Evaluation of 2016-2017 Home Energy Reports Program

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ADM Associates, Inc.

Prepared by:
Adam Thomas
Anjali Gupta, Ph.D.
Jeremy Offenstein, Ph.D.
Zephaniah Davis
Melissa Kosla

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1. Executive Summary

This measurement and verification ("M&V") report provides the impact and process evaluation of Pacific Power Washington's 2016-2017 Home Energy Reports (HER) Program.

1.1 Program Description

The HER Program provides tailored reports to residential customers. These reports include:

- Comparisons of customers' current energy use to their past use;
- Comparison of energy use to similar homes in the area; and
- Tips on how customers can reduce their energy use as well as information on Pacific Power energy efficiency programs

The program uses a randomized control trial (RCT) experimental design. At the outset of program design, pre-selected customers are randomly assigned to a treatment group or a control group. The RCT is of type 'opt-out' and treatment customers can discontinue, 'opt-out' of, receiving home energy reports. The control group serves as the basis for comparison to the treatment group in measuring the effects of the home energy reports.

The program includes three waves:

- Legacy: launched in July 2012
- Expansion: launched in September 2014
- Refill: launched in December 2014

The main features of the program's impact evaluation included:

- An RCT and a post-program regression (PPR) panel data model were used to estimate energy savings.
- Surveys were conducted with the treatment and control groups to assess behavior and utility satisfaction and to determine actions taken by treatment participants after receiving home energy reports.

1.2 Evaluation Objectives

The objectives of this evaluation are as follows:

- Validate kWh savings impacts by wave for each of the 2016 and 2017 program years;
- Obtain feedback from treatment group households as to their program experience; and
- Measure the effects of the program on knowledge of energy efficiency and other-program participation.

1.3 Verified Energy Savings

Below, Table 1summarizes the total numbers of customers who participated in the full program without opting out. Table 2 summarizes the verified energy savings across all three waves.

Table 1: Overall Savings Summary

Variable	*2016*	*2017*
Number of Treatment Customers	45,955	40,898
Number of Control Customers	24,963	22,432
Verified Net Savings (MWh)	**9,590**	**12,284**

Table 2: Savings by Wave

	Legacy		*Expansion*		*Refill*	
Variable	*2016*	*2017*	*2016*	*2017*	*2016*	*2017*
Number of Treatment Customers	10,210	9,456	30,947	27,412	4,798	4,030
Number of Control Customers	10,130	9,476	10,042	8,950	4,791	4,006
Percent Realized Savings	1.78%	2.31%	1.13%	1.71%	0.72%	1.02%
Average Daily Savings per Customer	1.189	1.547	0.432	0.654	0.141	0.202
Verified Net Savings Before Double Count Adjustment (MWh)	4,443	5,340	4,888	6,547	248	297
Savings Counted in Other Energy Efficiency Programs (MWh)[1]	-35	49	26	34	20	17
Final Verified Net Savings (MWh)	**4,408**	**5,389**	**4,914**	**6,581**	**268**	**314**

Table 3 and Table 4 summarize realization rates[2] by program year. They are calculated by dividing the verified net savings (ex-post, see Table 2) by ex-ante savings provided to the Evaluator. The programs in aggregate demonstrated positive realization rates (105% and 101% for 2016 and 2017, respectively).

[1] These amounts are used to adjust the realized savings to account for energy savings measure implemented through other residential energy efficiency programs. A negative value indicates less of an effect (decreased consumption) from these programs as compared to the control group and thus their savings is subtracted to account for the difference. A positive value means the opposite.

[2] The ratio of ex-post to ex-ante savings.

Table 3: Expected and Realized Savings by Wave - 2016

Wave	*Expected Savings*	*Evaluated Savings*	*Realization Rate*
Legacy	4,428	4,408	100%
Expansion	4,466	4,914	110%
Refill	270	268	99%
Total	**9,164**	**9,590**	**105%**

Table 4: Expected and Realized Savings by Wave- 2017

Wave	*Expected Savings*	*Evaluated Savings*	*Realization Rate*
Legacy	5,736	5,389	94%
Expansion	6,134	6,581	107%
Refill	355	314	89%
Total	**12,226**	**12,284**	**101%**

Table 5: Expected and Realized Savings by Wave– 2016 and 2017 Combined

Wave	*Expected Savings*	*Evaluated Savings*	*Realization Rate*
Legacy	10,164	9,797	96%
Expansion	10,600	11,495	108%
Refill	625	582	93%
Total	**21,389**	**21,874**	**102%**

1.4 Key Findings

1.4.1 Impact Evaluation Findings

- **The post-program regression (PPR) model provides the verified savings for the 2016 and 2017 evaluation.** It was chosen to aid comparison to past evaluations which employed the PPR method. The post-only regression (PO) and linear fixed effects regression (LFER) methods were also used as comparisons.
- **Legacy savings as a percent of annual use declined in 2016 and rebounded in 2017.** Savings in 2016 were 1.78% of annual billed use. Savings in 2017 were 2.31%. This hovers around the 2015 savings value of 2.09%. Typically savings increase every year for behavioral programs as customers learn more about ways to save energy, however this type of fluctuation is common.

- **Expansion and Refill waves demonstrated a consistent improvement in energy savings.** Savings as a percent of annual use climbed in 2016 and 2017 for the Expansion and Refill waves.
- **Legacy has begun to demonstrate some degradation of its control group.** Wave 1 had two months, of the 12-month pre-period, that, due to attrition, have become statistically significantly different in energy usage between the remaining control and treatment participants. Using on annualized use and regressing pre-period consumption with treatment assignment as a predictor, ADM performed additional checks to confirm the groups were still balanced. However, this is of key concern for the program as further degradation of the control group may result in invalid comparisons.

1.4.2 Process Evaluation Findings

- **Refill respondents indicated higher satisfaction with the program than the Legacy or Expansion waves.** Refill respondents rated their satisfaction with the program at 4.17 out of 5.00, compared to 3.68 and 3.45 for the Expansion and Legacy waves, respectively.
- **Longer program tenure is correlated with an increased likelihood to indicate no longer wanting to receive reports.** Eighteen percent of Legacy respondents stated they would no longer like to receive a report. In comparison, Expansion and Refill respondents were 9% and 5% likely to indicate this, respectively. This corresponds to the stated program satisfaction ratings, and it is ADM's hypothesis that Legacy treatment households may demonstrate "program fatigue" after seven six to seven years of receiving reports.
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- **Participants in the Refill wave are notably younger with a higher educational attainment, lower income, fewer home occupants, and lower homeownership rate than prior program waves.** ADM identified statistically significant demographic indicators for the Refill wave compared to the Legacy and Expansion Waves in this respect.

1.5 Recommendations

- **Consider developing strategies to modify the control group to better-align with the treatment group on an annual or monthly basis.** This may include "refilling" the control group with new households or removing control group households to create a new match. Selection of control group replacements at various points during the program, such as at the end of the end of the Legacy and Expansion waves, will help test validity. Such replacements can be chosen using propensity score matching, based on historic kWh usage.

- **Where possible, tailor program recommendations to demographics.** The Refill wave skews younger, with a lower homeownership rate (and 20% of respondents indicated an income less than $25,000 per year). Program materials sent to this wave should have messaging focused on tips more appropriate for renters and lower income households (such as focusing information on low-cost or no-cost efficiency options, rather than on higher -cost appliances).
- **Consider cross-referencing treatment customers with known low income screening tools (such as LIHEAP registration) to spur outreach for Pacific Power low income programs.** These groups are to some extent pre-engaged with wattSmart via the home energy report and could be targeted for appropriate income-qualified programs.

1.6 Cost Effectiveness Results

Below, Table 6 summarizes the results of the cost-effectiveness findings for the HER program.

Table 6: Cost/Benefit Ratios for the HER by Program Year

Program Year	*PTRC*	*TRC*	*UCT*	*RIM*	*PCT*
2016	2.70	2.46	2.46	0.43	n/a
2017	2.32	2.11	2.11	0.39	n/a
2016 - 2017	2.47	2.25	2.25	0.41	n/a

The program was cost effective from all perspectives except the Ratepayer Impact Measure (RIM) test. PacifiCorp Total Resource Cost (PTRC) test results were 2.70 for 2016, 2.32 for 2017, and 2.47 for the combined 2016 – 2017 years.

2. Program Background

The HER program is designed to generate quantifiable behavioral savings that cannot be feasibly attained through standard energy efficiency efforts. The program differs from standard energy conservation marketing efforts in that it provides customized reports to customers, comparing their billed energy use to homes in their area with similar energy consumption. The comparison is intended to leverage social norming effects; this is a long-known behavioral science tenet that individuals desire to be at a similar or better level than their peers, and thus, the report drives high users to reduce their energy consumption.[3]

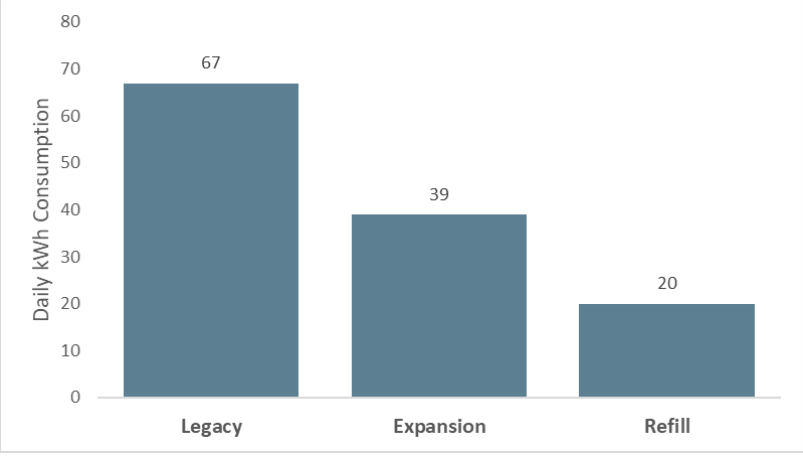
HER was first introduced to Pacific Power's Washington customers in August 2012, followed by two subsequent waves:

Legacy Wave –	onset August 2012
Expansion Wave -	onset September 2014
Refill Wave -	onset January 2015

The program is a randomized control trial (RCT). In this experimental design, a group of eligible customers are randomly assigned to treatment or control groups. Treatment households receive mailed or emailed home energy reports, which show the comparison of their use to their neighbors. The program is an opt-out implementation model; treatment customers who wish to not participate but may contact Pacific Power and request to be removed from the program at any time.

The Legacy wave of the program first targeted the highest users in Pacific Power's Washington service area. As shown in Figure 1, the Legacy wave customers used an average of 67 kWh per day during the baseline year (i.e. 12-month pre-period before a wave begins), while the Expansion and Refill waves use 39 and 20 kWh per day during the baseline year, respectively.

Figure 1: Average Daily Consumption by Wave (Pre-period)



[3] Davis, Matt. 2011. *Behavior and Energy Savings: Evidence from a Series of Experimental Interventions*. Environmental Defense Fund.

3. EM&V Methodology

The impact evaluation approach for this program is as follows:

1) The control groups for each treatment wave were tested for validity as a statistical match for the treatment households in the baseline year;
2) Energy savings are estimated via regression modeling; and
3) Excess savings from other-program-participation by the treatment group are accounted for and netted out of the program savings from the home energy Reports program.

3.1 Control Group Validity Testing

Control group validity testing entails testing for statistically significant differences in usage between the treatment and control groups for each baseline month. The control groups were validated in prior evaluations of this program[4], however it is important to reassess this in the current evaluation because as the treatment and control groups decay, there is a possibility of the groups ceasing to be a statistical match. We conducted a two-tailed T-test based on kWh used per day (which normalize for differences in billing period length). Below, Table 7, Table 8 and Table 9 detail any differences and statistical significance.

Table 7: Legacy Wave Monthly Average Baseline Usage by Treatment Status

Month-Year	Control Mean	Treatment Mean	Difference	Confidence Low	Confidence High	PR > T	
July-11	52.19	51.83	0.37	-0.29	1.02	0.28	
August-11	55.97	55.57	0.40	-0.30	1.10	0.26	
September-11	49.69	49.32	0.37	-0.22	0.96	0.22	
October-11	54.03	54.18	-0.15	-0.64	0.35	0.56	
November-11	84.11	84.91	-0.80	-1.50	-0.09	0.03	*
December-11	104.30	104.83	-0.53	-1.40	0.34	0.23	
January-12	100.30	100.50	-0.20	-1.02	0.62	0.63	
February-12	84.53	84.43	0.10	-0.56	0.77	0.76	
March-12	71.26	71.17	0.09	-0.47	0.64	0.76	
April-12	53.35	52.97	0.38	-0.08	0.84	0.10	
May-12	45.88	45.48	0.40	-0.07	0.87	0.10	
June-12	47.28	46.68	0.60	0.02	1.18	0.04	*

* significant at $p < .05$.

[4] Navigant Consulting, Inc. *Pacific Power Washington 2014-2015 Home Energy Reports Program Evaluation*, 2016.

Table 8: Expansion Wave Monthly Average Baseline Usage by Treatment Status

Month-Year	Control Mean	Treatment Mean	Difference	Confidence Low	Confidence High	PR > T
September-13	31.27	30.99	0.27	-0.06	0.61	0.11
October-13	31.17	30.90	0.27	-0.05	0.59	0.09
November-13	45.02	44.67	0.35	-0.21	0.91	0.22
December-13	56.28	56.11	0.18	-0.53	0.88	0.63
January-14	51.59	51.46	0.14	-0.48	0.76	0.66
February-14	48.62	48.41	0.21	-0.37	0.80	0.48
March-14	35.72	35.58	0.14	-0.22	0.51	0.45
April-14	28.45	28.41	0.04	-0.24	0.31	0.79
May-14	27.37	27.33	0.04	-0.24	0.33	0.76
June-14	30.72	30.58	0.13	-0.22	0.49	0.46
July-14	40.72	40.52	0.20	-0.24	0.64	0.38
August-14	36.74	36.55	0.19	-0.22	0.60	0.37

* significant at p < .05.

Table 9: Refill Wave Monthly Average Baseline Usage by Treatment Status

Month-Year	Control Mean	Treatment Mean	Difference	Confidence Low	Confidence High	PR > T
January-14	21.88	22.13	-0.25	-1.19	0.69	0.60
February-14	21.01	21.39	-0.39	-1.28	0.51	0.40
March-14	15.75	15.68	0.07	-0.49	0.63	0.80
April-14	12.98	13.18	-0.19	-0.61	0.23	0.37
May-14	12.87	12.78	0.09	-0.31	0.49	0.66
June-14	15.78	15.53	0.24	-0.26	0.74	0.34
July-14	23.36	23.43	-0.07	-0.70	0.56	0.83
August-14	22.01	22.08	-0.07	-0.68	0.53	0.81
September-14	16.85	16.74	0.12	-0.38	0.61	0.65
October-14	17.20	17.41	-0.21	-0.73	0.30	0.42
November-14	28.41	28.73	-0.31	-1.30	0.67	0.54
December-14	30.97	31.58	-0.61	-1.71	0.48	0.27

* significant at p < .05.

The Legacy wave began to demonstrate a slight imbalance between the remaining treatment and control customers. Examining Table 7, we see that two months of the Legacy wave's baseline were no longer balanced at the 95% confidence level. This indicates the groups' usage was balanced at the onset of the RCT however, if baseline usage were to be re-calculated with the remaining treatment and control customers[5] some baseline months would reveal statistically significant differences. Two alternative regressions were run to confirm balance on all waves: The first examined annual instead of monthly baseline usage and did not find any statistically significant differences. The second regression examined if treatment household predicted baseline usage, and the results did not indicate correlation. These secondary checks help determine if imbalances,

[5] Those customers who have not opted out or moved.

found during the initial validity check, are false positives (due to random chance), or that the hypothesis, that the control and treatment group are balanced, should be rejected.

3.1 Decay

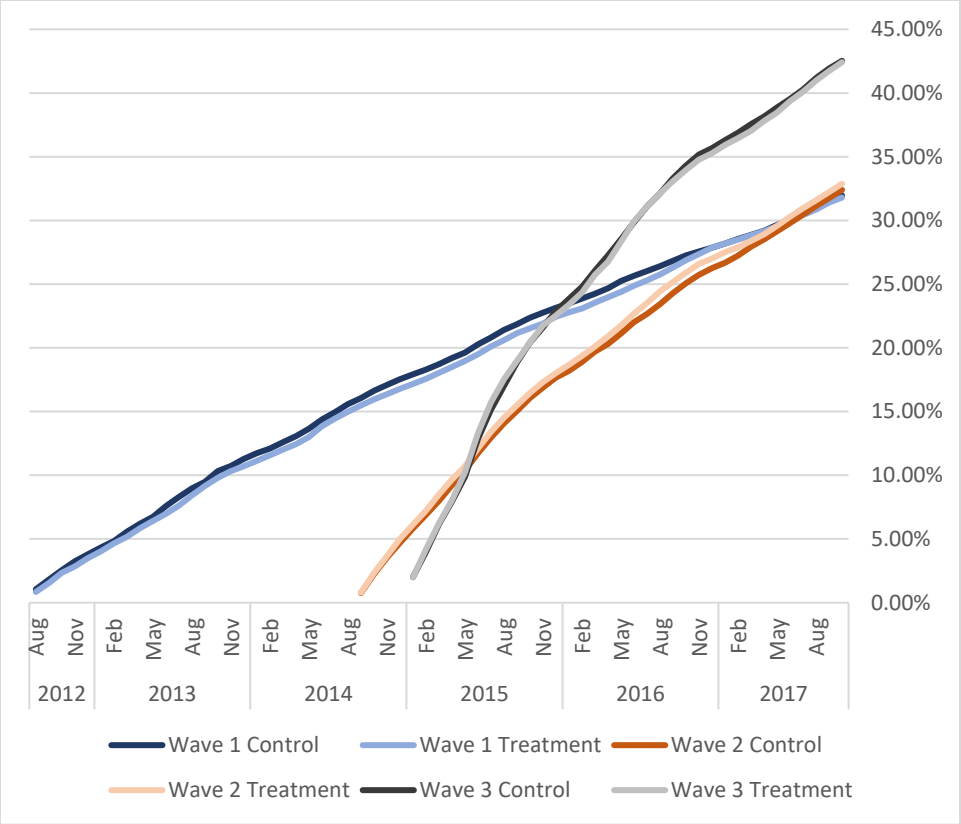
The tracking of treatment and control households can be affected by either move-outs or opt-outs (known collectively as 'decay').

