 Yes ➔**GOTO I3**
2 No ➔ **Thank and Terminate**
97 DON'T KNOW ➔ **Thank and Terminate**

*** I3.** Are you familiar with this household's purchases of light bulbs in the past year?

1 Yes ➔ **GOTO C3**
2 No ➔ **THANK & TERMINATE INTERVIEW**
97 DON'T KNOW ➔**THANK & TERMINATE INTERVIEW**

C CFL PURCHASE(S)

C1 CUT

C2 CUT

CFL Bulbs

C3. Think about **CFL bulbs** first. Did you or anyone in your household purchase any **CFL bulbs, separately from a fixture** in 2014?

For now, don't count any CFL bulbs that came in the same package as a light fixture

1 Yes
2 No ➔ **SKIP TO X1.**
97 DON'T KNOW ➔ **SKIP TO X1.**

***CFL BULBS COME IN MANY SHAPES AND SIZES. THE MOST COMMON TYPE OF CFL IS MADE WITH A GLASS TUBE BENT INTO A "TWISTY" SHAPE AND FITS IN A REGULAR LIGHT BULB SOCKET*.**

C4 Approximately, how many CFL **bulbs** did your household purchase in 2014?

If you purchased any multi-packs, please enter the total number of **bulbs** you purchased.
[**IF NECESSARY**: For example, a pack with three bulbs would count as three. Your best estimate is fine.]

1 One → **SKIP TO C8** **SET TOT_LAMPS=1**

2 More than one: RECORD ANSWER
→**SKIP TO C5** **SET TOT_LAMPS=ANSWER**

97 DON'T KNOW → **SKIP TO X1**

C5 Did you purchase all the CFL bulbs at the same store?

1 Yes → **SKIP TO C8**
2 No
97 DON'T KNOW → **SKIP TO C12**

C6 REMOVED

C7 From how many different stores did you purchase CFL bulbs in 2014? **[IF NECESSARY SAY –** Your best estimate is fine]
1_____ [RECORD # OF STORES]
97 DON'T KNOW → **SKIP TO C12**

[BEFORE STARTING STORE MODULE, SET SUM_LAMPS = 0]

[STORE MODULE – C8 to C11 -- REPEAT UP TO 3 TIMES]

[IF (TOT_LAMPS = 1) OR (C5 =1) Program so that if only one store. Ask STORE MODULE only one time]

IF (TOT_LAMPS = 1) OR (C5 =1), SKIP TO C8]

C8 [ONLY FIRST TIME THROUGH MODULE

(if C7=1) The following questions are about **the store** where you purchased the CFL bulb in 2014.

(if C7>1) The following questions are about **the two stores *(if C7=2)*/the three stores *(if C7=3)*/up to three different stores (if C7>3)** where you might have purchased CFL bulbs in 2014. First, list the store where you purchased the **most** bulbs, then the stores where you may have bought fewer.

[Responses to c8, c9, and c11 should be coded as c8a-c c9a-c and c11a-c for stores 1 through 3 asked about]

C8a At what store did you buy the **most** CFL bulbs? **[Use store precodes listed below]**

C8b **[ONLY SECOND TIME THROUGH MODULE]**
Think about the place where you purchased the second most number of CFL bulbs in 2014. At what store did you buy the second most CFL bulbs?

C8c **[ONLY THIRD TIME THROUGH MODULE]**
Think about the place where you purchased the third most bulbs. At what store did you buy the third most CFL bulbs?

[DO NOT READ] [ACCEPT ONLY ONE RESPONSE]

1.	ACE HARDWARE
2.	ALBERT'S RED APPLE
3.	ALBERTSONS
4.	ARIRANG ORIENTAL MARKET
5.	ASIAN FOOD CENTERS
6.	BARTELL DRUGS
7.	BATTERIES PLUS
8.	BEAVER VALLEY GENERAL STORE
9.	BEST BUY
10.	BIG LOTS
11.	BRIDLE TRAILS RED APPLE MARKET
12.	CARNATION MARKET
13.	CARNICERIA LA CHIQUITA
14.	COSTCO
15.	DO IT BEST - ISLAND LUMBER & HARDWARE
16.	DO IT BEST HARDWARE CENTER
17.	DODSON'S IGA
18.	DOLLAR TREE
19.	FOOD MARKET AT LEA HILL
20.	FOSS' GROCERY
21.	FRED MEYER
22.	FRONT STREET RED APPLE MARKET
23.	FRY'S ELECTRONICS
24.	GARGUILES RED APPLE MARKET
25.	GOODWILL
26.	GROCERY OUTLET
27.	H MART
28.	HADLOCK BUILDING SUPPLY
29.	HAGGEN

30.	HARDWARE SALES
31.	HOME DEPOT
32.	INTERCONTINENTAL FOODS
33.	LOWE'S
34.	MAPLE VALLEY MARKET
35.	MCLENDON HARDWARE
36.	MOUNT VERNON RED APPLE MARKET
37.	OLYMPIA LIGHTING CENTER
38.	ONLY A DOLLAR PLUS
39.	PIONEER MARKET
40.	PIONEER ROBERTS MARKET
41.	PRAIRIE CENTER RED APPLE MARKET
42.	PUGET PANTRY
43.	RALPH'S RED APPLE MARKET
44.	SAM'S CLUB
45.	SCOTT LAKE GROCERY
46.	SEBO'S DO IT CENTER
47.	SEBO'S HARDWARE AND EQUIPMENT RENTAL
48.	THE MARKETS
49.	THE STAR STORE, INC.
50.	TRUE VALUE HARDWARE
51.	VALLEY HARVEST MARKET
52.	VASHON MARKET
53.	VASHON THRIFTWAY
54.	WALGREENS
55.	WALMART
56.	WALT'S LYNWOOD CENTER
57.	WESTSIDE BUILDING SUPPLY DO IT CENTER

95 OTHER (SPECIFY) _____
97 DON'T KNOW → **SKIP TO C11**

C9 In what city or town was this store located?