3.1.1 Move-Outs

When an inhabitant moves, that households cannot be retained as the inhabitant/address link has been broken. The evaluation timespan for that household ends on the move out date. If a household's final bill was before November 2017[6], it was considered a move out household. To determine if a household became a move out at the very end of the year, additional 2018 data are needed to confirm the final billing date. Figure 2 displays the cumulative level of both treatment and control move outs over the program life by month, wave and treatment/control status. The Legacy wave of the program targeted higher use household, which are historically correlated with owner-occupied single-family homes. Subsequent waves targeted households with increasingly lower use. While not the intended target of the program, these latter types often have a higher share of renters and multifamily dwellings; these groups typically display higher move-out rates as they are a more mobile population.

[6] Few homes had data from January and February 2018. For most homes, billing data ends in December. This precludes move-out determinations from being made without examining subsequent months.

Figure 2: Move Outs by Treatment/Control and Wave



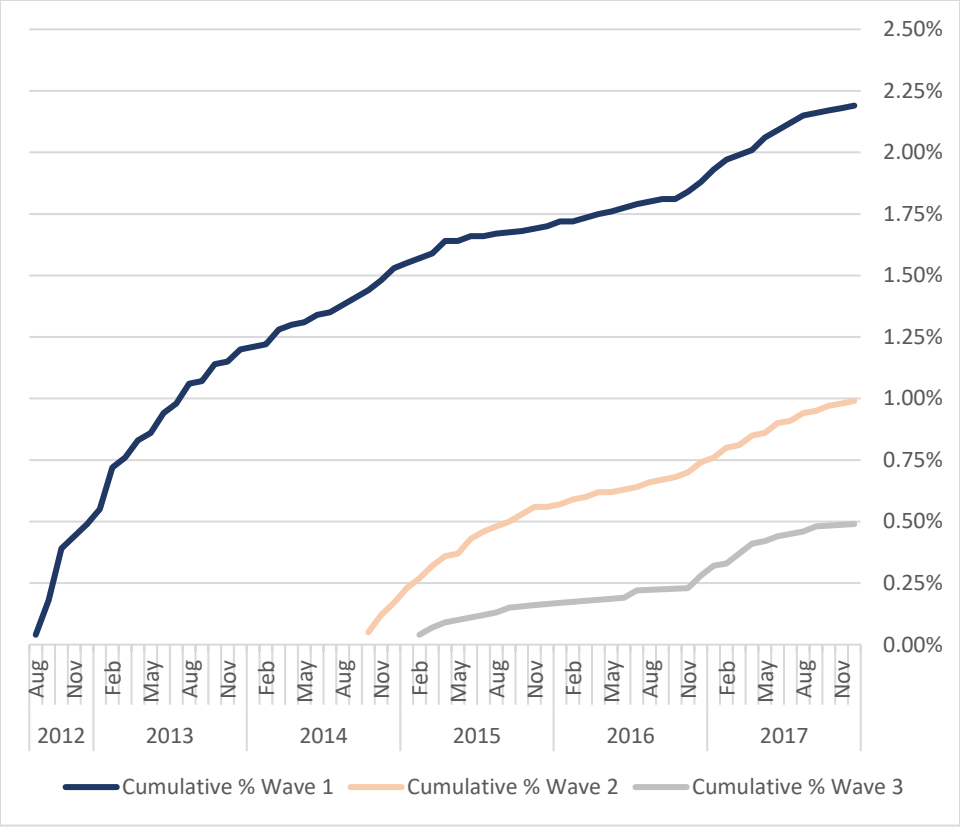
From each wave's onset until November 2017, the Legacy wave experienced a 31.80% move out rate for treatment and 31.96% for the control group. The Expansion wave had move out rates of 32.88% (treatment) and 32.40% (control). The Refill wave had move out rates of 42.42% (treatment) and 42.53% (control).

3.1.1 Opt-Outs

Households which receive energy reports (treatment group) can opt-out and no longer receive the mailings at any time. While these participants may wish to opt out of receiving report however, they are retained as evaluation households: While treatment opt-outs are observed, it is not possible to determine who in the control group would have opted out of receiving reports had they been in the treatment group, and thus no equivalent modification can be made. To prevent this from biasing results, the treatment group opt-outs are retained as evaluation households and the energy usage from the opt-outs in each group cancel each other out.

Figure 3 details the opt-outs over the program life by month and wave, including a cumulative tally.

Figure 3: Cumulative Treatment Group Opt Outs by Wave



From the onset of the Legacy Wave to December 2017, 2.19% of treatment customers have chosen to opt out. The Expansion and Refill waves had opt-out rates of 0.99% and 0.49%, respectively.

3.2 Savings Calculation Methodologies

For the impact evaluation, multiple analyses were run to determine wave-specific savings, including the post-only regression (PO), post-program regression (PPR) and linear fixed effects regression (LFER) models. There were run for each of the three waves (Legacy, Expansion, Refill) and for each timespan of interest: 2016 and 2017.

The primary savings calculation method used is a post-program regression model, recommended in the National Renewable Energy Laboratory (NREL) Uniform Methods Project (UMP)[7].

ADM compared the results of the three models: While the PO model with pre-usage controls yielded a slightly higher R-square than the PPR model, results are presented using the PPR specification to facilitate better comparability to prior evaluations. Savings estimates from the two models differed by less than .2%.

[7] https://energy.gov/sites/prod/files/2015/02/f19/UMPChapter17-residential-behavior.pdf

3.2.1 Post-Program Regression Specification

The post-program regression (PPR) model combines both cross-sectional and time series data in a panel dataset. This model uses only the post- program data, with lagged energy use for the same calendar month of the pre-program period acting as a control for any small systematic differences between the participant and control customers. In particular, energy use in calendar month *t* of the post-program period is framed as a function of both the participant variable and energy use in the same calendar month of the pre-program period. The underlying logic is that systematic differences between participants and controls will be reflected in differences in their past energy use, which is highly correlated with their current energy use. The version we estimate includes monthly fixed effects and interacts these monthly fixed effects with the pre-program energy use variable. These interaction terms allow pre-program usage to have a different effect on post-program usage in each calendar month.

Formally, the model is:

$$ADC_{kt} = \sum_{J} \beta_{1j} Month_{jt} + \sum_{J} \beta_{2j} Month_{jt} \cdot ADClag_{kt} + \beta_3 Participant_k + \varepsilon_{kt} ,$$

where,

ADC_{kt} = The average daily consumption in kWh for customer k during billing cycle t. This is the dependent variable in the model;

$Month_{jt}$ = A binary variable taking a value of 1 when j=t and 0 otherwise;[8]

$ADClag_{kt}$ = Customer k's energy use in the same calendar month of the pre-program year as the calendar month of month t;

$Participant_k$ = A binary variable indicating whether customer k is in the participant group (taking a value of 1) or in the control group (taking a value of 0);

ε_{kt} = The cluster-robust error term for customer k during billing cycle t. Cluster- robust errors account for heteroscedasticity and autocorrelation at the customer level.[9]

[8] If there are T post-program months, there are T monthly dummy variables in the model, with the dummy variable $Month_{tt}$ the only one to take a value of 1 at time t. These are, in other words, monthly fixed effects.

[9] For examples of academic applications of the approach to energy behavioral programs see: Alcott, Hunt. "Social Norms and Energy Conservation", Working paper, Massachusetts Institute of Technology (MIT), Cambridge, MA, 2009. Ayres, I., S. Raseman and A. Shih. "Evidence from Two Large Field Experiments that Peer Comparison Feedback Can Reduce Residential Energy Usage", NBER working paper no. 15386, September 2009. Costa, D.L. and M.E. Kahn. "Energy Conservation ″Nudges″ and Environmentalist Ideology: Evidence from a Randomized Residential Electricity Field Experiment", NBER working paper no. 15939, April 2010.

In this model, β_3 is the estimate of average daily energy savings due to the program. Program savings are the product of the average daily savings estimate and the total number of participant-days in the analysis.

3.2.2 Post-Only Specification

The model specification is as follows:

$$Usage_{it} = \alpha_0 + \beta * treatment_i$$
$$+\alpha_1 * PreUsage_i$$
$$+\alpha_2 * PreSummer_i$$
$$+\alpha_3 * PreWinter_i$$
$$+\gamma * mm_t$$
$$+\delta_1 * mm_t * PreUsage_i$$
$$+\delta_2 * mm_t * PreSummer_i$$
$$+\delta_3 * mm_t * PreWinter_i$$
$$+\varepsilon_{it}$$

Where

- *i* denotes the *i*th customer
- *t* denotes the first, second, third, etc. month of the post-treatment period
- $Usage_{it}$ is the average daily use for read *t* for household *i* during the post-treatment period
- $PreUsage_i$ is the average daily usage across households *i's* available pre-treatment billing reads.
- $PreWinter_i$ is the average daily usage over the months of December January, February, and March over household *i's* available pre-treatment meter reads.
- $PreSummer_i$ is the average daily usage over the months of June, July, August, and September over household *i's* available pre-treatment meter reads.
- mm_t is a vector of month-year dummies

And parameter definitions are:

- α_0 is an intercept term
- α_1, α_2 , α_3 are effects of control variables $PreUsage_i$, $PreWinter_i$, $PreSummer_i$ on $Usage_{it}$ in the reference month.
- $\delta_1, \delta_2, \delta_3$ are the effect of the control variables in each month-year (mm_t) of the post period.
- ε_{it} is an error term

3.2.3 Linear Fixed-Effects Regression Model

The simplest version of a linear fixed-effects regression (LFER) model, the One-Way LFER model, is one in which average daily consumption of kWh by customer *k* in bill *t*, denoted by ADC_{kt} , is a function of two variables: the binary variable $Treatment_k$, taking a value of 1 if

household *k* is assigned to the treatment group, and 0 otherwise; and the binary variable $Post_t$, taking a value of 0 if the observation *t* is before the *program start date* and 1 if the observation is after the program start date.

Formally, the model is,

$$ADC_{kt} = \alpha_{0k} + \alpha_1 Post_t + \alpha_2 Treatment_k \cdot Post_t + \varepsilon_{kt}.$$

Three observations about this specification deserve comment. First, the coefficient α_{0k} captures *all* customer-specific effects on energy use that do not change over time, including those that are unobservable. Second, α_1 captures the average effect among control customers of being in the post treatment period. In other words, it captures the effects of exogenous factors, such as an economic recession, that affect control customers in the post treatment period but not in the pre-treatment period. Third, $\alpha_1 + \alpha_2$ captures the average effect among treatment customers of being in the post treatment period, and so for these households the effect directly attributable to the program is captured by the coefficient α_2.

3.3 Double Counting Analysis

Measurement of savings from behavioral programs needs to account for other program savings to ensure that the PacifiCorp residential portfolio is not double counting any savings.

The first step in this process is to cross-reference the account IDs for each treatment and control group customer with all other program participation in the study period. Pacific Power provided ADM with all other program tracking data, and the datasets were cross-referenced by account number. This resulted in a total "other program kWh" per-group, per-wave, per-state.

What is important in this analysis is to normalize the effects to the number of households in the group. The treatment and control groups are not precisely matched in customer count (and in the case of the Expansion wave, the treatment group is 3.07 times the size of the control group). As such, if one were to directly compare the other-program-kWh of the treatment and control group, it would overestimate the double count (a treatment group of 30,000 customers is most assuredly going to show higher savings than a matched control group of 10,000 customers). By comparing this on a per-household basis, we normalize to the reality of mismatched treatment and control group population sizes.

The final double count savings (calculated separately for each unique wave in each program year) is as follows:

$$Uplift = \left(\frac{OP\ kWh}{Hosehold_{Treatment}} - \frac{OP\ kWh}{Hosehold_{Control}}\right) \times \#\ Accounts_{Treatemt}$$

Where,

$$\frac{OP\ kWh}{Hosehold_{Treatment}} = Other\ program\ kWh\ per\ household\ in\ the\ treatment\ group$$

$$\frac{OP\ kWh}{Hosehold_{Control}} = Other\ program\ kWh\ per\ household\ in\ the\ control\ group$$

$$\#\ Accounts_{Treatemt} = Total\ accounts\ in\ the\ treatment\ group$$

Further discussion of the double counting analysis as well detailed results can be found in Appendix B: Double Counting Analysis.

3.4 Summary of Data Used

The data used in this study was comprised of billing data supplied by Pacific Power and treatment and control group assignment information provided by the third-party implementer, Opower.

As part of the data cleaning, the following observations were removed to create the sample used in the regression analyses:

- Observations with fewer than 10 days or more than 90 days in the billing cycle; these observations were removed because long and short bills can be an indication of an issue in the recording of energy use. In past evaluations, the inclusion range was 20-40 days. ADM broadened this range as abnormal billing reads may not be randomly distributed; in particular, long billing cycles are more common among rural populations.
- Observations outside of the evaluation period: the 12-month pre-program period and the post-program period.
- Outliers, which are defined as observations with average daily usage at least 10 times larger or 10 times smaller than the median usage; these observations were removed because very high or very low observations of energy use can have an outsize impact on the regression results biasing the estimate of savings.

3.5 Process Evaluation

ADM conducted a telephone survey of treatment and control group households in the HER Program. The objectives of this survey were to:

- Identify energy habits of treatment and control group households;
- Obtain feedback on program experience from treatment households;
- Develop metrics of knowledge gained as a result of program participation;
- Identify behaviors taken by treatment households to produce energy savings.

Surveys were conducted on weeknight evenings and during weekends to ensure a representative sample. The survey was administered in both English and Spanish.

3.5.1 Sample Size

The sample was comprised of 80 households for each treatment and control group wave. This sample was developed to meet 90% confidence and ±10% precision for binary questions.

Table 10: Survey Sample & Completion Summary

Wave	*Target*	*Achieved*	*Sample Provided*	*Total Population*
Legacy Treatment	80	80	1,623	9,438
Legacy Control	80	80	1,655	9,459
Expansion Treatment	80	80	1,780	26,601
Expansion Control	80	80	1,794	8,720
Refill Treatment	80	80	1,743	3,964
Refill Control	80	80	1,734	3,944

4. Impact Evaluation Results

Table 11 summarizes the verified energy savings across all three waves. Overall verified net savings were 21,874 MWh over the two year period. Of this, 45% were from the Legacy Wave, 52% from the Expansion Wave, and 3% from the Refill Wave. Savings estimated across the three models differed by 3%. The post program regression model is used for reporting savings.

Table 11: Overall Savings Summary

Variable	***2016***	***2017***	***2016-12017***
Number of Treatment Customers	45,955	40,898	40,898
Number of Control Customers	24,963	22,432	22,432
Savings as a Percent of Annual Use	1.23%	1.78%	1.49%
Verified Net Savings (MWh)	**9,590**	**12,284**	**21,874**

Table 12: Savings by Wave

	Legacy		***Expansion***		***Refill***	
Variable	***2016***	***2017***	***2016***	***2017***	***2016***	***2017***
Number of Treatment Customers	10,210	9,456	30,947	27,412	4,798	4,030
Number of Control Customers	10,130	9,476	10,042	8,950	4,791	4,006
Percent Savings	1.78%	2.31%	1.13%	1.71%	0.72%	1.02%
90% Confidence Interval	[1.90%, 1.66%]	[2.54%, 2.09%]	[1.31%, .94%]	[1.93%, 1.49%]	[1.22%, .26%]	[1.61%, .40%]
Average Daily Savings per Customer (kWh)	1.189	1.547	0.432	0.654	0.141	0.202
Standard Error	0.08	.09	0.04	0.05	0.74	0.66
90% Confidence Interval	[1.32, 1.06]	[1.7,1.4]	[0.5,0.36]	[0.74, 0.57]	[0.24, 0.05]	[0.32, 0.08]
Verified Net Savings Before Double Count Adjustment (MWh)	4,443	5,340	4,888	6,547	248	297
90% Confidence Interval	[4,983.9, 4,002.24]	[5,900.80, 4,859.48]	[5,865.3, 4,223.06]	[7,511.95, 5,786.23]	[699.30, 145.69]	[749.75, 187.44]
Savings Double Count in Other Energy Efficiency Programs (MWh) [10]	-35	49	26	34	20	17
Final Verified Net Savings (MWh)	**4,408**	**5,389**	**4,914**	**6,581**	**268**	**314**

[10] These amounts are used to adjust the realized savings to account for energy savings measure implemented through other residential energy efficiency programs. A negative value indicates less of an effect (decreased consumption) from these programs as compared to the control group and thus their savings is subtracted to account for the difference. A positive value means the opposite.

4.1 Model Output

The output from the Post Program Regression model was used to report savings estimates for the program. shown below in Table 13.

Table 13: Post Program Regression Results

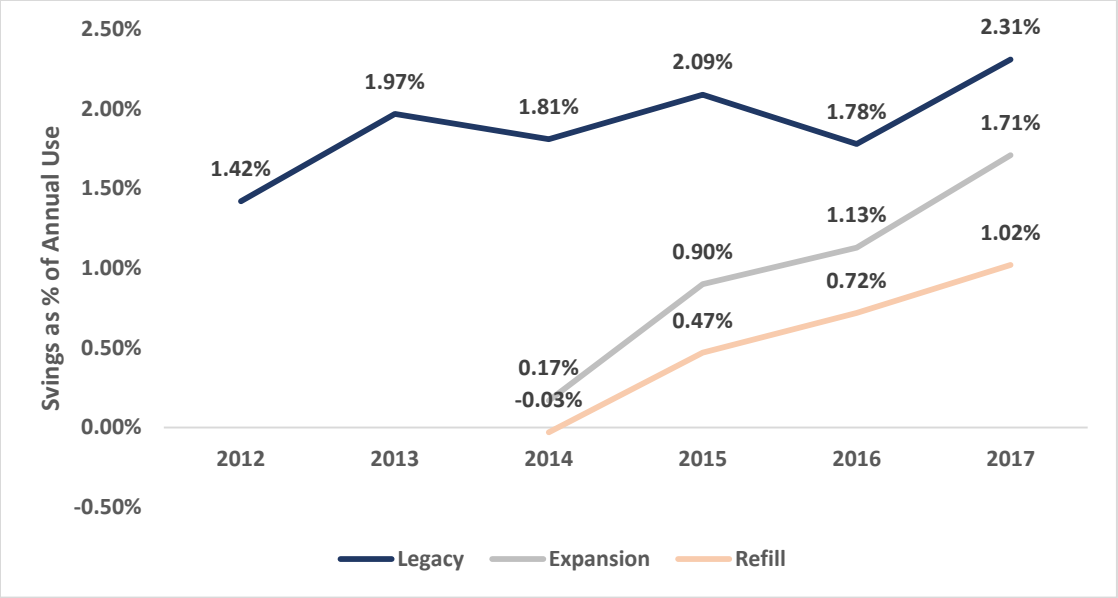
	Legacy		***Expansion***		***Refill***	
Variable	***2016***	***2017***	***2016***	***2017***	***2016***	***2017***
Number of Treatment Customers	10,210	9,456	30,947	27,412	4,798	4,030
Number of Control Customers	10,130	9,476	10,042	8,950	4,791	4,006
Percent Savings	1.78%	2.31%	1.13%	1.71%	0.72%	1.02%
Average Daily Savings per Customer (kWh)	1.189	1.547	0.432	0.654	0.141	0.202
Verified Net Savings Before Double Count Adjustment (MWh)	**4,443**	**5,340**	**4,888**	**6,547**	**248**	**297**

The three waves have significantly differing savings rates as a percent of annual use. There are multiple factors which contribute to this:

- **Length of time in treatment group.** Waves 1-3 have received reports for five, three, and two years, respectively. Historically, there has been a documented effect in behavioral programs of longer treatment resulting increased savings as a percent of billed use.
- **Difference in pre-treatment energy use.** With each successive wave, the available savings potential declines as the program first targeted high-use customers. Higher users have historically demonstrated a high percentage of savings. This is due to there being more usage that could be considered discretionary, and as a result, high-use customers have the greater potential for savings both in absolute and relative terms.

Across all waves, savings as a percent of billed use have trended upwards since program inception. As shown inFigure 4, all waves demonstrated their highest savings as percent of billed use in 2017. The Expansion and Refill waves had particularly acute increases, reaching 1.71% and 1.02% of billed use in 2017 respectively.

Figure 4: Longitudinal Savings as Percent of Billed Use by Wave & Program Year



4.2 Double Counting Findings

Savings estimates for HER must also take into account savings resulting from other programs. ADM examined program tracking data from Pacific Power's residential rebate programs, Home Energy Savings (HES) and Low Income Weatherization (LIW), and savings claimed by these programs was netted out of HER savings estimates to avoid double-counting of the same savings.

4.2.1 Double Counting from Down Stream Measures

The first double-counting analysis is for the downstream measures. These programs track participation by customer and thus program savings can be directly tied to a treatment or control group accounts.

Table 14: Double Count Results - 2016

Wave	*Participants*	*Other-Program kWh per-Account*		*Double-Count (kWh)*[11]
		Treatment	*Control*	
Legacy	10,210	41.35	37.95	34,790
Expansion	30,947	19.78	20.61	-25,747
Refill	4,798	12.13	16.22	-19,593

Table 15: Double Count Results - 2017

[11] The sign on this value indicated whether the kWh value is added or subtracted from program savings.

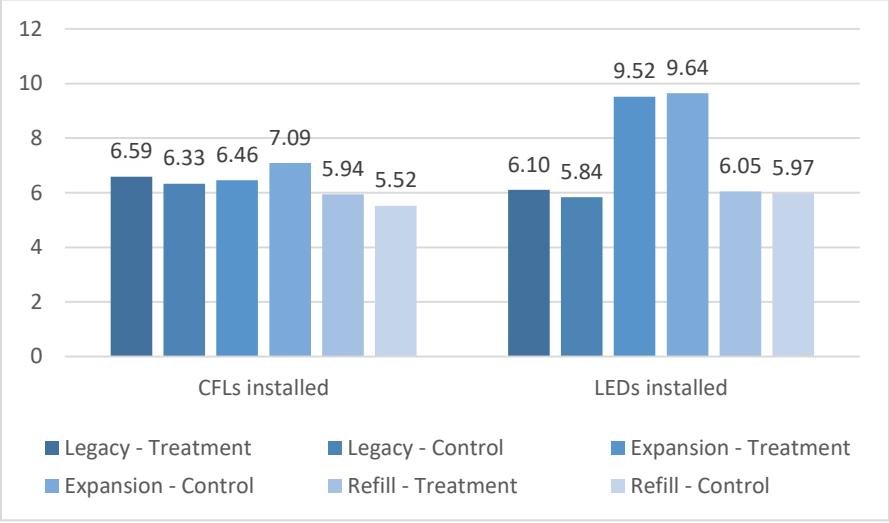
Wave	*Participants*	*Other-Program kWh per-Account*		*Double-Count (kWh)*[12]
		Treatment	*Control*	
Legacy	9,456	19.77	24.93	-48,735
Expansion	27,412	11.52	12.76	-34,036
Refill	4030	4.12	8.46	-17,478

4.2.2 Double Counting Analysis for Upstream Point-of-Sale Measures

For upstream point-of-sale lighting markdown measures, the end-use customer is not tracked. As a result, the double counting analysis for this program cannot be tied to program data. To address a possibly unequal amount of lighting installation across treatment and control groups, ADM surveyed treatment and control group customers and asked about CFLs and LEDs purchase and installation quantities in 2017. The quantities of CFLs and LEDs installed are summarized in Figure 5.

Within a wave, quantities installed were often higher for the control or treatment group. The only statistically significant difference was between CFLs installed in the Expansion group; with 7.09 installed per household reported in the control group and 6.46 in the treatment group, this would imply that this wave's impact model is underestimating savings. However, due to the high variation in the direction of these effects across models, ADM opted to not apply the results of this model. This is consistent with how this effect was addressed in the 2014-2015 evaluations of this program.

Figure 5: Quantities of CFLs & LEDs Installed



[12] The sign on this value indicated whether the kWh value is added or subtracted from program savings.

5. Process Evaluation Findings

ADM designed and administered a customer survey for the treatment and control groups in the Legacy, Expansion, and Refill waves. The research objectives of this were to:

- Identify energy habits of treatment and control group households;
- Obtain feedback on program experience from treatment households;
- Develop metrics of knowledge gained as a result of program participation;
- Identify behaviors taken by treatment households to produce energy savings.

5.1 Self-Perception of Consumption & Efficiency

Respondents were first asked how they felt their energy usage compared to other homes of similar size.

Figure 6: Self-Perception of Usage Compared to Similar Homes – Legacy

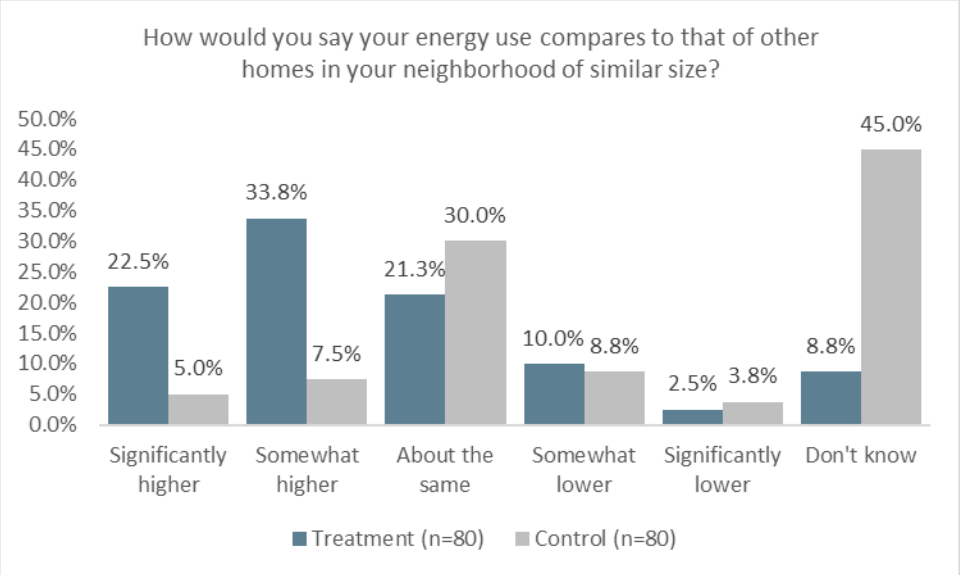


Figure 7: Self-Perception of Usage Compared to Similar Homes –Expansion

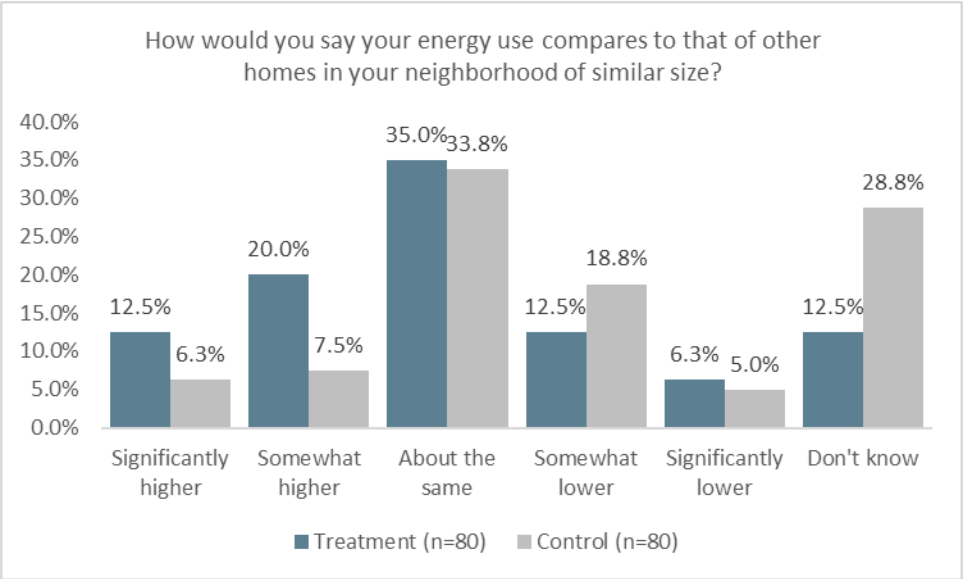
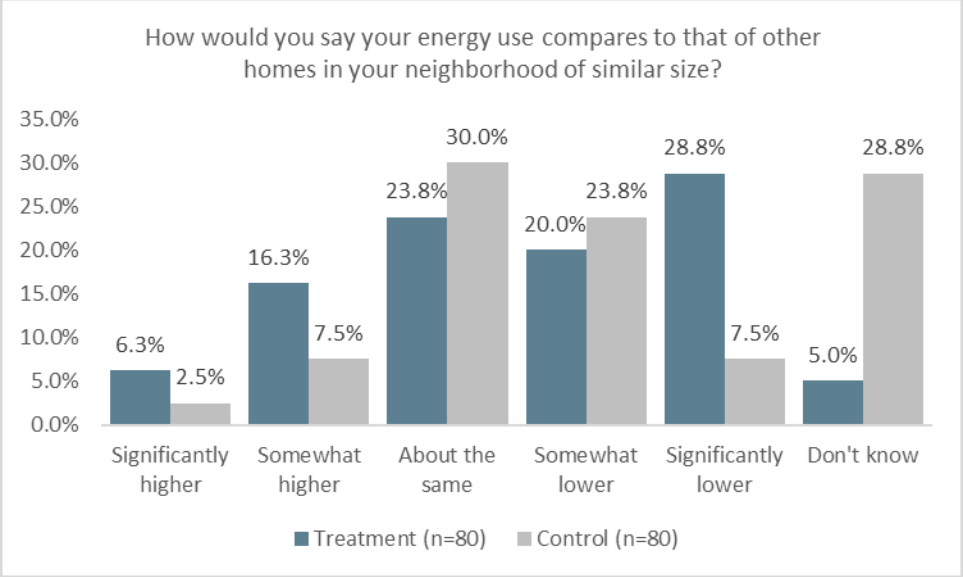


Figure 8: Self-Perception of Usage Compared to Similar Homes – Refill



What is most telling in these responses is the increased self-awareness of the home energy report recipients. In all three waves, a significantly ($p<.05$) higher proportion of control group respondents stated that they do not know how their home's energy use compares to similar homes. Most notably, 45% of Wave 1 control group respondents stated that they don't know how their usage would compare to their neighbors.

In general, members of the treatment waves are also more likely to describe themselves as relatively intensive energy users compared to control group respondents. This difference in self-perception is most notable among the Legacy respondents, among whom 56.1% consider

themselves use at least somewhat more energy than their neighbors, compared to 12.5% of control group respondents. The fact that such a dramatic difference in self-perception is observed in all waves speaks to the efficacy of the home energy report in providing increased self-awareness about household energy use.

Respondents were then asked to identify how efficient they perceive their household to be in terms of energy use.

Figure 9: Self-Assessment of Home Efficiency – Legacy

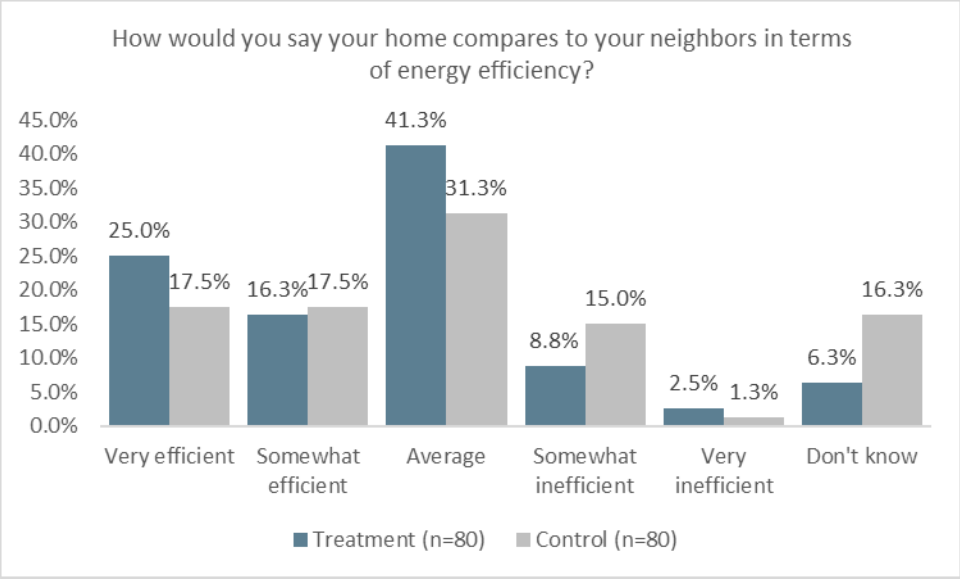


Figure 10: Self-Assessment of Home Efficiency – Expansion

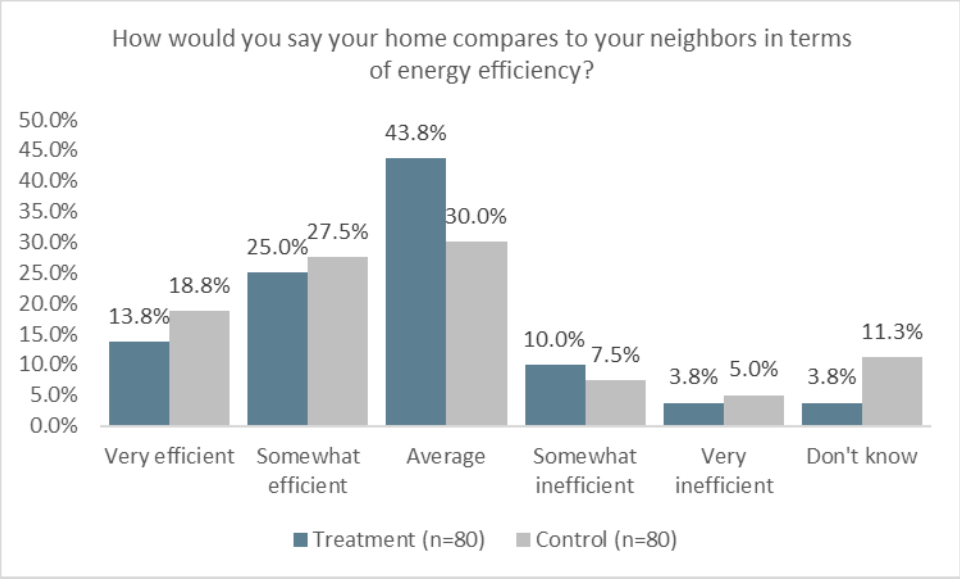
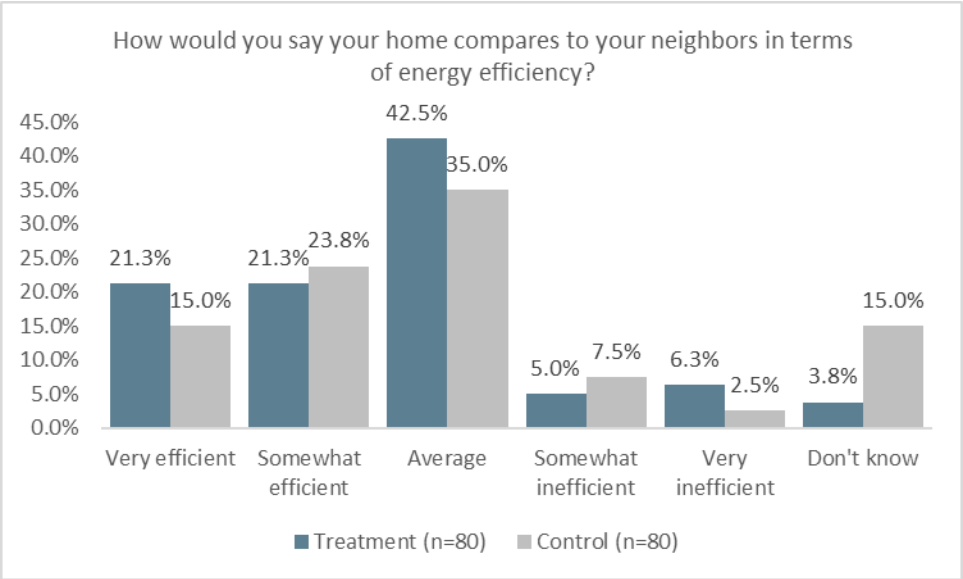


Figure 11: Self-Assessment of Home Efficiency – Refill



The home energy report does not seem to have as large an impact on independent assessments of efficiency as it does on the relative assessment of energy use. The notable effect common to all three waves is that treatment respondents are more likely to identify themselves as "average" while control group respondents are more likely to state that they "don't know" how efficient their home is in comparison to their neighbors. A respondent's assessment of their energy use relative to their neighbors does not seem to have a consistent effect on their independent assessment of their own energy use. Among Legacy respondents, recipients of the home energy reports who classified their energy use as at least somewhat higher than their neighbors were not significantly more likely than members of the control to then independently classify their energy use as inefficient or somewhat inefficient. The reciprocal is true of respondents who classified their energy use as more efficient than their neighbors—recipients were no more likely than the control group to make a connection between their energy use relative to their neighbors and their energy use considered in isolation.

5.2 Response to Energy Efficiency Messaging

Respondents were then asked if they were aware of energy efficiency programs offered by Pacific Power. If they stated that they were aware of such programs, they were then read descriptions of specific programs and asked if they could recall the specific program described.

Only Refill respondents indicated a statistically significant increase in general awareness of Pacific Power energy efficiency programs.[13]

[13] Each value is presented as a percent of total respondents (i.e., though only those that indicated awareness wattSmart programs were asked if they could identify Home Energy Savings, the percent displayed for Home Energy Savings is "percent of all survey respondents that recall the program", rather than "percent of those that are aware of wattSmart that can recall Home Energy Savings specifically".