[ACCEPT ONLY ONE RESPONSE]

1 ANACORTES
2 AUBURN
BAINBRIDGE
3 ISLAND
4 BELLEVUE
5 BELLINGHAM

6 BLAINE
7 BONNEY LAKE
8 BOTHELL
9 BREMERTON
10 BURIEN
11 BURLINGTON
12 CARNATION
13 CLE ELUM
14 CLINTON
15 CONCRETE
16 COUPEVILLE
17 COVINGTON
18 DES MOINES
19 EDGEWOOD
20 ELLENSBURG
21 ENUMCLAW
22 EVERSON
23 FEDERAL WAY
24 FERNDALE
25 FREELAND
26 GRAHAM
27 ISSAQUAH
28 KENMORE
29 KENT
30 KINGSTON
31 KIRKLAND
32 LA CONNER
33 LACEY
34 LANGLEY
35 LYNDEN
36 MAPLE VALLEY
37 MERCER ISLAND
38 MOUNT VERNON
39 NEWCASTLE
40 NORTH BEND
41 OAK HARBOR
42 OLYMPIA
43 POINT ROBERTS
44 PORT HADLOCK
45 PORT LUDLOW
46 PORT ORCHARD

47 PORT TOWNSEND
48 POULSBO
49 PUYALLUP
50 REDMOND
51 RENTON
52 ROSLYN
53 SAMMAMISH
54 SEDRO WOOLLEY
55 SILVERDALE
56 SUMNER
57 TENINO
58 TUKWILA
59 TUMWATER
60 VASHON
61 WOODINVILLE
62 YELM

95 OTHER (SPECIFY) _____
97 DON'T KNOW

[C10 DELETED]

[IF TOT_LAMPS=1, AUTO POPULATE C11=1 AND SKIP TO C12]
[IF C5=1 (ONE TRIP) AUTO POPULATE C11 = TOT_LAMPS AND SKIP TO C12]
[INSERT "REMAINING" IN QUESTION SCRIPT FOR C11 only for LOOPS 2 and 3]

C11 How many of the (remaining) **[TOT_LAMPS – SUM_LAMPS]** CFL bulbs did you purchase at that time?

1 [RECORD #]
97 DON'T KNOW [GOTO NEXT LOOP]

END OF LOOP RULES:
SUM_LAMPS = SUM_LAMPS + C11
IF SUM_LAMPS >= 0.9* TOT_LAMPS, BREAK LOOP AND GOTO C12

IF (TOT_LAMPS = 1) OR (C5 =1), BREAK LOOP AND GO TO C12

GOTO C8b FOR 2nd PURCHASE,
GOTO C8c FOR 3rd PURCHASE,
or BREAK LOOP AND GOTO C12 IF NO MORE PURCHASES TO ASK ABOUT

C12 How many of the **[TOT_LAMPS]** bulbs that you purchased in 2014 are currently installed in or around your home?

1 [RECORD #]
997 DON'T KNOW

C13 What type of bulb did *the majority* of these CFL bulbs replace? Was it . . .

[IF TOT_LAMPS=1 USE ALTERNATE WORDING: What type of bulb did the CFL replace? Was it…]

[SHOW 1-6. ACCEPT ONE ANSWER. CHANGE ALL OPTIONS TO SINGULAR WHEN tot_lamps=1]

1 Other CFL bulbs,
2 Regular/incandescent bulbs,
3 Halogen bulbs,
4 A mix of CFL and other bulbs, or
5 Did not replace other bulbs
6 OTHER, SPECIFY____
97 DON'T KNOW

[IF C12 >= TOT_LAMPS (DID NOT INSTALL LESS THAN PURCHASED) SKIP TO NEXT APPLICABLE SECTION]

C14 What did you do with the bulbs you did NOT install. Did you . . ?

[SHOW 1-5. ACCEPT MULTIPLE ANSWERS]

1 Store them in your home,
2 Give them away,
3 Return them to the store, or
4 Installed them all
5 Do something else with them? (SPECIFY: _____)
97 DON'T KNOW

X Compact Fluorescent Fixtures

CFL Fixtures

X1 There are also **CFL fixtures**. Light fixtures have a bulb inside and can plug directly into the outlet or connect to electrical wires. Have you **heard** of CFL fixtures?

1 Yes
2 No ➔ **L1**

97 DON'T KNOW **L1**

X2 DELETED

X3 Did you or someone in your household **buy** any CFL fixtures in 2014?

1 Yes
2 No ➔ **SKIP TO L1.**

97 DON'T KNOW ➔ **SKIP TO L1.**

X4 How many CFL fixtures did you buy in 2014?

1 One ➔ **SKIP TO X8** **SET TOT_FIX=1**
2 More than one [SPECIFY, Your best estimate of the NUMBER of CFL fixtures purchased in 2014 is fine

➔**SKIP TO X5** **SET TOT_FIX=ANSWER**

97 DON'T KNOW ➔ **IF I4=1SKIP TO D0;**
IF I4=3SKIP TO L1;

X5 Did you purchase all the CFL fixtures on the same shopping trip?