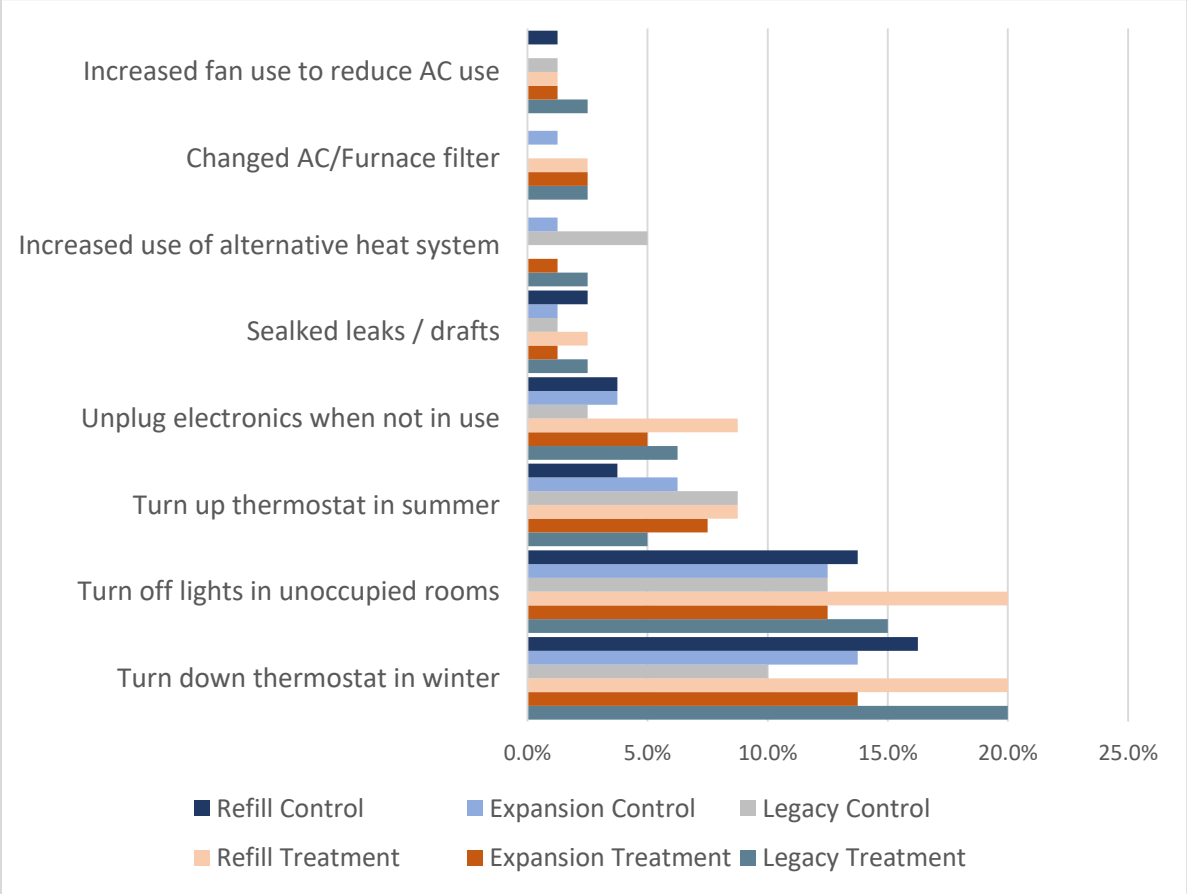
Table 16: Recollection of Energy Efficiency Programs

	Legacy		*Expansion*		*Refill*	
	Treat.	***Control***	***Treat.***	***Control***	***Treat.***	***Control***
Any Program (non-specific)	61.3%	62.5%	63.8%	66.3%	70.0%	51.3%
Home Energy Savings	48.8%	46.3%	43.7%	47.5%	45.0%	37.6%
Low Income Weatherization	35.0%	32.5%	31.2%	37.5%	40.0%	28.8%
wattSmart Business	30.0%	30.0%	20.0%	38.8%	30.0%	20.0%

5.3 Energy Conservation Behaviors Adopted

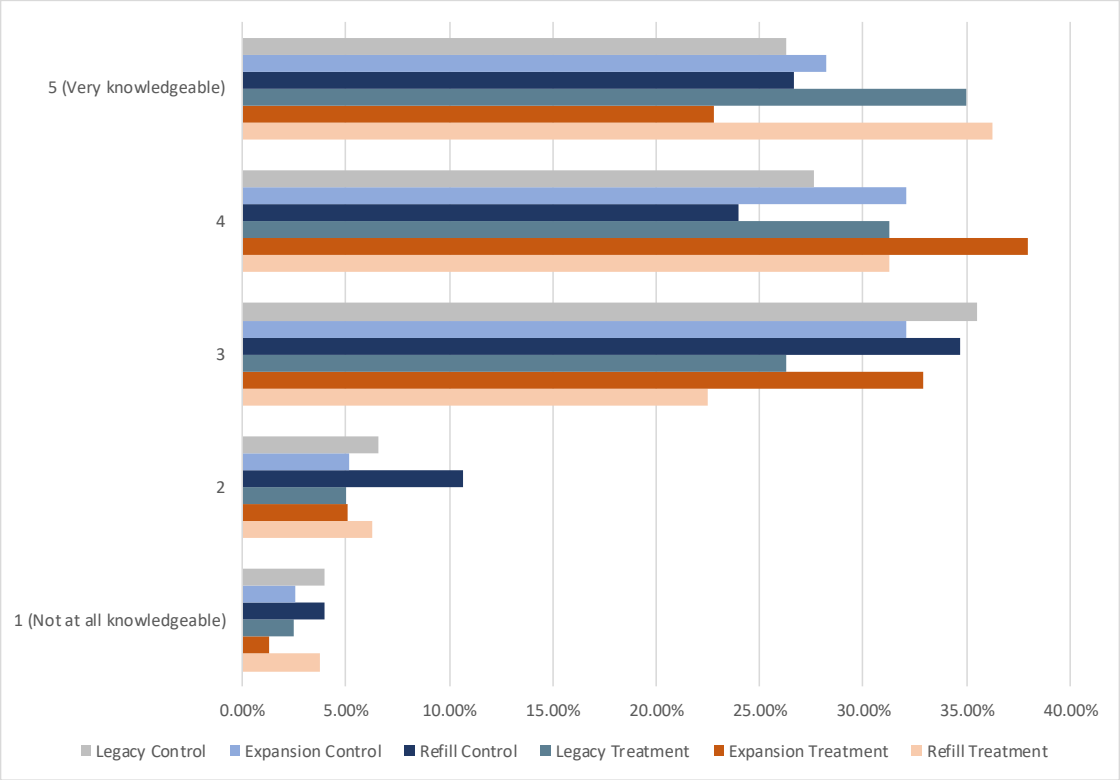
Respondents were asked to identify behaviors they had undertaken or improvements they had made to their home in the last 12 months that would reduce their electricity usage. Figure 12 summarizes common behaviors taken by survey respondents. All listed behaviors were pre-set categories in the survey except for "Increase use of alternative heating system". ADM found this to be a common answer in "other", in which verbatim responses included specifying increase use of wood stoves, wood fireplaces, gas fireplaces, and propane heating to reduce electricity usage.

Figure 12: Common Behaviors Cited by Survey Respondents



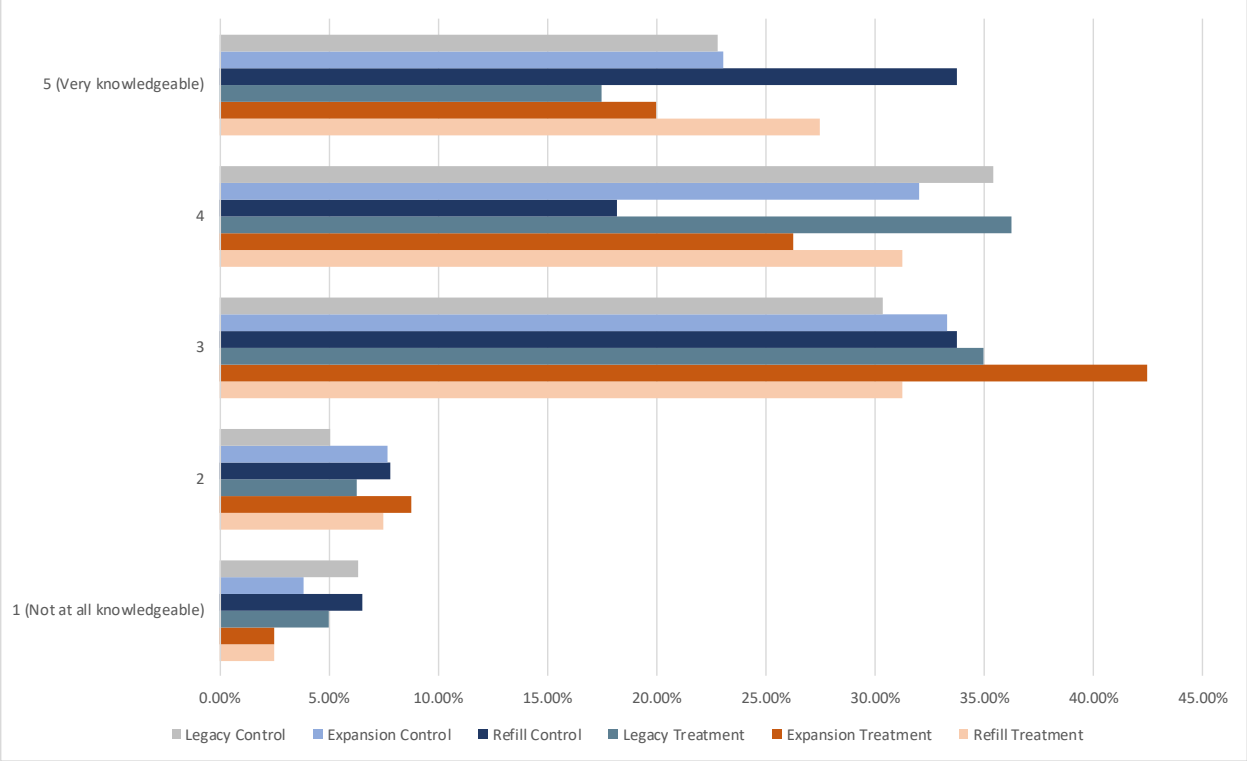
Overall, on a scale of "1 to 5" where "1" means "Not at all knowledgeable" and "5" means "Very knowledgeable," how knowledgeable are you about ways to save energy in your home?

Figure 13: Self-Assessment of Knowledge of Energy Efficiency



Using a scale of 1 to 5, with 1 meaning "you have not done much" and 5 meaning "you have done almost everything you can", how would you rate your household's efforts to save electricity in your home?

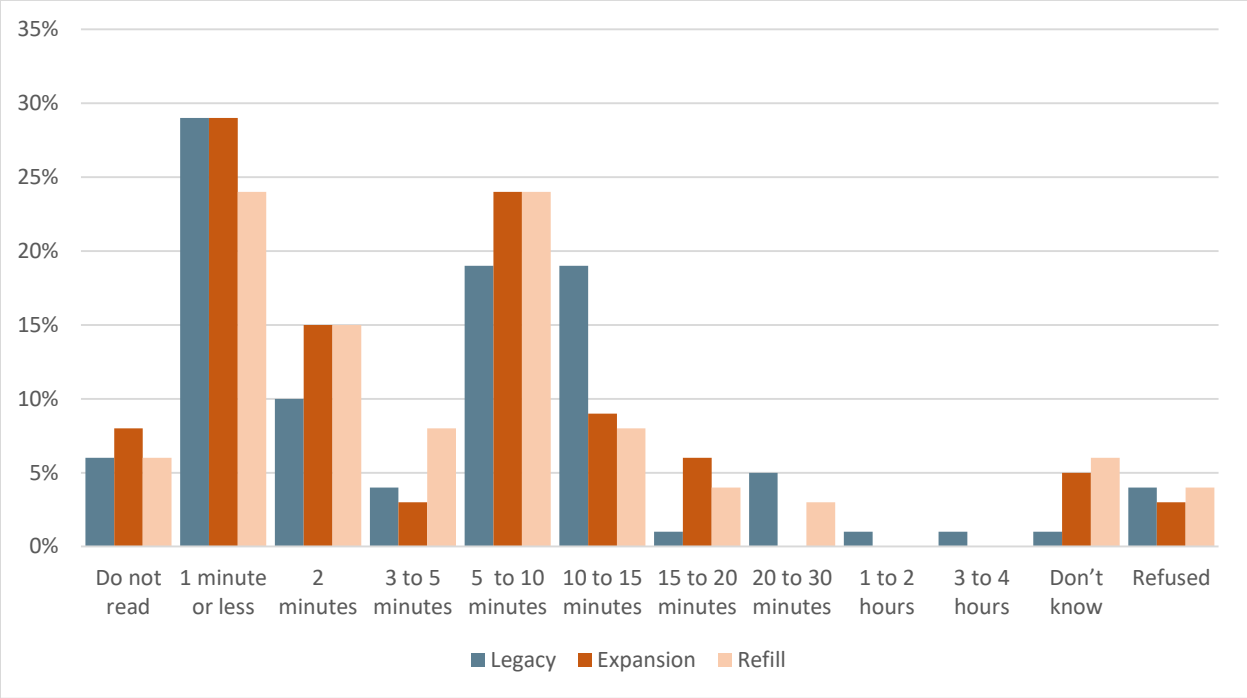
Figure 14: Self-Assessment of Household Efforts to Save Electricity



5.4 Engagement with Home Energy Report

Respondents were asked to identify how much time they spend reading their home energy report.

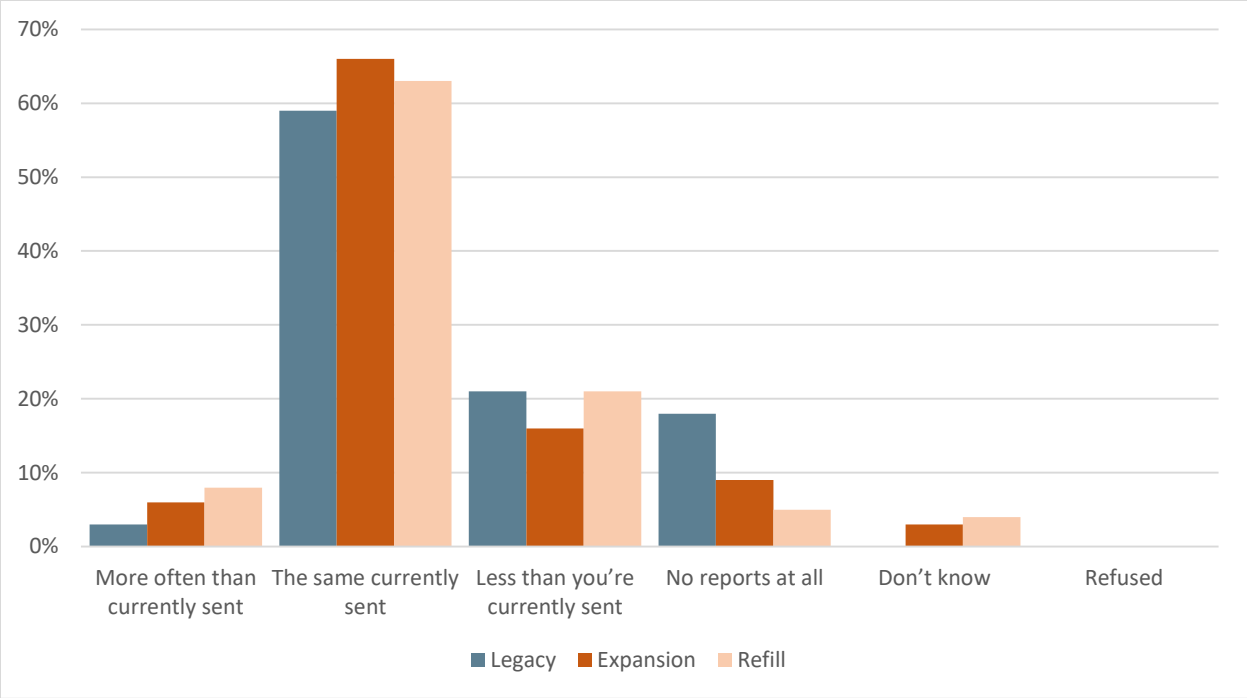
Figure 15: Time Spent Reading Home Energy Report



Across all three waves, respondents were most likely to indicate that they spend one minute or less reading the home energy report (ranging from 29% in the Legacy wave to 24% in the Refill wave). The next popular answer was 5 to 10-minutes (22% of all respondents). ,.

Respondents were then asked to identify how often they would like to receive reports, relative to their current delivery schedule. These results are summarized below in Figure 16.

Figure 16: Desired Frequency of Report Delivery

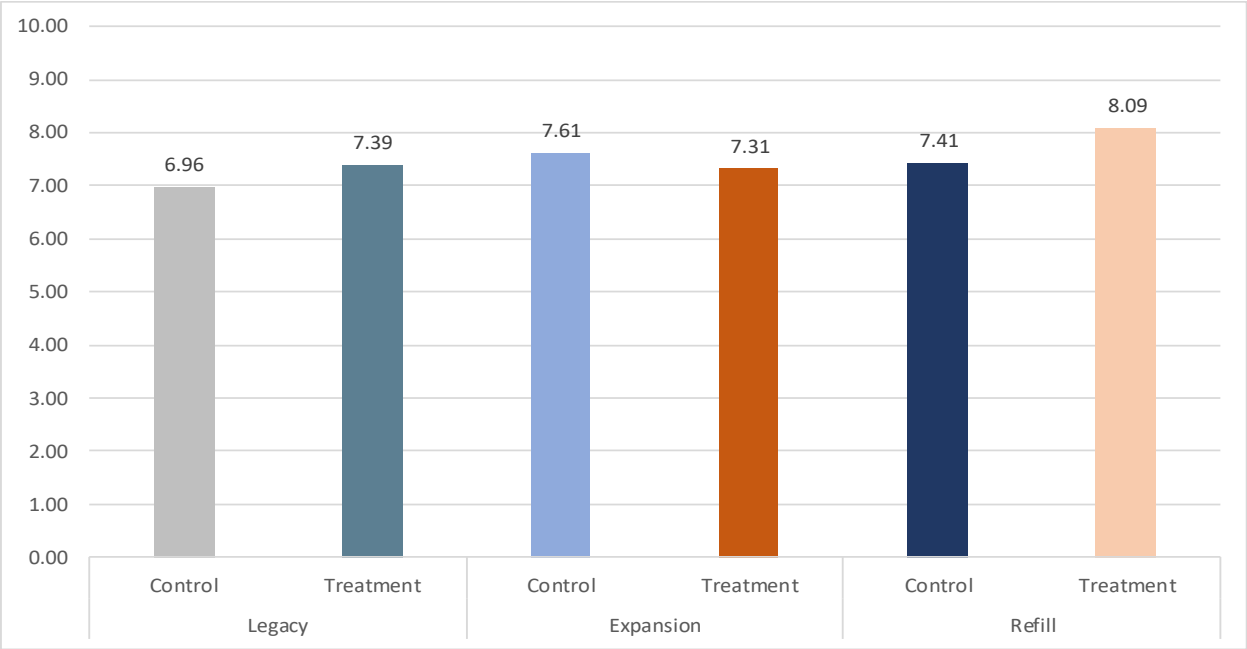


Overall, the majority of respondents (63%) would like to keep the same delivery schedule for home energy reports. Ten percent of respondents stated that they would not like to receive any further reports. Of those that stated they would not like to see any further reports, 35% indicated that they do not read their report at all. ADM also notes that there is a linear relationship in program tenure and a desire to no longer receive reports; Legacy customers were over three times as likely to indicate that they do not want to receive further reports as Refill customers (18% and 5%, respectively).

5.5 Customer Satisfaction Level

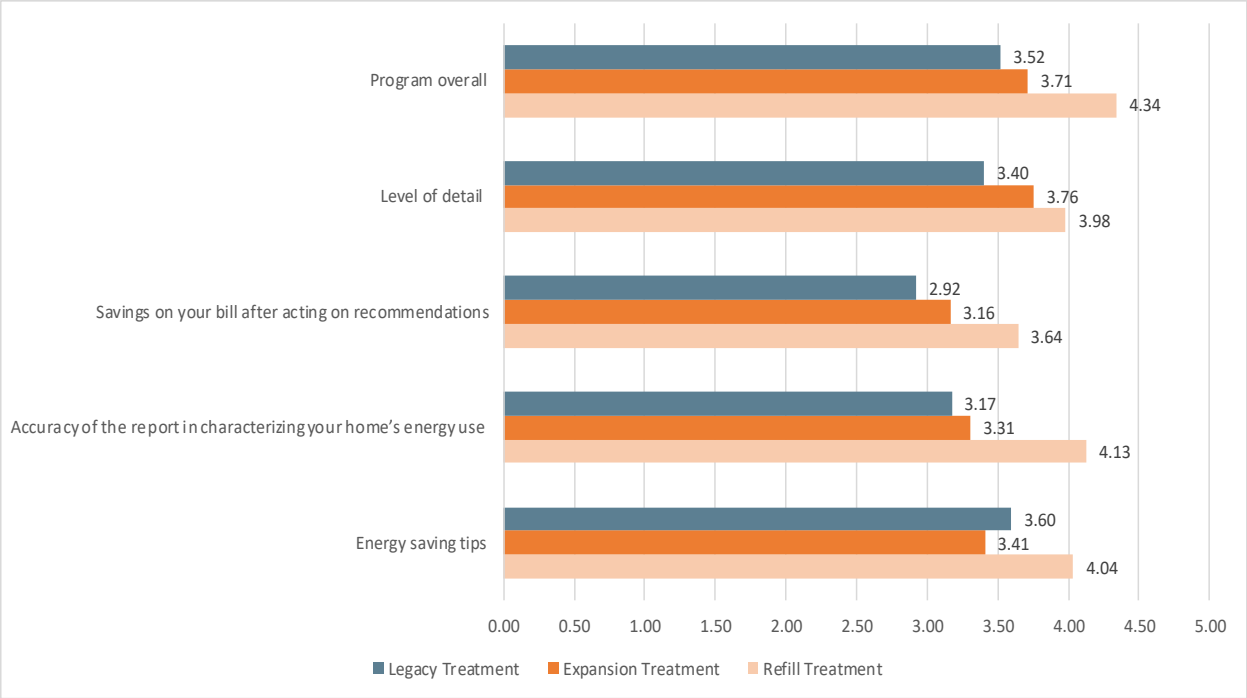
Respondents were then asked to rate their satisfaction with Pacific Power and with other program elements.

Figure 17: Satisfaction with Pacific Power



On a scale of 1-5, where "1" is "very dissatisfied" and "5" is "very satisfied," how satisfied would you say you are with the following home energy report characteristics?

Figure 18: Satisfaction with Program Elements



The Refill wave was more likely to indicate satisfaction with Pacific Power and with the program overall. There is no statistically significant causal relationship between satisfaction and program treatment.

6. Effective Measure Life and Lifetime Savings

This section discusses methods used in determining measure life as well as program lifetime savings.

6.1 Methodology

The lifetime savings were calculated based on the convergence of savings based on the degradation and attrition rates. The formula for this is:

$$Lifetime\ MWh = 1st\ yr\ MWh + \sum_{t=2}^{\infty} 1st\ yr\ MWh \times (1-\theta)^{t-1} \times (1-\lambda)^{t-1}$$

Where,

$t = Year\ t$

$\theta = Savings\ degredation\ rate$

$\lambda = Program\ attrition\ rate$

This series converges at:

$$Lifetime\ MWh = \frac{1st\ yr\ MWh}{\theta + \lambda - (\theta \times \lambda)}$$

Effective Useful Life is the median length of time (in years) that an energy efficiency measure is functional. Effective Useful Life (EUL) is calculated as:

Lifetime MWH / First-year MWh

The calculation of this requires first-year savings, attrition rate and degradation rate, which are discussed in the following section.

6.2 Inputs

6.2.1 Realized Savings

Table 17 below displays the final realized MWh savings after adjusting for double counting.

Table 17: Realized Savings by Wave and by Year

Wave	*2016*	*2017*	*Total*
Legacy	4,408	5,389	9,797
Expansion	4,914	6,581	11,495
Refill	268	314	582
Total	**9,590**	**12,284**	**21,874**

6.2.2 Attrition Rates

The attrition rates, discussed in section 3.1 Decay, are summarized below in Table 18:

Table 18: Program Attrition by Wave

Wave	*Attrition Rate*
Legacy	7.4%
Expansion	11.4%
Refill	16.0%

In calculating EUL, we used attrition observed in each wave. The result was a separate EUL for each of the three randomized control trials.

6.2.3 Saving Degradation Rate

Unlike the attrition, the degradation rate (or savings decay), is intrinsically not observable during the program, thus it is necessary to use secondary materials to select an appropriate savings degradation rate. To determine an appropriate rate, ADM reviewed studies and reports of persistence in similar HER programs.

In 2016 Navigant conducted a degradation rate and persistence study of a two-year ComEd HER program[14] The group estimated degradation to be 24%, noting that groups which received reports for longer periods of time showed more savings persistence than those whole received reports for a relatively short period of time. A meta-analysis conducted by Cadmus[15] (2014) examined five studies conducted by Alcott and Rogers, NMR Group/Tetra Tech/Allcot, Integral Analytics, and DNV-GL. Each study focused on RCT HER programs which were discontinued after two years of treatment. The groups which no longer received reports were then compared with groups which still continued to receive reports, as well as control groups. The result varied between 11% and 32% degradation, but the average degradation rate is approximately 20% per year. The results of this analysis prompted the Statewide Evaluation Team to use a 20% degradation rate to estimate potential savings and cost-effectiveness in a study submitted to the Pennsylvania Public Service Commission.[16]

After reviewing related literature, ADM has determined that a 20% degradation rate is appropriate in determining an EUL for the Pacific Power HER Evaluation.

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[14] Navigant. 2016. ComEd Home Energy Report Program Decay Rate and Persistence Study – Year Two. http://ilsagfiles.org/SAG_files/Evaluation_Documents/Draft%20Reports%20for%20Comment/ComEd_EPY7/ComEd_HER_Year_Two_Persistence_and_Decay_Study_2016-07-20_Draft.pdf

[15] Khawaja, M. Sami, Ph.D. and James Stewart, Ph.D. Long-Run Savings and Cost-Effectiveness of Home Energy Report Programs. Cadmus Group, Inc. November 2014. http://www.cadmusgroup.com/wp-content/uploads/2014/11/Cadmus_Home_Energy_Reports_Winter2014.pdf

[16] Statewide Evaluation Team (SWE). 2015. Residential Behavioral Program Persistence Study. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_Res_Behavioral_Program-Persistence_Study.pdf

6.3 Results

The home energy report lifetime savings, for 2016 and 2017 are presented in Table 19 and Table 20.

Table 19: Lifetime Savings and Effective Useful Life (EUL) - 2016

2016	***Legacy***	***Expansion***	***Refill***
Degradation Rate	20%	20%	20%
Attrition Rate	7.4%	11.4%	16.0%
First-year MWh	4,408	4,914	268
Effective Useful Life	3.86	3.43	3.05
Lifetime MWh	17,014	16,864	817

Table 20: Lifetime Savings and Effective Useful Life (EUL) - 2017

2017	***Legacy***	***Expansion***	***Refill***
Degradation Rate	20%	20%	20%
Attrition Rate	7.4%	11.4%	16.0%
First-year MWh	5,389	6,581	314
EUL	3.86	3.43	3.05
Lifetime MWh	20,801	22,585	957

The resulting Legacy, Expansion and Refill wave EULs are 3.86, 3.43 and 3.05 years, respectively, inversely representative to attrition rates.

7. Key Findings and Recommendations

7.1 Impact Evaluation Findings

- **The post-program regression (PPR) model provides the verified savings for the 2016 and 2017 evaluation.** It was chosen to aid comparison to past evaluations which employed the PPR method. The post-only regression (PO) and linear fixed effects regression (LFER) methods were also used as comparisons.
- **Wave 1 savings as a percent of annual use declined in 2016 and rebounded in 2017.** Savings in 2016 were 1.78% of annual billed use. Savings in 2017 were 2.31%. This hovers around the 2015 savings value of 2.09%.
- **Wave 2 and Wave 3 demonstrated a consistent improvement in energy savings.** Savings as a percent of annual use climbed in 2016 and 2017 for the Expansion and Refill waves.
- **Wave 1 has begun to demonstrate some degradation of its control group.** Wave 1 had two months, of the 12-month pre-period, that, due to attrition, have become statistically significantly different in energy usage between the remaining control and treatment participants. Additional checks to confirm the groups are still balanced passed based on annualized use and regressing pre-period consumption with treatment assignment as a predictor. However, this is of key concern for the program as further degradation of the control group may result in invalid comparisons.

7.2 Process Evaluation Findings

- **Refill respondents indicated higher satisfaction with the program than the Legacy or Expansion waves.** Refill respondents rated their satisfaction with the program at 4.17 out of 5.00, compared to 3.68 and 3.45 for the Expansion and Legacy waves, respectively.
- **Longer program tenure is correlated with an increased likelihood to indicate no longer wanting to receive reports.** Eighteen percent of Legacy respondents stated they would no longer like to receive a report. In comparison, Expansion and Refill respondents were 9% and 5% likely to indicate this, respectively. This corresponds to the stated program satisfaction ratings, and it is ADM' hypothesis that Legacy treatment households may demonstrate "program fatigue" after seven six to seven years of receiving reports.
- **Participants in the Refill wave are notably younger with a higher educational attainment, lower income, fewer home occupants, and lower homeownership rate than prior program waves.** ADM identified statistically significant demographic indicators for the Refill wave compared to the Legacy and Expansion Waves in this respect.

7.3 Recommendations

- **Consider developing strategies to modify the control group to better-align with the treatment group on an annual or monthly basis.** This may include "refilling" the control group with new households or removing control group households to create a new match. Selection of control group replacements at various points during the program, such as at the end of the end of the Legacy and Expansion waves, will help test validity. Such replacements can be chosen using propensity score matching, based on historic kWh usage.
- **Where possible, tailor program recommendations to demographics.** The Refill wave skews younger, with a lower homeownership rate (and 20% of respondents indicated an income less than $25,000 per year). Program materials sent to this wave should have messaging focused on tips more appropriate for renters and lower income households (such as focusing information on low-cost or no-cost efficiency options, rather than on higher -cost appliances).
- **Consider cross-referencing treatment customers with known low income screening tools (such as LIHEAP registration) to spur outreach for Pacific Power low income programs.** These groups are to some extent pre-engaged with wattSmart via the home energy report and could be targeted for appropriate income-qualified programs.

8. Cost Effectiveness

This section presents the cost-effectiveness findings for the HER program using the realized savings for program year 2016 and 2017 for the state of Washington. Navigant completed cost-effectiveness tests of the Program using various approaches: PacifiCorp Total Resource Cost (PTRC) test, Total Resource Cost (TRC) test, Utility Cost (UTC) test, Ratepayer Impact Measure (RIM) test, and the Participant Cost Test (PCT). Each scenario is analyzed using modeled assumptions provided by PacifiCorp. These scenarios utilize the following assumptions:

- **Avoided Costs:** Utilized PacifiCorp's 2015 IRP west residential whole house 49% decrement along with the Washington single family heat pump load shape to calculate avoided costs.
- **Modeling Inputs:** Program level savings provided by PacifiCorp in the file Realized Savings Memo.docx.
- **Energy Rates:** Utilized the rates provided by PacifiCorp for the 2016 and 2017 Annual Report.
- **Line Loss Factors:** Residential line loss factor utilized throughout the analysis.
- **Measure Life:** The analysis utilized a 2-year measure life to be consistent with the 2017 annual reporting process.

The cost-effectiveness inputs are as follows:

Table 21: Utility Inputs

Parameter	***2016***	***2017***	***2016-2017***
Discount Rate for all B/C Tests	6.66%	6.66%	**6.66%**
Inflation Rate for all B/C Tests	1.90%	1.90%	**1.90%**
Line Loss Factor - Energy (%)	9.67%	9.67%	**9.67%**
Residential Energy Rate ($/kWh)	$0.08	$0.09	**-**
Gross Customer Costs	$0	$0	**$0**
Program Costs	$16,041	$20,498	**$36,538**
Utility Administrative	$4,756	$6,994	**$11,749**
Program Delivery	$317,907	$472,315	**$790,222**
Incentive Costs	$0	$0	**$0**

Table 22: Program Savings for the HER by Program Year

Program Year	***Gross kWh Savings***	***Realization Rate***	***Adjusted Gross kWh Savings***	***Net to Gross Ratio***	***Net kWh Savings***	***Measure Life***
2016	9,164,167	105%	9,590,000	100%	9,590,000	2
2017	12,225,593	100%	12,284,000	100%	12,284,000	2
2016-2017	**21,389,760**	**102%**	**21,874,000**	**100%**	**21,874,000**	**2**

Table 23: Cost/Benefit Ratios for the HER by Program Year

Program Year	***PTRC***	***TRC***	***UCT***	***RIM***	***PCT***
2016	2.70	2.46	2.46	0.43	n/a
2017	2.32	2.11	2.11	0.39	n/a

2016-2017	**2.47**	**2.25**	**2.25**	**0.41**	**n/a**

Table 24 provides cost-effectiveness results for the combination of program year 2016 and 2017, followed by the results for each individual year.

Table 24: HER Program Level Cost-Effectiveness Results – PY 2016 and 2017

Cost-Effectiveness Test	***Levelized $/kWh***	***Costs***	***Benefits***	***Net Benefits***	***Benefit/Cost Ratio***
Total Resource Cost Test (PTRC) + Conservation Adder	$0.02	$838,509	$2,074,461	$1,235,952	2.47
Total Resource Cost Test (TRC) No Adder	$0.02	$838,509	$1,885,874	$1,047,365	2.25
Utility Cost Test (UCT)	$0.02	$838,509	$1,885,874	$1,047,365	2.25
Rate Impact Test (RIM)		$4,653,505	$1,885,874	($2,767,631)	0.41
Participant Cost Test (PCT)		$0	$3,814,995	$3,814,995	n/a
Lifecycle Revenue Impacts ($/kWh)					$0.00
Discounted Participant Payback (years)					n/a

Table 25: HER Program Level Cost-Effectiveness Results – PY 2016

Cost-Effectiveness Test	***Levelized $/kWh***	***Costs***	***Benefits***	***Net Benefits***	***Benefit/Cost Ratio***
Total Resource Cost Test (PTRC) + Conservation Adder	$0.02	$338,703	$916,076	$577,372	2.70
Total Resource Cost Test (TRC) No Adder	$0.02	$338,703	$832,796	$494,093	2.46
Utility Cost Test (UCT)	$0.02	$338,703	$832,796	$494,093	2.46
Rate Impact Test (RIM)		$1,936,158	$832,796	($1,103,362)	0.43
Participant Cost Test (PCT)		$0	$1,597,455	$1,597,455	n/a
Lifecycle Revenue Impacts ($/kWh)					$0.00
Discounted Participant Payback (years)					n/a

Table 26: HER Program Level Cost-Effectiveness Results – PY 2017

Cost-Effectiveness Test	***Levelized $/kWh***	***Costs***	***Benefits***	***Net Benefits***	***Benefit/Cost Ratio***
Total Resource Cost Test (PTRC) + Conservation Adder	$0.02	$499,806	$1,158,386	$658,580	2.32
Total Resource Cost Test (TRC) No Adder	$0.02	$499,806	$1,053,078	$553,272	2.11
Utility Cost Test (UCT)	$0.02	$499,806	$1,053,078	$553,272	2.11
Rate Impact Test (RIM)		$2,717,347	$1,053,078	($1,664,269)	0.39
Participant Cost Test (PCT)		$0	$2,217,541	$2,217,541	n/a
Lifecycle Revenue Impacts ($/kWh)					$0.00
Discounted Participant Payback (years)					n/a