1 Yes ➔ **SKIP TO X8**
2 No
97 DON'T KNOW ➔ **SKIP TO X12**

X6 REMOVED

[ASK IF X5 = 2, MORE THAN ONE STORE]
X7 On how many different trips did you purchase CFL fixtures in 2014?

1 [RECORD # OF TRIPS]
97 DON'T KNOW ➔ **SKIP TO X12**

[BEFORE STARTING STORE MODULE, SET SUM_FIX = 0]

STORE MODULE – X8 to X11
[REPEAT UP TO 3 TIMES]

[IF (TOT_FIX = 1) OR (X5 =1) Program so that if only one store. Ask STORE MODULE only one time]

IF (TOT_FIX = 1) OR (X5 =1), SKIP TO X8]

X8 **[ONLY FIRST TIME THROUGH MODULE**
(if X7=1) The following questions are about **the store** where you purchased the CFL fixture in 2014.
(if X7>1) The following questions are about **the two stores *(if X7=2)*/the three stores *(if X7=3)*/up to three different stores *(if X7>3)*** where you might have purchased CFL fixtures in 2014. First, list where you purchased the **most** fixtures, then the stores where you may have bought fewer.

[Responses to x8, x9, and x11 should be coded as x8a-c x9a-c and x11a-c for stores 1 through 3 asked about]

[ONLY FIRST TIME THROUGH MODULE]

X8a At what store did you buy the most CFL fixtures?

X8b [ONLY SECOND TIME THROUGH MODULE]

Think about where you purchased the second most number of CFL fixtures in 2014. At what store did you buy the second most CFL fixtures?

X8c [ONLY THIRD TIME THROUGH MODULE]

Think about where you purchased the third most number of CFL fixtures in 2014. At what store did you buy the third most CFL fixtures?

[ACCEPT ONLY ONE RESPONSE]

1.	ACE HARDWARE
2.	ALBERT'S RED APPLE
3.	ALBERTSONS
4.	ARIRANG ORIENTAL MARKET
5.	ASIAN FOOD CENTERS
6.	BARTELL DRUGS
7.	BATTERIES PLUS
8.	BEAVER VALLEY GENERAL STORE
9.	BEST BUY
10.	BIG LOTS
11.	BRIDLE TRAILS RED APPLE MARKET
12.	CARNATION MARKET
13.	CARNICERIA LA CHIQUITA
14.	COSTCO
15.	DO IT BEST - ISLAND LUMBER & HARDWARE
16.	DO IT BEST HARDWARE CENTER
17.	DODSON'S IGA
18.	DOLLAR TREE
19.	FOOD MARKET AT LEA HILL
20.	FOSS' GROCERY
21.	FRED MEYER
22.	FRONT STREET RED APPLE MARKET
23.	FRY'S ELECTRONICS
24.	GARGUILES RED APPLE MARKET
25.	GOODWILL

26.	GROCERY OUTLET
27.	H MART
28.	HADLOCK BUILDING SUPPLY
29.	HAGGEN
30.	HARDWARE SALES
31.	HOME DEPOT
32.	INTERCONTINENTAL FOODS
33.	LOWE'S
34.	MAPLE VALLEY MARKET
35.	MCLENDON HARDWARE
36.	MOUNT VERNON RED APPLE MARKET
37.	OLYMPIA LIGHTING CENTER
38.	ONLY A DOLLAR PLUS
39.	PIONEER MARKET
40.	PIONEER ROBERTS MARKET
41.	PRAIRIE CENTER RED APPLE MARKET
42.	PUGET PANTRY
43.	RALPH'S RED APPLE MARKET
44.	SAM'S CLUB
45.	SCOTT LAKE GROCERY
46.	SEBO'S DO IT CENTER
47.	SEBO'S HARDWARE AND EQUIPMENT RENTAL
48.	THE MARKETS
49.	THE STAR STORE, INC.
50.	TRUE VALUE HARDWARE
51.	VALLEY HARVEST MARKET
52.	VASHON MARKET
53.	VASHON THRIFTWAY
54.	WALGREENS
55.	WALMART
56.	WALT'S LYNWOOD CENTER
57.	WESTSIDE BUILDING SUPPLY DO IT CENTER

95 OTHER (SPECIFY) _____
97 DON'T KNOW ➔ **SKIP TO X12**

X9 In what city or town is this store located?

[ACCEPT ONLY ONE RESPONSE]

1 ANACORTES
2 AUBURN

BAINBRIDGE ISLAND
BELLEVUE
BELLINGHAM
BLAINE
BONNEY LAKE
BOTHELL
BREMERTON
BURIEN
BURLINGTON
CARNATION
CLE ELUM
CLINTON
CONCRETE
COUPEVILLE
COVINGTON
DES MOINES
EDGEWOOD
ELLENSBURG
ENUMCLAW
EVERSON
FEDERAL WAY
FERNDALE
FREELAND
GRAHAM
ISSAQUAH
KENMORE
KENT
KINGSTON
KIRKLAND
LA CONNER
LACEY
LANGLEY
LYNDEN
MAPLE VALLEY
MERCER ISLAND
MOUNT VERNON
NEWCASTLE
NORTH BEND
OAK HARBOR