9. Appendix A: Regression Output

Table 27: 2016 PO Parameter Estimates, Legacy Wave

Variable	*2016*		*2017*	
	Coefficient	*t-statistic*	*Coefficient*	*t-statistic*
(Intercept)	12.395	22.361	16.788	27.956
treatment	-1.159	-14.992	-1.590	-17.841
avgPre.kWh	0.287	7.607	-0.684	-16.634
avgPreSummer.kWh	-0.104	-5.826	0.258	13.228
avgPreWinter.kWh	0.672	40.090	1.364	74.607
factor(month)2	0.369	0.473	-1.126	-1.309
factor(month)3	-0.923	-1.199	-3.620	-4.321
factor(month)4	-6.494	-8.263	-6.569	-7.727
factor(month)5	-8.716	-11.079	-10.689	-12.620
factor(month)6	-8.422	-10.701	-11.454	-13.356
factor(month)7	-7.051	-8.937	-8.224	-9.626
factor(month)8	-6.060	-7.670	-9.347	-10.976
factor(month)9	-8.874	-11.206	-11.397	-13.291
factor(month)10	-4.411	-5.572	-8.094	-9.421
factor(month)11	0.553	0.697	-3.130	-3.062
factor(month)12	2.469	3.090		
avgPre.kWh:factor(month)2	0.644	12.097	0.850	14.368
avgPre.kWh:factor(month)3	0.806	15.395	1.761	30.663
avgPre.kWh:factor(month)4	0.763	14.208	1.907	32.678
avgPre.kWh:factor(month)5	0.419	7.801	1.484	25.582
avgPre.kWh:factor(month)6	-0.033	-0.605	0.887	15.044
avgPre.kWh:factor(month)7	-0.335	-6.217	0.533	9.080
avgPre.kWh:factor(month)8	-0.264	-4.895	0.634	10.867
avgPre.kWh:factor(month)9	0.474	8.753	1.481	25.164
avgPre.kWh:factor(month)10	1.074	19.827	2.046	34.669
avgPre.kWh:factor(month)11	0.974	17.949	1.409	19.900
avgPre.kWh:factor(month)12	-0.363	-6.627		
avgPreSummer.kWh:factor(month)2	-0.237	-9.397	-0.343	-12.222
avgPreSummer.kWh:factor(month)3	-0.225	-9.092	-0.649	-23.884
avgPreSummer.kWh:factor(month)4	0.067	2.656	-0.591	-21.395
avgPreSummer.kWh:factor(month)5	0.396	15.591	-0.122	-4.432
avgPreSummer.kWh:factor(month)6	0.736	28.948	0.406	14.552
avgPreSummer.kWh:factor(month)7	0.981	38.468	0.732	26.330
avgPreSummer.kWh:factor(month)8	0.942	36.898	0.635	22.951
avgPreSummer.kWh:factor(month)9	0.364	14.203	-0.031	-1.113
avgPreSummer.kWh:factor(month)10	-0.199	-7.768	-0.612	-21.917
avgPreSummer.kWh:factor(month)11	-0.322	-12.529	-0.478	-14.128
avgPreSummer.kWh:factor(month)12	0.152	5.865		
avgPreWinter.kWh:factor(month)2	-0.540	-22.818	-0.660	-25.116
avgPreWinter.kWh:factor(month)3	-0.772	-33.172	-1.378	-53.940
avgPreWinter.kWh:factor(month)4	-1.001	-41.937	-1.626	-62.671
avgPreWinter.kWh:factor(month)5	-0.919	-38.465	-1.606	-62.261

avgPreWinter.kWh:factor(month)6	-0.745	-31.176	-1.419	-54.100
avgPreWinter.kWh:factor(month)7	-0.628	-26.200	-1.275	-48.911
avgPreWinter.kWh:factor(month)8	-0.658	-27.459	-1.318	-50.827
avgPreWinter.kWh:factor(month)9	-0.944	-39.219	-1.630	-62.284
avgPreWinter.kWh:factor(month)10	-1.048	-43.548	-1.661	-63.314
avgPreWinter.kWh:factor(month)11	-0.774	-32.071	-1.188	-38.295
avgPreWinter.kWh:factor(month)12	0.359	14.707		

Table 28: 2016 PPR Parameter Estimates, Legacy Wave

Variable	***2016***		***2017***	
	Coefficient	***t-statistic***	***Coefficient***	***t-statistic***
(Intercept)	19.105	40.656	18.721	36.546
treatment	-1.189	-15.185	-1.547	-17.055
factor(month)2	0.132	0.196	1.175	1.575
factor(month)3	-0.983	-1.487	-0.855	-1.180
factor(month)4	-7.901	-12.170	-0.927	-1.310
factor(month)5	-11.510	-19.147	-5.882	-9.009
factor(month)6	-9.334	-16.044	-8.236	-12.924
factor(month)7	-8.365	-14.622	-4.900	-7.851
factor(month)8	-8.197	-14.261	-7.036	-11.271
factor(month)9	-9.254	-15.865	-6.251	-9.831
factor(month)10	-2.401	-3.744	-0.626	-0.894
factor(month)11	-2.065	-3.085	1.867	2.129
factor(month)12	-1.056	-1.552		
avgPre.kWh	0.716	160.092	0.966	198.217
factor(month)2:avgPre.kWh	-0.113	-15.978	-0.134	-17.018
factor(month)3:avgPre.kWh	-0.156	-20.234	-0.323	-38.202
factor(month)4:avgPre.kWh	-0.126	-13.617	-0.370	-36.868
factor(month)5:avgPre.kWh	0.042	4.737	-0.301	-31.183
factor(month)6:avgPre.kWh	0.070	8.646	-0.167	-18.800
factor(month)7:avgPre.kWh	0.072	9.906	-0.116	-14.687
factor(month)8:avgPre.kWh	0.030	4.211	-0.196	-25.705
factor(month)9:avgPre.kWh	-0.073	-9.340	-0.314	-36.743
factor(month)10:avgPre.kWh	-0.154	-17.277	-0.326	-33.550
factor(month)11:avgPre.kWh	-0.144	-20.450	-0.377	-38.075
factor(month)12:avgPre.kWh	0.177	27.895		

Table 29: 2016 LFER Parameter Estimates, Legacy Wave

Variable	***2016***		***2017***	
	Coefficient	***t-statistic***	***Coefficient***	***t-statistic***
post_dummy	-6.947	-60.782	-4.341	-34.713
post_dummy:treatment	-1.222	-7.575	-1.661	-9.390

Table 30: 2017 PO Parameter Estimates, Expansion Wave

Variable	*2016*		*2017*	
	Coefficient	*t-statistic*	*Coefficient*	*t-statistic*
(Intercept)	4.610	27.873	4.922	25.484
treatment	-0.437	-11.112	-0.667	-13.871
avgPre.kWh	0.202	9.708	-0.154	-6.348
avgPreSummer.kWh	-0.048	-4.946	-0.006	-0.504
avgPreWinter.kWh	0.750	85.062	1.206	117.454
factor(month)2	0.482	2.096	0.687	2.520
factor(month)3	-0.269	-1.192	1.313	4.952
factor(month)4	-2.073	-8.920	0.325	1.205
factor(month)5	-3.086	-13.273	-1.715	-6.422
factor(month)6	-2.578	-11.072	-2.173	-7.934
factor(month)7	-1.893	-8.092	1.527	5.624
factor(month)8	-0.358	-1.525	1.439	5.344
factor(month)9	-2.786	-11.819	-0.903	-3.308
factor(month)10	-0.739	-3.140	-0.831	-3.039
factor(month)11	-0.279	-1.179	1.192	3.792
factor(month)12	-1.697	-7.059		
avgPre.kWh:factor(month)2	0.590	19.981	0.416	11.894
avgPre.kWh:factor(month)3	0.890	30.806	1.100	32.333
avgPre.kWh:factor(month)4	0.949	31.898	1.378	39.876
avgPre.kWh:factor(month)5	0.690	23.121	1.061	30.971
avgPre.kWh:factor(month)6	0.260	8.708	0.567	16.128
avgPre.kWh:factor(month)7	-0.062	-2.064	0.062	1.772
avgPre.kWh:factor(month)8	-0.072	-2.387	0.166	4.802
avgPre.kWh:factor(month)9	0.653	21.585	0.945	26.976
avgPre.kWh:factor(month)10	1.165	38.591	1.629	46.413
avgPre.kWh:factor(month)11	1.154	38.008	1.063	25.749
avgPre.kWh:factor(month)12	0.313	10.128		
avgPreSummer.kWh:factor(month)2	-0.183	-13.234	-0.098	-5.996
avgPreSummer.kWh:factor(month)3	-0.227	-16.814	-0.279	-17.552
avgPreSummer.kWh:factor(month)4	-0.040	-2.863	-0.296	-18.319
avgPreSummer.kWh:factor(month)5	0.214	15.353	0.073	4.558
avgPreSummer.kWh:factor(month)6	0.556	39.814	0.550	33.578
avgPreSummer.kWh:factor(month)7	0.843	60.045	0.993	60.987
avgPreSummer.kWh:factor(month)8	0.847	60.200	0.880	54.473
avgPreSummer.kWh:factor(month)9	0.226	15.983	0.216	13.206
avgPreSummer.kWh:factor(month)10	-0.237	-16.777	-0.389	-23.751
avgPreSummer.kWh:factor(month)11	-0.369	-25.998	-0.273	-14.128
avgPreSummer.kWh:factor(month)12	-0.170	-11.782		
avgPreWinter.kWh:factor(month)2	-0.505	-40.488	-0.480	-32.532
avgPreWinter.kWh:factor(month)3	-0.798	-65.337	-1.115	-77.660
avgPreWinter.kWh:factor(month)4	-1.075	-85.441	-1.423	-97.576
avgPreWinter.kWh:factor(month)5	-1.032	-81.850	-1.451	-100.367
avgPreWinter.kWh:factor(month)6	-0.894	-70.847	-1.332	-89.763
avgPreWinter.kWh:factor(month)7	-0.789	-62.135	-1.176	-79.969
avgPreWinter.kWh:factor(month)8	-0.795	-62.525	-1.213	-83.262

avgPreWinter.kWh:factor(month)9	-1.023	-80.024	-1.446	-97.894
avgPreWinter.kWh:factor(month)10	-1.084	-84.926	-1.499	-101.265
avgPreWinter.kWh:factor(month)11	-0.824	-64.239	-1.055	-61.769
avgPreWinter.kWh:factor(month)12	0.096	7.342		

Table 31: 2017 PPR Parameter Estimates, Expansion Wave

Variable	***2016***		***2017***	
	Coefficient	***t-statistic***	***Coefficient***	***t-statistic***
(Intercept)	8.240	62.925	5.481	35.947
treatment	-0.432	-10.628	-0.654	-13.253
factor(month)2	1.490	8.139	1.332	6.249
factor(month)3	-1.072	-5.751	1.389	6.341
factor(month)4	-2.155	-10.997	2.316	10.193
factor(month)5	-3.026	-16.010	2.214	10.217
factor(month)6	-1.883	-10.089	0.983	4.540
factor(month)7	-3.118	-16.638	1.504	6.920
factor(month)8	-2.457	-13.100	2.053	9.583
factor(month)9	-3.068	-15.336	1.080	4.680
factor(month)10	-0.152	-0.754	1.750	7.475
factor(month)11	1.117	5.927	3.390	12.805
factor(month)12	-1.802	-9.624		
avgPre.kWh	0.803	366.134	1.087	425.355
factor(month)2:avgPre.kWh	-0.181	-55.508	-0.201	-52.679
factor(month)3:avgPre.kWh	-0.055	-13.488	-0.236	-48.591
factor(month)4:avgPre.kWh	-0.077	-14.552	-0.302	-49.449
factor(month)5:avgPre.kWh	0.000	0.006	-0.354	-60.851
factor(month)6:avgPre.kWh	-0.005	-1.052	-0.254	-48.507
factor(month)7:avgPre.kWh	-0.077	-20.605	-0.278	-64.383
factor(month)8:avgPre.kWh	0.018	4.386	-0.249	-54.213
factor(month)9:avgPre.kWh	-0.109	-21.702	-0.356	-61.658
factor(month)10:avgPre.kWh	-0.142	-27.922	-0.321	-54.112
factor(month)11:avgPre.kWh	-0.168	-47.703	-0.343	-60.481
factor(month)12:avgPre.kWh	0.125	40.696		

Table 32: 2017 LFER Parameter Estimates, Expansion Wave

Variable	***2016***		***2017***	
	Coefficient	***t-statistic***	***Coefficient***	***t-statistic***
post_dummy	-2.512	-35.974	-0.472	-5.957
post_dummy:treatment	-0.404	-5.022	-0.603	-6.605

Table 33: 2017 PO Parameter Estimates, Refill Wave

Variable	2016		2017	
	Coefficient	t-statistic	Coefficient	t-statistic
(Intercept)	2.649	15.719	4.112	19.288
treatment	-0.136	-2.493	-0.331	-4.627
avgPre.kWh	0.468	12.591	0.231	4.760
avgPreSummer.kWh	-0.217	-10.928	-0.201	-7.855
avgPreWinter.kWh	0.760	51.626	1.138	58.780
factor(month)2	-0.134	-0.570	-0.625	-2.076
factor(month)3	-0.367	-1.588	-0.516	-1.762
factor(month)4	-0.407	-1.714	-0.905	-3.042
factor(month)5	-0.575	-2.410	-1.619	-5.460
factor(month)6	-0.329	-1.371	-1.457	-4.797
factor(month)7	0.086	0.358	0.421	1.395
factor(month)8	0.530	2.186	-0.005	-0.018
factor(month)9	-0.669	-2.747	-1.034	-3.395
factor(month)10	-0.123	-0.505	-1.198	-3.939
factor(month)11	0.215	0.877	-1.124	-3.258
factor(month)12	-0.117	-0.467		
avgPre.kWh:factor(month)2	0.170	3.273	0.164	2.366
avgPre.kWh:factor(month)3	0.234	4.546	0.375	5.571
avgPre.kWh:factor(month)4	0.245	4.655	0.509	7.466
avgPre.kWh:factor(month)5	0.197	3.713	0.500	7.322
avgPre.kWh:factor(month)6	-0.051	-0.957	0.260	3.766
avgPre.kWh:factor(month)7	-0.240	-4.469	-0.150	-2.162
avgPre.kWh:factor(month)8	-0.307	-5.687	-0.102	-1.477
avgPre.kWh:factor(month)9	0.219	4.032	0.369	5.304
avgPre.kWh:factor(month)10	0.442	8.050	0.675	9.685
avgPre.kWh:factor(month)11	0.475	8.625	0.389	4.820
avgPre.kWh:factor(month)12	0.218	3.848		
avgPreSummer.kWh:factor(month)2	0.006	0.205	0.033	0.915
avgPreSummer.kWh:factor(month)3	0.057	2.082	0.039	1.083
avgPreSummer.kWh:factor(month)4	0.216	7.641	0.082	2.260
avgPreSummer.kWh:factor(month)5	0.358	12.615	0.272	7.511
avgPreSummer.kWh:factor(month)6	0.634	22.208	0.601	16.387
avgPreSummer.kWh:factor(month)7	0.882	30.760	1.080	29.434
avgPreSummer.kWh:factor(month)8	0.960	33.244	1.012	27.683
avgPreSummer.kWh:factor(month)9	0.377	12.963	0.430	11.635
avgPreSummer.kWh:factor(month)10	0.073	2.494	0.002	0.055
avgPreSummer.kWh:factor(month)11	-0.101	-3.461	0.033	0.758
avgPreSummer.kWh:factor(month)12	-0.150	-4.987		
avgPreWinter.kWh:factor(month)2	-0.326	-15.850	-0.366	-13.285
avgPreWinter.kWh:factor(month)3	-0.531	-26.044	-0.793	-29.643
avgPreWinter.kWh:factor(month)4	-0.802	-38.493	-1.059	-39.156
avgPreWinter.kWh:factor(month)5	-0.857	-40.912	-1.220	-45.057
avgPreWinter.kWh:factor(month)6	-0.803	-38.110	-1.197	-43.650
avgPreWinter.kWh:factor(month)7	-0.758	-35.779	-1.102	-40.165
avgPreWinter.kWh:factor(month)8	-0.746	-35.036	-1.116	-40.834

avgPreWinter.kWh:factor(month)9	-0.877	-40.859	-1.207	-43.769
avgPreWinter.kWh:factor(month)10	-0.798	-36.764	-1.088	-39.322
avgPreWinter.kWh:factor(month)11	-0.525	-24.116	-0.722	-22.927
avgPreWinter.kWh:factor(month)12	0.156	6.942		

Table 34: 2017 PPR Parameter Estimates, Refill Wave

Variable	***2016***		***2017***	
	Coefficient	***t-statistic***	***Coefficient***	***t-statistic***
(Intercept)	3.691	21.478	4.143	20.731
treatment	-0.141	-2.416	-0.202	-2.840
factor(month)2	0.490	2.019	-0.225	-0.796
factor(month)3	-0.485	-2.011	-0.609	-2.156
factor(month)4	0.357	1.420	-0.244	-0.826
factor(month)5	-0.088	-0.342	-0.225	-0.761
factor(month)6	0.963	3.868	0.119	0.412
factor(month)7	-0.151	-0.620	0.428	1.507
factor(month)8	0.373	1.557	1.018	3.726
factor(month)9	-0.656	-2.773	-0.034	-0.124
factor(month)10	-0.754	-3.204	-1.271	-4.656
factor(month)11	0.999	4.428	0.458	1.586
factor(month)12	-1.226	-5.337		
avgPre.kWh	0.858	139.084	1.080	147.177
factor(month)2:avgPre.kWh	-0.173	-19.134	-0.166	-15.438
factor(month)3:avgPre.kWh	-0.042	-3.866	-0.159	-12.195
factor(month)4:avgPre.kWh	-0.145	-10.869	-0.211	-12.957
factor(month)5:avgPre.kWh	-0.057	-3.922	-0.260	-15.644
factor(month)6:avgPre.kWh	-0.037	-3.158	-0.178	-13.066
factor(month)7:avgPre.kWh	-0.111	-12.580	-0.215	-20.687
factor(month)8:avgPre.kWh	0.003	0.340	-0.180	-17.372
factor(month)9:avgPre.kWh	-0.014	-1.343	-0.179	-14.854
factor(month)10:avgPre.kWh	0.045	4.531	-0.079	-6.677
factor(month)11:avgPre.kWh	-0.171	-22.991	-0.298	-30.278
factor(month)12:avgPre.kWh	0.289	39.350		

Table 35: 2017 LFER Parameter Estimates, Expansion Wave

Variable	***2016***		***2017***	
	Coefficient	***t-statistic***	***Coefficient***	***t-statistic***
post_dummy	0.597	8.298	2.361	28.053
post_dummy:treatment	-0.161	-1.584	-0.323	-2.711

10. Appendix B: Double Counting Analysis

To avoid double-counting of savings, program savings from other energy efficiency programs due to HER participation must be counted toward either the HER program or the other energy efficiency programs but not both. The double-counted savings, positive or negative, are subtracted from the net savings estimates from the regression analysis to get total verified savings.

Customer ID and address fields were used to identify HER treatment and control participants who had also enrolled in the Home Energy Savings (HES) and Low Income Weatherization (LIW) programs. HES and LIW program savings were categorized as: Appliances, Building Shell, Energy Kits, HVAC, Lighting, and Water Heating.

Table 36 and Table 37 detail the 2016 other program savings. In 2016, HVAC aggregated savings were highest for all waves except for the Expansion Control and Refill Treatment groups which had the highest aggregate savings from Energy Kits. By wave, the Expansion Treatment reported the most savings (612,205 kWh).