42 OLYMPIA
43 POINT ROBERTS
44 PORT HADLOCK
45 PORT LUDLOW
46 PORT ORCHARD
47 PORT TOWNSEND
48 POULSBO
49 PUYALLUP
50 REDMOND
51 RENTON
52 ROSLYN
53 SAMMAMISH
54 SEDRO WOOLLEY
55 SILVERDALE
56 SUMNER
57 TENINO
58 TUKWILA
59 TUMWATER
60 VASHON
61 WOODINVILLE
62 YELM

95 OTHER (SPECIFY) _____
97 DON'T KNOW

X10 DELETED

[IF TOT_FIX=1, AUTO POPULATE X11=1 AND SKIP TO X12]
[IF X5=1 (ONE TRIP) AUTO POPULATE X11 = TOT_FIX AND SKIP TO X12]

[INSERT "REMAINING" IN QUESTION SCRIPT FOR X11 only for LOOPS 2 and 3. IF TOTFIX-SUMFIX=1, SKIP X11]

X11 How many of the (remaining) **[TOT_FIX – SUM_FIX]** CFL fixtures did you purchase at that time?

1 [RECORD #]
97 DON'T KNOW [GOTO NEXT LOOP]

END OF LOOP RULES:
SUM_FIX = SUM_FIX + X11
IF SUM_FIX >= .9*TOT_FIX BREAK LOOP AND GOTO X12

IF (TOT_FIX = 1) OR (X5 =1) BREAK LOOP AND GOTO X12

GOTO X8b FOR 2nd PURCHASE,
GOTO X8c FOR 3rd PURCHASE,
or GOTO X12 IF NO MORE PURCHASES TO ASK ABOUT

X12 How many of the **[TOT_FIX]** fixtures that you purchased in 2014 are currently installed in or around your home?

1 [RECORD #]
97 DON'T KNOW

X13 What did the new CFL fixtures replace? Was it . . .

[IF TOT_FIX=1 USE ALTERNATE WORDING: What did the new CFL fixture replace? Was it …]

[SHOW 1-4, ACCEPT MULTIPLE. CHANGE ALL OPTIONS TO SINGULAR WHEN tot_fix=1]

1 Other CFL fixture
2 Regular/incandescent/halogen fixture
3 Mix of different fixtures
4 It was an additional fixture

95 Something else? (SPECIFY_____)
97 DON'T KNOW

[IF X12 >= TOT_FIX (DID NOT INSTALL LESS THAN PURCHASED) SKIP TO NEXT APPLICABLE SECTION]

X14 What did you did with the fixture(s) you did not install. Did you ?

[SHOW 1-4. ACCEPT MULTIPLE ANSWERS]

1 Store it/them in your home,
2 Give it/them away,
3 Return it/them to the store, or
95 do something else? (SPECIFY _____)
97 DON'T KNOW

[IF I4=3 PROCEED TO L1, OTHERWISE SKIP TO D0]

L LED PURCHASE(S)

LED Bulbs

L1

Think about LED bulbs. Did you or anyone in your household purchase any LED bulbs, separately from a fixture in 2014?

For now, don't count any LED bulbs that came in the same package as a light fixture. LEDs are the most efficient light bulbs available today

1 Yes
2 No ➔ **SKIP TO XL1**
97 DON'T KNOW ➔ [**SKIP TO XL1.]**

L4 Approximately, how many LED bulbs did your household purchase in 2014? If you purchased any multi-packs, please list the total number of BULBS you purchased. [**IF NECESSARY**: For example, a pack with three bulbs would count as three. Your best estimate is fine.]

1 One ➔ **SKIP TO L8** **SET LTOT_LAMPS=1**
2 More than one [SPECIFY, Your best estimate of the NUMBER of LED bulbs purchased in 2014 is fine

2RECORD ANSWER
➔**ASK L5** **SET TOT_LAMPS=ANSWER**
97 DON'T KNOW ➔ **SKIP TO XL1**

L5 Did you purchase all the LEDs on the same shopping trip?

1 Yes ➔ **SKIP TO L8**
2 No
97 DON'T KNOW ➔ **SKIP TO L12**

L6 REMOVED

L7 On how many different trips did you purchase LEDs in 2014? **[IF NECESSARY SAY –** Your best estimate is fine]
1_____ [RECORD # OF TRIPS]
97 DON'T KNOW ➔ **SKIP TO L12**

BEFORE STARTING STORE MODULE, SET LSUM_LAMPS = 0

STORE MODULE – L8 to L11
REPEAT UP TO 6 TIMES]

[IF (LTOT_LAMPS = 1) OR (L5 =1) Program so that if only one store. Ask STORE MODULE only one time]

IF (LTOT_LAMPS = 1) OR (L5 =1), SKIP TO L8]

[L8, L9, and L11 should be coded as L8a-c, L9a-c, L11a-c for the three stores asked about]

L8 **[ONLY FIRST TIME THROUGH MODULE**
(if L7=1) The following questions are about **the store** where you purchased the LED bulbs in 2014.
(if L7>1) The following questions are about **the two stores *(if L7=2)*/the three stores *(if L7=3)*/up to three different stores *(if L7>3)*** where you might have purchased your LEDs in 2014. First, list the store where you purchased the most bulbs, then the stores where you may have bought fewer.

L8a At what store did you buy the most LEDs?

L8b **[ONLY SECOND TIME THROUGH MODULE]**
Think about the place where you purchased the second most number of LED bulbs in 2014. At what store did you buy the second most LEDs?

L8c **[ONLY THIRD TIME THROUGH MODULE]**
Think about the place where you purchased the third most bulbs. At what store did you buy the third most LEDs?

[DO NOT READ] [ACCEPT ONLY ONE RESPONSE]

58.	ACE HARDWARE
59.	ALBERT'S RED APPLE
60.	ALBERTSONS
61.	ARIRANG ORIENTAL MARKET
62.	ASIAN FOOD CENTERS
63.	BARTELL DRUGS
64.	BATTERIES PLUS
65.	BEAVER VALLEY GENERAL STORE
66.	BEST BUY
67.	BIG LOTS
68.	BRIDLE TRAILS RED APPLE MARKET
69.	CARNATION MARKET
70.	CARNICERIA LA CHIQUITA
71.	COSTCO
72.	DO IT BEST - ISLAND LUMBER & HARDWARE
73.	DO IT BEST HARDWARE CENTER
74.	DODSON'S IGA
75.	DOLLAR TREE
76.	FOOD MARKET AT LEA HILL
77.	FOSS' GROCERY
78.	FRED MEYER
79.	FRONT STREET RED APPLE MARKET

80.	FRY'S ELECTRONICS
81.	GARGUILES RED APPLE MARKET
82.	GOODWILL
83.	GROCERY OUTLET
84.	H MART
85.	HADLOCK BUILDING SUPPLY
86.	HAGGEN
87.	HARDWARE SALES
88.	HOME DEPOT
89.	INTERCONTINENTAL FOODS
90.	LOWE'S
91.	MAPLE VALLEY MARKET
92.	MCLENDON HARDWARE
93.	MOUNT VERNON RED APPLE MARKET
94.	OLYMPIA LIGHTING CENTER
95.	ONLY A DOLLAR PLUS
96.	PIONEER MARKET
97.	PIONEER ROBERTS MARKET
98.	PRAIRIE CENTER RED APPLE MARKET
99.	PUGET PANTRY
100.	RALPH'S RED APPLE MARKET
101.	SAM'S CLUB
102.	SCOTT LAKE GROCERY
103.	SEBO'S DO IT CENTER
104.	SEBO'S HARDWARE AND EQUIPMENT RENTAL
105.	THE MARKETS
106.	THE STAR STORE, INC.
107.	TRUE VALUE HARDWARE
108.	VALLEY HARVEST MARKET
109.	VASHON MARKET
110.	VASHON THRIFTWAY
111.	WALGREENS
112.	WALMART
113.	WALT'S LYNWOOD CENTER
114.	WESTSIDE BUILDING SUPPLY DO IT CENTER

95 OTHER (SPECIFY) _____

97 DON'T KNOW → **SKIP TO L11**

L9 In what city or town was this store located?

[ACCEPT ONLY ONE RESPONSE]

1 ANACORTES
2 AUBURN
BAINBRIDGE
3 ISLAND
4 BELLEVUE
5 BELLINGHAM
6 BLAINE
7 BONNEY LAKE
8 BOTHELL
9 BREMERTON
10 BURIEN
11 BURLINGTON
12 CARNATION
13 CLE ELUM
14 CLINTON
15 CONCRETE
16 COUPEVILLE
17 COVINGTON
18 DES MOINES
19 EDGEWOOD
20 ELLENSBURG
21 ENUMCLAW
22 EVERSON
23 FEDERAL WAY
24 FERNDALE
25 FREELAND
26 GRAHAM
27 ISSAQUAH
28 KENMORE
29 KENT
30 KINGSTON
31 KIRKLAND
32 LA CONNER
33 LACEY
34 LANGLEY
35 LYNDEN
36 MAPLE VALLEY
37 MERCER ISLAND

38 MOUNT VERNON
39 NEWCASTLE
40 NORTH BEND
41 OAK HARBOR
42 OLYMPIA
43 POINT ROBERTS
44 PORT HADLOCK
45 PORT LUDLOW
46 PORT ORCHARD
47 PORT TOWNSEND
48 POULSBO
49 PUYALLUP
50 REDMOND
51 RENTON
52 ROSLYN
53 SAMMAMISH
54 SEDRO WOOLLEY
55 SILVERDALE
56 SUMNER
57 TENINO
58 TUKWILA
59 TUMWATER
60 VASHON
61 WOODINVILLE
62 YELM

95 OTHER (SPECIFY) _____
97 DON'T KNOW

[L10 DELETED]

[IF LTOT_LAMPS=1, AUTO POPULATE L11=1 AND SKIP TO L12]
[IF L5=1 (ONE TRIP) AUTO POPULATE L11 = LTOT_LAMPS AND SKIP TO L12]
[INSERT "REMAINING" IN QUESTION SCRIPT FOR L11 only for LOOPS 2 and 3]

L11 How many of the (remaining) **[LTOT_LAMPS – LSUM_LAMPS]** LED bulbs did you purchase at that time?

1 [RECORD #]
97 DON'T KNOW [GOTO NEXT LOOP]

END OF LOOP RULES:
LSUM_LAMPS = LSUM_LAMPS + L11

IF LSUM_LAMPS >= .9*LTOT_LAMPS, BREAK LOOP AND GOTO L12

IF (LTOT_LAMPS = 1) OR (L5 =1), BREAK LOOP AND GO TO L12

GOTO L8b FOR 2nd PURCHASE,
GOTO L8c FOR 3rd PURCHASE,
or BREAK LOOP AND GOTO L12 IF NO MORE PURCHASES TO ASK ABOUT

L12 How many of the **[LTOT_LAMPS]** bulbs that you purchased in 2014 are currently installed in or around your home?