Table 36: 2016 Other Program Savings (kWh) by Wave and Treatment Status

	Legacy Wave		***Expansion Wave***		***Refill Wave***	
Measurement Type	***Control***	***Treatment***	***Control***	***Treatment***	***Control***	***Treatment***
Appliances	3,011	2,898	1,990	4,509	532	354
Building Shell	31,981	32,945	33,898	72,534	5,036	14,867
Energy Kits	110,291	108,779	86,063	231,764	28,206	25,996
HVAC	229,492	264,127	77,139	289,009	43,922	17,000
Lighting	441	-	-	49	-	-
Water Heating	9,192	13,484	7,919	14,339	-	-
Total	**384,407**	**422,233**	**207,009**	**612,205**	**77,696**	**58,217**

By participation, Energy Kits had the most treatment and control customers across all waves as detailed in Table 37.

Table 37: 2016 Other Program Participants by Wave and Treatment Status

	Legacy Wave		Expansion Wave		Refill Wave	
Measurement Type	**Control**	**Treatment**	**Control**	**Treatment**	**Control**	**Treatment**
Appliances	24	23	16	42	5	4
Building Shell	20	19	24	49	4	8
Energy Kits	279	265	280	734	121	112
HVAC	66	70	44	117	14	12
Lighting	12	-	-	29	-	-
Water Heating	16	20	19	34	-	-

Table 38 details the double count calculations.

Table 38: 2016 PO Regression Double Count Calculation

Wave		Total Double Count	# Accounts	Avg. Double Count	MWh
Legacy	Control	384,407	10,111	38.02	
	Treatment	422,233	10,186	41.45	34.97
Expansion	Control	207,009	9,754	21.22	
	Treatment	612,205	29,970	20.43	-23.85
Refill	Control	77,696	4,784	16.24	
	Treatment	58,217	4,814	12.09	-19.97

Table 39 and Table 40 detail the 2017 other program savings. In 2017, HVAC aggregated savings were highest for all waves except for the Refill Treatment group which had the highest aggregate savings from Energy Kits. By wave, the Expansion Treatment reported the most savings (315,840 kWh).

Table 39: 2017 Other Program Savings (kWh) by Wave and Treatment Status

	Legacy Wave		Expansion Wave		Refill Wave	
Measure Type	**Control**	**Treatment**	**Control**	**Treatment**	**Control**	**Treatment**
Appliances	1,224	832	1,014	2,783	532	-
Building Shell	9,516	5,167	6,914	32,414	2,414	2,991
Energy Kits	48,462	40,933	40,653	83,637	10,401	7,752

HVAC	165,353	138,734	65,653	185,199	20,547	5,876
Water Heating	6,226	1,301	-	11,807	-	-
Whole Home	5,420	-	-	-	-	-
Total	**236,201**	**186,967**	**114,234**	**315,840**	**33,894**	**16,620**

Table 40: Recipants by Wave and Treatment Status

	Legacy Wave		***Expansion Wave***		***Refill Wave***	
Measure Type	***Control***	***Treatment***	***Control***	***Treatment***	***Control***	***Treatment***
Appliances	8	6	10	21	3	-
Building Shell	5	3	4	24	2	2
Energy Kits	117	101	127	267	42	29
HVAC	86	63	55	134	18	8
Water Heating	4	1	-	7	-	-
Whole Home	1	-	-	-	-	-

Table 41 details the 2017 double-count calculations.

Table 41: 2017 PO Regression Double-Count Calculation

Wave		***Total Double Count***	***# Accounts***	***Avg. Double Count***	***MWh***
Legacy	Control	236,201	9,459	24.97	
	Treatment	186,967	9,438	19.81	-48.71
Expansion	Control	114,234	8,720	13.10	
	Treatment	315,840	26,601	11.87	-32.64
Refill	Control	33,894	3,944	8.59	
	Treatment	166,620	3,964	4.19	-17.45

11. Appendix C: Survey Instruments

Treatment Group Survey

Glossary of Terms:
[PROGRAM]: Program name ("Home Energy Reports")
[UTILITY_LONG]: Utility's full name (Washington is "Pacific Power", Utah is "Rocky Mountain Power")
[UTILITY_SHORT]: Utility's shortened name (if there is applicable abbreviation. Else = UTILITY_LONG)
[LOCATION]: Premise address for the contacted household

"Hello, my name is [name] with [Survey_Company], calling on behalf of [UTILITY_LONG]. We are conducting a survey of [UTILITY_LONG] customers to collect consumer feedback about the effectiveness energy efficiency programs and messaging. We are not selling anything. The survey will take 10-12 minutes, and the responses are kept strictly confidential.

May we ask you some questions about your experience with [UTILITY_LONG] energy efficiency programs and messaging?

1. Yes
2. No [THANK AND TERMINATE SURVEY]
98. DON'T KNOW [THANK AND TERMINATE SURVEY]
99. REFUSED [THANK AND TERMINATE SURVEY]

1. **Am I reaching you on a cell phone?**

    1. Yes
    2. No

[DISPLAY Q2 IF Q1 = 1]

2. **Is this a safe time to talk or are you driving?**

    1. Yes [CONTINUE SURVEY]
    2. No [RESCHEDULE]

3. **We have your address listed as [LOCATION]. Is that correct?**

    1. Yes
    2. No [THANK AND TERMINATE SURVEY]
    98. DON'T KNOW [THANK AND TERMINATE SURVEY]
    99. REFUSED [THANK AND TERMINATE SURVEY]

4. **Are you the person in the household who reads communications from [UTILITY_LONG]? This would include the electric bill, notifications about your account, and other information.**

    1. Yes [SKIP TO Q6]
    2. No [DISPLAY Q5]
    98. DON'T KNOW [DISPLAY Q5
    99. REFUSED [THANK AND TERMINATE SURVEY]

5. **Can I speak to the person in your household that handles the communications you receive from [UTILITY_ LONG]?**

    1. Yes
    2. No [THANK AND TERMINATE SURVEY]
    98. DON'T KNOW [THANK AND TERMINATE SURVEY]
    99. REFUSED [THANK AND TERMINATE SURVEY]

6. **Do you recall seeing reports from [UTILITY_ LONG] in the mail or through email that describe your home's electricity use? This report includes graphs that show your electricity use and compares your use to your neighbors. This is different from your electric bill, and does not include your natural gas use.**

    1. Yes
    2. No [THANK AND TERMINATE SURVEY]
    98. DON'T KNOW [THANK AND TERMINATE SURVEY]
    99. REFUSED [THANK AND TERMINATE SURVEY]

7. **How helpful was the home energy report for understanding your household's electricity use? Was it… [READ. MARK ONE]**

    1. Very helpful
    2. Somewhat helpful
    3. Slightly helpful
    4. Not at all helpful
    98. DON'T KNOW [DON'T READ]
    99. REFUSED [DON'T READ]

8. **How would you say your energy use compares to other homes of similar size in your neighborhood? Is your usage… [READ. MARK ONE]**

    1. Significantly higher
    2. Somewhat higher
    3. About the same
    4. Somewhat lower
    5. Significantly lower
    98. DON'T KNOW [DON'T READ]
    99. REFUSED [DON'T READ]

9. **How would you say your home compares to your neighbors in terms of energy efficiency? Is your home… [READ. MARK ONE]**

    1. Very energy efficient
    2. Somewhat energy efficient
    3. Average
    4. Somewhat inefficient
    5. Very inefficient
    98. DON'T KNOW [DON'T READ]
    99. REFUSED [DON'T READ]

10. **Have you heard of wattSmart energy efficiency programs offered by [UTILITY_LONG]? These programs offer financial incentives for energy efficiency improvements made by residential and commercial customers**

    1. Yes
    2. No
    98. DON'T KNOW
    99. REFUSED

[DISPLAY Q11-Q15 IF Q10=1]

"I'm going to describe the energy efficiency programs offered by [UTILITY_LONG]. After I describe each one, please state whether you have heard of the program prior to this call". [READ EACH DESCRIPTION. MARK ONE ANSWER FOR EACH]

11. **[IF UTILITY_LONG= "Rocky Mountain Power", "wattSmart Homes", IF UTILITY_LONG= "Pacific Power", "Home Energy Savings"]: this program offers cash incentives for home energy efficiency improvements, including efficient lighting, appliances, heating, and cooling, as well as for home insulation.**

    1. Yes
    2. No
    98. DON'T KNOW
    99. REFUSED

12. **Low Income Weatherization. This program provides free-of-charge weatherization services to qualifying low-income customers**

    1. Yes
    2. No
    98. DON'T KNOW
    99. REFUSED

[DISPLAY Q13 ONLY IF UTLITY_LONG= "Rocky Mountain Power"]

13. **AC Cool-Keeper. This program provides incentives for homes and businesses to have a control device connected to your central air conditioner, reducing its use during hot summer peak days.**

    1. Yes
    2. No
    98. DON'T KNOW
    99. REFUSED

14. **wattSmart Business. This program provides rebates to businesses for installing efficient equipment in their buildings.**

    1. Yes
    2. No
    98. DON'T KNOW
    99. REFUSED

[DISPLAY Q15 ONLY IF UTLITY_LONG= "Rocky Mountain Power"]

15. **Irrigation Load Control. This program provides rebates to agricultural customers to curtail the use of their irrigation systems during hot summer peak hours.**

    1. Yes
    2. No
    98. DON'T KNOW
    99. REFUSED

"I now have a couple questions about any light bulb purchases you may have done for your home in the last year"

16. **How many CFL light bulbs have been purchased for your household in 2017? [IF NEEDED: "These are the bulbs with a spiral shape"]**

    1. [CFL_PURCHASE_QUANTITY]
    98. DON'T KNOW
    99. REFUSED

[DISPLAY Q17 IF [CFL_PURCHASE_QUANTITY] > 0]

17. **Of the [CFL_ PURCHASE _QUANTITY] CFLs you've purchased in 2017, how many of them have been installed?**

    1. [CFL_INSTALL_QUANTITY]
    98. DON'T KNOW
    99. REFUSED

18. **How many LED light bulbs have been purchased for your household in 2017? [IF NEEDED: "These are more expensive energy efficient light bulbs that usually look like a regular light bulb"]**

    1. [LED_PURCHASE_QUANTITY]
    98. DON'T KNOW
    99. REFUSED

[DISPLAY Q19 IF [LED_PURCHASE_QUANTITY] > 0]

19. **Of the [LED_ PURCHASE _QUANTITY] LEDs purchased in 2017, how many of them have been installed?**

    1. [LED _INSTALL_QUANTITY]
    98. DON'T KNOW
    99. REFUSED

20. **In 2017, did you purchase any energy efficient equipment or make energy efficiency upgrades to your home that would reduce your electricity usage?**

    1. Yes
    2. No
    98. DON'T KNOW
    99. REFUSED

[DISPLAY Q21 IF Q20 = 1]

21. **What purchases or upgrades did you make in 2017? Please only include purchase or upgrades that would reduce your electricity usage. [DO NOT READ. PROBE FOR MULTIPLE]**

    1. Replaced an air conditioner/HVAC unit (AC, heat pump, window unit)
    2. Tuned-up or serviced an air conditioner/HVAC unit
    3. Installed and/or replaced an evaporative cooler
    4. CFLs/compact fluorescent lighting
    5. LED bulbs
    6. Clothes washer
    7. Clothes dryer
    8. Dishwasher
    9. Furnace fan
    10. Other fans (whole-house, attic fan, box fans, ceiling fans)
    11. Refrigerator
    12. Freezer
    13. Pool equipment – heaters, pumps, variable speed drives or controls
    14. Programmable thermostat
    15. Smart thermostat / Wi-Fi thermostat / NEST / Ecobee
    16. Water heater – storage tank, tankless, heat pump water heater

17. Windows – double pane, triple pane, low-e windows, storm windows
18. Solar screens
19. Efficient electronics
20. Insulation (attic insulation, wall insulation, floor insulation)
21. Solar panels / solar PV
22. Other _____
98. DON'T KNOW
99. REFUSED

[DISPLAY Q22 IF Q21 < 98]

22. **How important was the information from your Home Energy Report from [UTILITY_LONG] in your decision to make those energy efficient purchases or upgrades? [READ. MARK ONE]**

1. Very important
2. Somewhat important
3. Slightly important
4. Not important at all
98. DON'T KNOW [DON'T READ]
99. REFUSED [DON'T READ]

23. **In the last two years, have you made any changes in your energy use habits that would conserve electricity in your home?**

1. Yes
2. No
98. DON'T KNOW
99. REFUSED

[DISPLAY Q24 IF Q23=1]

24. **What actions or changes have you made? [DO NOT READ. PROBE FOR MULTIPLE]**

1. Turned up the thermostat in summer to reduce AC use
2. Turned down the thermostat in winter to reduce heating use
3. Changed AC filter
4. Changed furnace filter
5. Clear areas around heating/cooling vents
6. Turned off lights in unoccupied rooms
7. Line-dry clothes
8. Run clothes washer with full load
9. Run dishwasher with full load
10. Used cold water setting on clothes washer
11. Used cold water setting on dishwasher
12. Unplug electronics when not in use
13. Turn off computers overnight
14. Take shorter showers

15. Turned down water heater setpoint
16. Sealed leaks and drafts
17. Cleaned refrigerator coils
18. Increased refrigerator/freezer temperature
19. Used heat blocking materials on windows / shaded windows during hot daytime
20. Increased use of fans to reduce use of AC
21. Shifted use off-peak (e.g., avoided use of laundry/electronics/ during peak time)
22. Other _____
98. DON'T KNOW
99. REFUSED

[DISPLAY Q25 IF Q24<98]

25. **How important was the information from your Home Energy Report in your decision to take these actions to conserve energy? [READ. MARK ONE]**

    1. Very important
    2. Somewhat important
    3. Slightly important
    4. Not important at all
    98. DON'T KNOW [DON'T READ]
    99. REFUSED [DON'T READ]

26. **Overall, on a scale of "1 to 5" where "1" means "Not at all knowledgeable" and "5" means "Very knowledgeable," how knowledgeable are you about ways to save energy in your home?**

    1. [SCORE]
    98. DON'T KNOW
    99. REFUSED

27. **How would you rate your household's efforts to save electricity in your home? Using a scale of 1 to 5, with 1 meaning "you have not done much" and 5 meaning "you have done almost everything you can" to lower your monthly energy bill in your home.**

    1. [SCORE]
    98. DON'T KNOW [SKIP TO Q29]
    99. REFUSED [SKIP TO Q29]

[DISPLAY Q28 IF Q27 ≥ 3]

28. **What motivated you to save electricity in your home? [DO NOT READ. MARK ALL INDICATED]**

    1. Reduce electricity costs / reduce electric bill
    2. Conservation / good for environment

3. Make my usage more similar to my neighbors
4. Other _____[RECORD VERBATIM]
98. DON'T KNOW [DON'T READ]
99. REFUSED [DON'T READ]

29. **How much time would you say you typically spend reading the Home Energy Report?… [READ. MARK ONE].**

1. [RECORD VERBATIM]
98. DON'T KNOW
99. REFUSED

30. **How many reports would you like to receive per year? Would you say… [READ. MARK ONE]**

1. More often than you're currently sent;
2. The same that you're currently sent; or
3. Less than you're currently sent
4. No reports at all
98. DON'T KNOW
99. REFUSED

31. **On a scale of 1-5, where "1" is "very dissatisfied" and "5" is "very satisfied," how satisfied would you say you are with the following Home Energy Report items? Please note that if you do not feel you are able to provide a score, you may say "I don't know". [RANDOMIZE 31i-31iv. 31v ALWAYS SECOND TO LAST. 31Error! Reference source not found. ALWAYS LAST] [ALLOW FOR 98 CODE FOR "DON'T KNOW" AND 99 CODE FOR "REFUSED"]**

i. The energy saving tips provided in your report
ii. The accuracy of the report in characterizing your home's energy use
iii. The savings on your bill after acting on recommendations in the report
iv. The level of detail in the report
v. The program overall

[DISPLAY Q32 IF ANY IN Q31 <3]

32. **You indicated some dissatisfaction with Home Energy Reports. Why were you dissatisfied?**

1. (VERBATIM)
98. DON'T KNOW

99. REFUSED

Company Satisfaction
The next questions relate to your overall experience as a customer of **[UTLITY_LONG].**

33. **Now, thinking about your experiences with [UTILITY_LONG] as your electric utility, how satisfied would you say you are with [UTILITY_LONG]?**

Please use a scale from 0 to 10 where "0" means "extremely dissatisfied" and "10" means "extremely satisfied." You can use any number between zero and ten.

Extremely dissatisfied										Extremely satisfied
0	1	2	3	4	5	6	7	8	9	10

34. **Why did you give [UTILITY_LONG] a [INSERT Q33 RATING] on overall satisfaction?**

Please be specific.

_____
_____
_____
_____
_____
_____

DEMOGRAPHIC

"I now have a couple of questions about your household. These are anonymous and will be used solely for the purpose of combining different customers' responses. If you do not want to answer any of these, let me know. It is okay to not answer any of these questions."

35. **Do you own or rent the home in which you live?**

1. Own
2. Rent
98. DON'T KNOW
99. REFUSED

36. **Which of the following brackets contains your age? [READ. MARK ONE. MARK APPLICABLE ANSWER IF CUSTOMER INTERRUPTS AND STATES EXACT AGE]**

1. 18-24
2. 25-34
3. 35-44

4. 45-54
5. 55-64
6. 65 or over
98. DON'T KNOW
99. REFUSED

37. **How many people live in your household full time?**

1. [#OCCUPANTS]
98. DON'T KNOW
99. REFUSED

38. **I'm going to read off a list of income ranges, please indicate which range your total pre-tax household income falls. This is the total annual income of your household:**

1. Less than $25,000
2. $25,000 - $49,999
3. $50,000 – $74,999
4. $75,000 - $99,999
5. $100,000-$149,999
6. $150,000 or above
98. DON'T KNOW
99. REFUSED

39. **What's the highest level of education you've completed? (DON'T READ)**

1. Up to 8th grade
2. Some high school
3. High school or GED equivalent
4. Some college
5. Associate's degree
6. Bachelor's college degree
7. Graduate degree/professional degree/JD/MD
98. DON'T KNOW
99. REFUSED
100.

40. **[INTERVIEWER: RECORD RESPONDENT'S GENDER. DO NOT ASK]**

1. Male
2. Female
3. Don't know

Control Group Survey

Glossary of Terms:
[UTILITY_LONG]: Utility's full name ("Pacific Power", "Rocky Mountain Power")
[UTILITY_SHORT]: Utility's shortened name (if there is applicable abbreviation. Else = UTILITY_LONG)
[LOCATION]: Premise address for the contacted household

"Hello, my name is [name] with [Survey_Company], calling on behalf of [UTILITY_LONG]. We are conducting a survey of [UTILITY_LONG] customers to collect information on household energy use habits. We are not selling anything. The survey will take 5-7 minutes, and the responses are kept strictly confidential.

May we ask you some questions about your household energy use?