1 [RECORD #]
997 DON'T KNOW

L13 What type of bulb did *the majority* of these LED bulbs replace? Was it . . .

[IF LTOT_LAMPS=1 USE ALTERNATE WORDING: What type of bulb did the LED replace? Was it…]
[SHOW 1-5. ACCEPT ONE ANSWER. CHANGE ALL OPTIONS TO SINGULAR WHEN LTOT_LAMPS=1]

1 CFLs,
2 Regular/incandescent bulbs,
3 Halogen bulbs,
4 A mix of CFL and other bulbs, or
5 Did not replace other bulbs
95 OTHER, SPECIFY___
97 DON'T KNOW

[IF L12 >= LTOT_LAMPS (DID NOT INSTALL LESS THAN PURCHASED) SKIP TO NEXT APPLICABLE SECTION]

L14 What did you do with the bulbs you did NOT install. Did you . . ?

[SHOW 1-4. ACCEPT MULTIPLE ANSWERS]

1 store them in your home,
2 give them away,
3 return them to the store, or
4 I INSTALLED THEM ALL
95 do something else with them? (SPECIFY: _____)
97 DON'T KNOW

XL LED Fixtures

LED Fixtures

XL1 There are also LED **FIXTURES**. Light fixtures have a bulb inside and can plug directly into the outlet or connect to electrical wires.

LED fixtures are designed specifically to use LEDs that plug in to the fixture. These fixtures often have an Energy Star label. Have you heard of these? [**IF NECESSARY**: These are not very common]

1 Yes
2 No ➔ **IF:**

L4=1 or 2 or L4B=1 or 2	**SKIP TO D0**
C4=1 or 2 or C4B=1 or 2	**SKIP TO D0**
X4=1 or 2 or X4B=1 or 2	**SKIP TO D0**
(L3=2, 96, 97 OR L4 =96 OR L4B=96 or 97) AND (C3=2, 96, 97 OR C4=96 OR C4B= 96 or 97) AND (X3=2, 96, 97 OR X4=96 OR X4B=96 or 97)	**T&T. DO NOT COUNT AS COMPLETE**

97 DON'T KNOW ➔ **IF:**

L4=1 or 2 or L4B=1 or 2	**SKIP TO D0**
C4=1 or 2 or C4B=1 or 2	**SKIP TO D0**
X4=1 or 2 or X4B=1 or 2	**SKIP TO D0**
(L3=2, 96, 97 OR L4 =96 OR L4B=96 or 97) AND (C3=2, 96, 97 OR C4=96 OR C4B= 96 or 97) AND (X3=2, 96, 97 OR X4=96 OR X4B=96 or 97)	**T&T. DO NOT COUNT AS COMPLETE**

XL2 DELETED

XL3 Did you or someone in your household buy any LED fixtures in 2014?

1 Yes
2 No ➔ **IF:**

L4=1 or 2 or L4B=1 or 2	**SKIP TO D0**
C4=1 or 2 or C4B=1 or 2	**SKIP TO D0**
X4=1 or 2 or X4B=1 or 2	**SKIP TO D0**
(L3=2, 96, 97 OR L4 =96 OR L4B=96 or 97) AND (C3=2, 96, 97 OR C4=96 OR C4B= 96 or 97) AND (X3=2, 96, 97 OR X4=96 OR X4B=96 or 97)	**T&T. DO NOT COUNT AS COMPLETE**

97 DON'T KNOW ➔ **IF:**

L4=1 or 2 or L4B=1 or 2	**SKIP TO D0**

C4=1 or 2 or C4B=1 or 2	**SKIP TO D0**
X4=1 or 2 or X4B=1 or 2	**SKIP TO D0**
(L3=2, 96, 97 OR L4 =96 OR L4B=96 or 97) AND (C3=2, 96, 97 OR C4=96 OR C4B= 96 or 97) AND (X3=2, 96, 97 OR X4=96 OR X4B=96 or 97)	**T&T. DO NOT COUNT AS COMPLETE**

XL4 How many LED fixtures did you buy in 2014?

1 One → **SKIP TO XL8** **SET LTOT_FIX=1**
2 More than one [SPECIFY, REQUIRE ANSWER. IF DK, GOTO X4b]
→**SKIP TO XL5** **SET LTOT_FIX=ANSWER**

97 DON'T KNOW →**GOTO XL4b**

XL4B What is your best estimate of the NUMBER of LED fixtures purchased in 2014?

1 One → **SKIP TO XL8** **SET LTOT_FIX=1**
2 RECORD ANSWER
→**SKIP TO XL5** **SET LTOT_FIX=ANSWER**
97 DON'T KNOW → **IF C3 ≠ 1, AND L3 ≠ 1 AND X3≠ 1 THANK AND TERMINATE, DO NOT COUNT AS COMPLETE. IF XL3=1 SKIP TO D0**

XL5 Did you purchase all the LED fixtures on the same shopping trip?

1 Yes → **SKIP TO XL8**
2 No
97 DON'T KNOW → **SKIP TO XL12**

XL6 REMOVED

[ASK IF XL5 = 2, MORE THAN ONE STORE]
XL7 On how many different trips did you purchase LED fixtures in 2014?

1 [RECORD # OF TRIPS]
97 DON'T KNOW → **SKIP TO XL12**

[BEFORE STARTING STORE MODULE, SET LSUM_FIX = 0]

STORE MODULE – XL8 to XL11
[REPEAT UP TO 3 TIMES]

[IF (LTOT_FIX = 1) OR (XL5 =1) Program so that if only one store. Ask STORE MODULE only one time]

IF (LTOT_FIX = 1) OR (XL5 =1), SKIP TO XL8]

[Responses to XL8, XL9, and XL11 should be coded as XL8a-c XL9a-c and XL11a-c for stores 1 through 3 asked about]

XL8. [ONLY FIRST TIME THROUGH MODULE]

(if XL7=1) The following questions are about **the store** where you purchased the LED fixture in 2014.
(if XL7>1) The following questions are about **the two stores *(if XL7=2)*/the three stores *(if XL7=3)*/up to three different stores *(if XL7>3)*** where you might have purchased LED fixtures in 2014. First, list the store where you purchased the **most** fixtures, then the stores where you may have bought fewer.

[ONLY FIRST TIME THROUGH MODULE]

X8a At what store did you buy the most LED fixtures?

X8b [ONLY SECOND TIME THROUGH MODULE]

Think about the place where you purchased the second most number of LED fixtures in 2014. At what store did you buy the second most LED fixtures?

X8c [ONLY THIRD TIME THROUGH MODULE]

Think about the place where you purchased the third most number of LED fixtures in 2014. At what store did you buy the third most LED fixtures?

[ACCEPT ONLY ONE RESPONSE]

1.	ACE HARDWARE
2.	ALBERT'S RED APPLE
3.	ALBERTSONS
4.	ARIRANG ORIENTAL MARKET
5.	ASIAN FOOD CENTERS
6.	BARTELL DRUGS
7.	BATTERIES PLUS
8.	BEAVER VALLEY GENERAL STORE
9.	BEST BUY
10.	BIG LOTS
11.	BRIDLE TRAILS RED APPLE MARKET
12.	CARNATION MARKET
13.	CARNICERIA LA CHIQUITA
14.	COSTCO
15.	DO IT BEST - ISLAND LUMBER & HARDWARE
16.	DO IT BEST HARDWARE CENTER
17.	DODSON'S IGA
18.	DOLLAR TREE
19.	FOOD MARKET AT LEA HILL
20.	FOSS' GROCERY
21.	FRED MEYER

22.	FRONT STREET RED APPLE MARKET
23.	FRY'S ELECTRONICS
24.	GARGUILES RED APPLE MARKET
25.	GOODWILL
26.	GROCERY OUTLET
27.	H MART
28.	HADLOCK BUILDING SUPPLY
29.	HAGGEN
30.	HARDWARE SALES
31.	HOME DEPOT
32.	INTERCONTINENTAL FOODS
33.	LOWE'S
34.	MAPLE VALLEY MARKET
35.	MCLENDON HARDWARE
36.	MOUNT VERNON RED APPLE MARKET
37.	OLYMPIA LIGHTING CENTER
38.	ONLY A DOLLAR PLUS
39.	PIONEER MARKET
40.	PIONEER ROBERTS MARKET
41.	PRAIRIE CENTER RED APPLE MARKET
42.	PUGET PANTRY
43.	RALPH'S RED APPLE MARKET
44.	SAM'S CLUB
45.	SCOTT LAKE GROCERY
46.	SEBO'S DO IT CENTER
47.	SEBO'S HARDWARE AND EQUIPMENT RENTAL
48.	THE MARKETS
49.	THE STAR STORE, INC.
50.	TRUE VALUE HARDWARE
51.	VALLEY HARVEST MARKET
52.	VASHON MARKET
53.	VASHON THRIFTWAY
54.	WALGREENS
55.	WALMART
56.	WALT'S LYNWOOD CENTER
57.	WESTSIDE BUILDING SUPPLY DO IT CENTER

95 OTHER (SPECIFY) _____
97 DON'T KNOW ➔ **SKIP TO XL12**

XL9 In what city or town is this store located?

[ACCEPT ONLY ONE RESPONSE]

1 ANACORTES
2 AUBURN
BAINBRIDGE
3 ISLAND
4 BELLEVUE
5 BELLINGHAM
6 BLAINE
7 BONNEY LAKE
8 BOTHELL
9 BREMERTON
10 BURIEN
11 BURLINGTON
12 CARNATION
13 CLE ELUM
14 CLINTON
15 CONCRETE
16 COUPEVILLE
17 COVINGTON
18 DES MOINES
19 EDGEWOOD
20 ELLENSBURG
21 ENUMCLAW
22 EVERSON
23 FEDERAL WAY
24 FERNDALE
25 FREELAND
26 GRAHAM
27 ISSAQUAH
28 KENMORE
29 KENT
30 KINGSTON
31 KIRKLAND
32 LA CONNER
33 LACEY
34 LANGLEY
35 LYNDEN
36 MAPLE VALLEY
37 MERCER ISLAND

38 MOUNT VERNON
39 NEWCASTLE
40 NORTH BEND
41 OAK HARBOR
42 OLYMPIA
43 POINT ROBERTS
44 PORT HADLOCK
45 PORT LUDLOW
46 PORT ORCHARD
47 PORT TOWNSEND
48 POULSBO
49 PUYALLUP
50 REDMOND
51 RENTON
52 ROSLYN
53 SAMMAMISH
54 SEDRO WOOLLEY
55 SILVERDALE
56 SUMNER
57 TENINO
58 TUKWILA
59 TUMWATER
60 VASHON
61 WOODINVILLE
62 YELM

95 OTHER (SPECIFY) _____
97 DON'T KNOW

XL10 DELETED

[IF LTOT_FIX=1, AUTO POPULATE XL11=1 AND SKIP TO XL12]
[IF XL5=1 (ONE TRIP) AUTO POPULATE XL11 = LTOT_FIX AND SKIP TO XL12]
[INSERT "REMAINING" IN QUESTION SCRIPT FOR XL11 only for LOOPS 2 and 3]

XL11 How many of the (remaining) **[LTOT_FIX – LSUM_FIX]** LED fixtures did you purchase at that time?

1 [RECORD #]
97 DON'T KNOW [GOTO NEXT LOOP]

END OF LOOP RULES:
LSUM_FIX = LSUM_FIX + XL11
IF LSUM_FIX >=.9*LTOT_FIX BREAK LOOP AND GOTO XL12

IF (LTOT_FIX = 1) OR (XL5 =1) BREAK LOOP AND GOTO XL12

GOTO XL8b FOR 2nd PURCHASE,
GOTO XL8c FOR 3rd PURCHASE,
or GOTO XL12 IF NO MORE PURCHASES TO ASK ABOUT

XL12 How many of the **[LTOT_FIX]** fixtures that you purchased in 2014 are currently installed in or around your home?**]**

1 [RECORD #]
97 DON'T KNOW

XL13 What did the new LED fixtures replace? Was it . . .

[IF LTOT_FIX=1 USE ALTERNATE WORDING: What did the new LED fixture replace? Was it …]

[SHOW 1-5, ACCEPT MULTIPLE. CHANGE ALL OPTIONS TO SINGULAR WHEN LTOT_FIX=1]
1 A CFL fixture,
2 Regular/incandescent fixture with regular bulbs,
3 A halogen fixture,
4 A mix of different fixtures

5 It was an additional fixture, or
95 Something else? (SPECIFY_____)
97 DON'T KNOW

[IF XL12 >= LTOT_FIX (DID NOT INSTALL LESS THAN PURCHASED) SKIP TO NEXT SECTION - DEMOGRAPHICS]
XL14 What did you do with the fixture(s) you did not install. Did you ?

[SHOW 1-4. ACCEPT MULTIPLE ANSWERS]
1 Store it/them in your home,
2 Give it/them away,
3 Return it/them to the store, or
95 do something else? (SPECIFY _____)
97 DON'T KNOW

HER HOME ENERGY REPORT

PUGET SOUND ENERGY Experience

HER1. How familiar are you with energy efficiency or conservation programs from Puget Sound Energy to help you with ways to use less energy and lower your bill?

1 Not at all familiar

2 Not very familiar

3 Somewhat familiar

4 Very familiar

HER2. Has your household received a Home Energy Report listing your home's energy use and comparing it with similar homes in the area?

1 Yes
2 No
97 DON'T KNOW

HER3. Do you remember seeing any of the following advertisements or messages in your Home Energy Report? [Check all that apply]

a. Get your home (and wallet) ready for winter – Home heating (Real, attached)

b. Upgrade now, score a double rebate! – Energy Star appliances (Real, attached)

c. Recycle your extra refrigerator or freezer for instant savings – Refrigerator Recycling (Real, attached)

d. Celebrate Earth Day – LED Lighting (Real, attached)

e. Solve your Home's Mysteries – PSE HomePrint Energy Assessment program (Real, attached)

[IF HER2 = 1] HER3. Please rate your interest in receiving the following: 1 is very uninterested and 7 is very interested

a. Home Energy Reports by email?
b. Bill notifications by email?
c. Email notice when home has unusual increase in energy usage?
d. Bi-annual email about seasonal tips to make your home more efficient?

HER4. Are you aware of Puget Sound Energy offering discounts on energy efficient lighting in retail stores? Yes/No

HER5 Taking into consideration all aspects of your utility service experience, please rate PUGET SOUND ENERGY overall:
1=Unacceptable
2
3
4
5=Average
6
7
8
9
10=Outstanding

W WRAP UP

W0 Is there anything that you want to pass on to PUGET SOUND ENERGY?

1 [RECORD RESPONSE]
2 [No response]
96 REFUSED
97 DON'T KNOW

W1. Thank you very much for your time and opinions.

If you would like more information about PUGET SOUND ENERGY programs and rebates available in your area click on the "more information" button below. [pse.com/rebates]

About DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter and greener.

Evaluation Report Response

Program: Home Energy Reports

Program Manager: Dane Tomalin

Study Report Name: Puget Sound Energy's Home Energy Reports: 2014 Impact Evaluation

Report Date: July, 2015

Evaluation Analyst: Jim Perich-Anderson

Date ERR Provided to Program Manager: 7/14/2015

Date of Program Manager Response: 8/7/2015

Please describe in detail, action plans to address the evaluation study's key findings and recommendations.

Overview: Home Energy Report evaluation shows "joint savings" for both electric and gas fuels in households that continue to receive reports and households that had the report service discontinued. The evaluation also includes PSE's Expansion Group 1st year results.

Action Plan: Based on the results in the evaluation report, Program Management will adopt the key findings as savings for the program. Program Management will continue to review the savings performance of the households that had report service discontinued in order to evaluate the persistence of this measure.

Date of Program Action: Home Energy Report program management has approved of the findings in the HER Evaluation and require no corrections or additional actions. The findings in the evaluation will be used for our ex-post savings claim for 2014. This evaluation and the methodologies within should be used for future HER evaluations.