1. Yes
2. No [THANK AND TERMINATE SURVEY]
98. DON'T KNOW [THANK AND TERMINATE SURVEY]
99. REFUSED [THANK AND TERMINATE SURVEY]

1. Am I reaching you on a cell phone?

    1. Yes
    2. No

[DISPLAY Q2 IF Q1 = 1]

2. **Is this a safe time to talk or are you driving?**

    1. Yes [CONTINUE SURVEY]
    2. No [RESCHEDULE]

3. **We have your address listed as [LOCATION]. Is that correct?**

    1. Yes
    2. No [THANK AND TERMINATE SURVEY]
    98. DON'T KNOW [THANK AND TERMINATE SURVEY]
    99. REFUSED [THANK AND TERMINATE SURVEY]

4. **How would you say your energy use compares to other homes of similar size in your neighborhood? Is your usage… [READ. MARK ONE]**

1. Significantly higher
2. Somewhat higher
3. About the same
4. Somewhat lower
5. Significantly lower
98. DON'T KNOW [DON'T READ]
99. REFUSED [DON'T READ]

5. **How would you say your home compares to your neighbors in terms of energy efficiency? Is your home… [READ. MARK ONE]**

    1. Very energy efficient
    2. Somewhat energy efficient
    3. Average
    4. Somewhat inefficient
    5. Very inefficient
    98. DON'T KNOW [DON'T READ]
    99. REFUSED [DON'T READ]

6. **Have you heard of wattSmart energy efficiency programs offered by [UTILITY_LONG]? These programs offer financial incentives for energy efficiency improvements made by residential and commercial customers**

    1. Yes
    2. No
    98. DON'T KNOW
    99. REFUSED

[DISPLAY Q11-Q15 IF Q10=1]

"I'm going to describe the energy efficiency programs offered by [UTILITY_LONG]. After I describe each one, please state whether you have heard of the program prior to this call". [READ EACH DESCRIPTION. MARK ONE ANSWER FOR EACH]

7. **[IF UTILITY_LONG= "Rocky Mountain Power", "wattSmart Homes", IF UTILITY_LONG= "Pacific Power", "Home Energy Savings"]: this program offers cash incentives for home energy efficiency improvements, including efficient lighting, appliances, heating, and cooling, as well as for home insulation.**

    1. Yes
    2. No
    98. DON'T KNOW
    99. REFUSED

8. **Low Income Weatherization. This program provides free-of-charge weatherization services to qualifying low-income customers**

    1. Yes

2. No
98. DON'T KNOW
99. REFUSED

[DISPLAY Q13 ONLY IF UTLITY_LONG= "Rocky Mountain Power"]

9. **AC Cool-Keeper. This program provides incentives for homes and businesses to have a control device connected to your central air conditioner, reducing its use during hot summer peak days.**

    1. Yes
    2. No
    98. DON'T KNOW
    99. REFUSED

10. **wattSmart Business. This program provides rebates to businesses for installing efficient equipment in their buildings.**

    1. Yes
    2. No
    98. DON'T KNOW
    99. REFUSED

[DISPLAY Q15 ONLY IF UTLITY_LONG= "Rocky Mountain Power"]

11. **Irrigation Load Control. This program provides rebates to agricultural customers to curtail the use of their irrigation systems during hot summer peak hours.**

    1. Yes
    2. No
    98. DON'T KNOW
    99. REFUSED

"I now have a couple questions about any light bulb purchases you may have done for your home in the last year"

12. **How many CFL light bulbs have been purchased for your household in the last year? [IF NEEDED: "These are the bulbs with a spiral shape"]**

    1. [CFL_PURCHASE_QUANTITY]
    98. DON'T KNOW
    99. REFUSED

[DISPLAY Q17 IF [CFL_PURCHASE_QUANTITY] > 0]

13. **Of the [CFL_ PURCHASE _QUANTITY] CFLs you've purchased in the last year, how many of them have been installed?**

    1. [CFL_INSTALL_QUANTITY]
    98. DON'T KNOW
    99. REFUSED

14. **How many LED light bulbs have been purchased for your household in the last year? [IF NEEDED: "These are more expensive energy efficient light bulbs that usually look like a regular light bulb"]**

    1. [LED_PURCHASE_QUANTITY]
    98. DON'T KNOW
    99. REFUSED

[DISPLAY Q19 IF [LED_PURCHASE_QUANTITY] > 0]

15. **Of the [LED_ PURCHASE _QUANTITY] LEDs purchased in the last year, how many of them have been installed?**

    1. [LED _INSTALL_QUANTITY]
    98. DON'T KNOW
    99. REFUSED

16. **In 2017, did you purchase any energy efficient equipment or make energy efficiency upgrades to your home that would reduce your electricity usage?**

    1. Yes
    2. No
    98. DON'T KNOW
    99. REFUSED

[DISPLAY Q21 IF Q16 = 1]

17. **What other purchases or upgrades did you make in 2017? Please only include purchase or upgrades that would reduce your electricity usage. [DO NOT READ. PROBE FOR MULTIPLE]**

    1. Replaced an air conditioner/HVAC unit (AC, heat pump, window unit)
    2. Tuned-up or serviced an air conditioner/HVAC unit

3. Installed and/or replaced an evaporative cooler
4. CFLs/compact fluorescent lighting
5. LED bulbs
6. Clothes washer
7. Clothes dryer
8. Dishwasher
9. Furnace fan
10. Other fans (whole-house, attic fan, box fans, ceiling fans)
11. Refrigerator
12. Freezer
13. Pool equipment – heaters, pumps, variable speed drives or controls
14. Programmable thermostat
15. Smart thermostat / Wi-Fi thermostat / NEST / Ecobee
16. Water heater – storage tank, tankless, heat pump water heater
17. Windows – double pane, triple pane, low-e windows, storm windows
18. Solar screens
19. Efficient electronics
20. Insulation (attic insulation, wall insulation, floor insulation)
21. Solar panels / solar PV
22. Other _____
98. DON'T KNOW
99. REFUSED

18. **In the last two years, have you made any changes in your energy use habits that would conserve energy in your home?**

1. Yes
2. No
98. DON'T KNOW
99. REFUSED

[DISPLAY Q24 IF Q23=1]

19. **What actions or changes have you made? [DO NOT READ. PROBE FOR MULTIPLE]**

1. Turned up the thermostat in summer to reduce AC use
2. Turned down the thermostat in winter to reduce heating use
3. Changed AC filter
4. Changed furnace filter

5. Clear areas around heating/cooling vents
6. Turned off lights in unoccupied rooms
7. Line-dry clothes
8. Run clothes washer with full load
9. Run dishwasher with full load
10. Used cold water setting on clothes washer
11. Used cold water setting on dishwasher
12. Unplug electronics when not in use
13. Turn off computers overnight
14. Take shorter showers
15. Turned down water heater setpoint
16. Sealed leaks and drafts
17. Cleaned refrigerator coils
18. Increased refrigerator/freezer temperature
19. Used heat blocking materials on windows / shaded windows during hot daytime
20. Increased use of fans to reduce use of AC
21. Shifted use off-peak (e.g., avoided use of laundry/electronics/ during peak time)
22. Other _____
98. DON'T KNOW
99. REFUSED

20. **Overall, on a scale of "1 to 5" where "1" means "Not at all knowledgeable" and "5" means "Very knowledgeable," how knowledgeable are you about ways to save energy in your home?**

    1. [SCORE]
    98. DON'T KNOW
    99. REFUSED

21. **How would you rate your household's efforts to save electricity in your home? Using a scale of 1 to 5, with 1 meaning "you have not done much" and 5 meaning "you have done almost everything you can" to lower your monthly energy bill in your home.**

    1. [SCORE]
    98. DON'T KNOW [SKIP TO Q33]
    99. REFUSED [SKIP TO Q33]

[DISPLAY Q28 IF Q27 ≥ 3]

22. **What motivated you to save electricity in your home? [DO NOT READ. MARK ALL INDICATED]**

    1. Reduce electricity costs / reduce electric bill
    2. Conservation / good for environment
    3. Make my usage more similar to my neighbors

4. Other _____[RECORD VERBATIM]
98. DON'T KNOW [DON'T READ]
99. REFUSED [DON'T READ]

Company Satisfaction
The next questions relate to your overall experience as a customer of **[UTLITY_LONG].**

23. **Now, thinking about your experiences with [UTILITY_LONG] as your electric utility, how satisfied would you say you are with [UTILITY_LONG]?**

Please use a scale from 0 to 10 where "0" means "extremely dissatisfied" and "10" means "extremely satisfied." You can use any number between zero and ten.

Extremely dissatisfied										Extremely satisfied
0	1	2	3	4	5	6	7	8	9	10

24. **Why did you give [UTILITY_LONG] a [INSERT Q23 RATING] on overall satisfaction?**

Please be specific.

_____
_____
_____
_____
_____
_____

DEMOGRAPHIC

I now have a couple of questions about your household. These are anonymous and will be used solely for the purpose of combining different customers' responses. If you do not want to answer any of these, let me know. It is okay to not answer any of these questions."

25. **Do you own or rent the home in which you live?**

1. Own

2. Rent
98. DON'T KNOW
99. REFUSED

26. **Which of the following brackets contains your age? [READ. MARK ONE. MARK APPLICABLE ANSWER IF CUSTOMER INTERRUPTS AND STATES EXACT AGE]**

1. 18-24
2. 25-34
3. 35-44
4. 45-56
5. 55-64
6. 65 or over
98. DON'T KNOW
99. REFUSED

27. **How many people live in your household full time?**

1. [#OCCUPANTS]
98. DON'T KNOW
99. REFUSED

28. **I'm going to read off a list of income ranges, please indicate which range your total pre-tax household income falls. This is the total annual income of your household:**

1. Less than $25,000
2. $25,000 - $49,999
3. $50,000 – $74,999
4. $75,000 - $99,999
5. $100,000-$149,999
6. $150,000 or above
98. DON'T KNOW
99. REFUSED

29. **What's the highest level of education you've completed? (DON'T READ)**

1. Up to 8th grade
2. Some high school
3. High school or GED equivalent
4. Some college
5. Associate's degree
6. Bachelor's college degree
7. Graduate degree/professional degree/JD/MD
98. DON'T KNOW
99. REFUSED

30. **[INTERVIEWER: RECORD RESPONDENT'S GENDER. DO NOT ASK]**

1. Male
2. Female
3. Don’t know

12. Appendix D: Survey Tabulations

12.1 Treatment Group Survey Tabulations

	Response	Legacy Wave		Expansion Wave		Refill Wave		All Waves	
		Count	Percent (n = 80)	Count	Percent (n = 80)	Count	Percent (n = 80)	Count	Percent (n = 240)
Q7. How helpful was The Home Energy Report for understanding your household's electricity use?	Very helpful	13	16%	22	28%	34	43%	69	29%
	Somewhat helpful	27	34%	28	35%	21	26%	76	32%
	Slightly helpful	12	15%	6	8%	10	13%	28	12%
	Not at all helpful	27	34%	22	28%	13	16%	62	26%
	Don't know	1	1%	2	3%	2	3%	5	2%
	Refused	0	0%	0	0%	0	0%	0	0%

	Response	Legacy Wave		Expansion Wave		Refill Wave		All Waves	
		Count	Percent (n = 80)	Count	Percent (n = 80)	Count	Percent (n = 80)	Count	Percent (n = 240)
Q8. How would you say your energy use compares to other homes of similar size in your neighborhood?	Significantly higher	18	23%	10	13%	5	6%	33	14%
	Somewhat higher	27	34%	16	20%	13	16%	56	23%
	About the same	17	21%	28	35%	19	24%	64	27%
	Somewhat lower	8	10%	10	13%	16	20%	34	14%
	Significantly lower	2	3%	5	6%	23	29%	30	13%
	Don't know	7	9%	10	13%	4	5%	31	9%
	Refused	1	1%	1	1%	0	0%	2	1%

Q9. How would you say	Response	Legacy Wave	Expansion Wave	Refill Wave	All Waves

your home compares to your neighbors in terms of energy efficiency?		*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 240)*
	Very energy efficient	20	25%	11	14%	17	21%	48	20%
	Somewhat energy efficient	13	16%	20	25%	17	21%	50	21%
	Average	33	41%	35	44%	34	43%	102	43%
	Somewhat inefficient	7	9%	8	10%	4	5%	19	8%
	Very inefficient	2	3%	3	4%	5	6%	10	4%
	Don't know	5	6%	3	4%	3	4%	11	5%
	Refused	0	0%	0	0%	0	0%	0	0%

Q10. Have you heard of wattSmart energy efficiency programs offered by Pacific Power?	*Response*	*Legacy Wave*		*Expansion Wave*		*Refill Wave*		*All Waves*	
		Count	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 240)*
	Yes	49	61%	51	64%	56	70%	156	65%
	No	26	33%	27	34%	24	30%	77	32%
	Don't know	5	6%	2	2%	0	0%	7	0%
	Refused	0	0%	0	0%	0	0%	0	3%

Q11. Home Energy Savings?	*Response*	*Legacy Wave*		*Expansion Wave*		*Refill Wave*		*All Waves*	
		Count	*Percent (n = 49)*	*Count*	*Percent (n = 51)*	*Count*	*Percent (n = 56)*	*Count*	*Percent (n = 156)*
	Yes	39	80%	35	69%	45	79%	119	76%
	No	10	20%	13	25%	11	19%	34	22%
	Don't know	0	0%	3	6%	1	0%	4	3%
	Refused	0	0%	0	0%	0	2%	0	0%

Q12. Low Income Weatherization?	*Response*	*Legacy Wave*		*Expansion Wave*		*Refill Wave*		*All Waves*	
		Count	*Percent (n = 49)*	*Count*	*Percent (n = 51)*	*Count*	*Percent (n = 56)*	*Count*	*Percent (n = 156)*

	Yes	28	57%	25	49%	32	57%	85	54%
	No	20	41%	26	51%	24	43%	70	45%
	Don't know	1	2%	0	0%	0	0%	1	1%
	Refused	0	0%	0	0%	0	0%	0	0%

Q14. wattSmart Business?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Percent (n = 49)***	***Count***	***Percent (n = 51)***	***Count***	***Percent (n = 56)***	***Count***	***Percent (n = 156)***
	Yes	24	49%	16	31%	23	41%	63	40%
	No	25	51%	34	67%	32	57%	91	58%
	Don't know	0	0%	1	2%	1	2%	2	1%
	Refused	0	0%	0	0%	0	0%	0	0%

Q17. How many CFLs have been purchased for your household in 2017?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Response (n = 80)***	***Count***	***Response (n = 80)***	***Count***	***Response (n = 80)***	***Count***	***Response (n = 240)***
	Mean value	67	5.30	70	3.49	72	2.38	209	2.38
	Don't know	13	16%	10	13%	8	10%	31	13%
	Refused	0	0%	0	0%	0	0%	0	0%

Q17. Of the [x] CFLs purchased, how many of them have been installed?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Response (n = 37)***	***Count***	***Response (n = 36)***	***Count***	***Response (n = 30)***	***Count***	***Response (n = 103)***
	Mean value	36	6.59	35	6.46	29	5.34	100	5.94
	Don't know	1	0%	1	2%	1	2%	3	1%
	Refused	0	0%	0	0%	0	0%	0	0%

Q18. How many LEDs have been purchased for your household in 2017?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Response (n = 80)***	***Count***	***Response (n = 80)***	***Count***	***Response (n = 80)***	***Count***	***Response (n = 240)***
	Mean value	71	8.02	68	6.90	73	4.13	212	5.75
	Don't know	9	11%	12	15%	7	9%	28	12%
	Refused	0	0%	0	0%	0	0%	0	0

Q19. Of the [x] LEDs purchased, how many of them have been installed?	*Response*	*Legacy Wave*		*Expansion Wave*		*Refill Wave*		*All Waves*	
		Count	*Response (n =48)*	*Count*	*Response (n = 42)*	*Count*	*Response (n = 37)*	*Count*	*Response (n = 127)*
	Mean value	47	6.10	42	9.52	37	6.05	126	7.94
	Don't know	1	2%	0	0%	0	0%	1	0%
	Refused	0	0%	0	0%	0	0%	0	0%
Q20. In 2017, did you purchase any equipment or make any energy efficiency upgrades to your home that would reduce your electricity usage?	*Response*	*Legacy Wave*		*Expansion Wave*		*Refill Wave*		*All Waves*	
		Count	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 240)*
	Yes	16	23%	18	23%	18	23%	54	23%
	No	60	75%	61	76%	61	76%	182	76%
	Don't know	2	3%	1	1%	1	1%	4	2%
	Refused	0	0%	0	0%	0	0%	0	0%

21. What purchases or upgrades did you make in 2017? Please only include purchase or upgrades that would reduce your electricity usage. [DO NOT READ. PROBE FOR MULTIPLE]	*Response*	*Legacy Wave*		*Expansion Wave*		*Refill Wave*	
		Count	*Percent (n = 23)*	*Count*	*Percent (n = 30)*	*Count*	*Percent (n = 23)*
	Replaced an air conditioner/HVAC unit (AC, heat pump, window unit)	0	0%	2	7%	3	13%
	Tuned-up or serviced an air conditioner/HVAC unit	0	0%	0	0%	0	0%
	Installed and/or replaced an evaporative cooler	1	4%	0	0%	0	0%
	CFLs/compact fluorescent lighting	0	0%	2	7%	0	0%
	LED bulbs	1	4%	3	10%	1	4%

	Clothes washer	1	4%	2	7%	1	4%
	Clothes dryer	1	4%	2	7%	1	4%
	Dishwasher	2	9%	2	7%	2	9%
	Furnace fan	1	4%	1	3%	0	0%
	Other fans (whole-house, attic fan, box fans, ceiling fans)	0	0%	0	0%	0	0%
	Refrigerator	3	13%	4	13%	3	13%
	Freezer	1	4%	0	0%	0	0%
	Pool equipment – heaters, pumps, variable speed drives or controls	0	0%	0	0%	0	0%
	Programmable thermostat	0	0%	0	0%	0	0%
	Smart thermostat / Wi-Fi thermostat / NEST / Ecobee	1	4%	1	3%	0	0%
	Water heater – storage tank, tankless, heat pump water heater	1	4%	1	3%	1	4%
	Windows – double pane, triple pane, low-e windows, storm windows	4	17%	3	10%	1	4%
	Solar screens	0	0%	0	0%	0	0%
	Efficient electronics	0	0%	0	0%	0	0%
	Insulation (attic insulation, wall insulation, floor insulation)	2	9%	3	10%	2	9%
	Solar panels / solar PV	0	0%	0	0%	0	0%
	Other _____	4	17%	4	13%	5	22%
	Don't know	0	0%	0	0%	2	9%
	Refused	0	0%	0	0%	1	4%

Q22. How important was information from the Home Energy Report from Pacific Power in your decision to make those energy efficient purchases or upgrades?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Percent (n = 18)***	***Count***	***Percent (n = 18)***	***Count***	***Percent (n = 15)***	***Count***	***Percent (n = 51)***
	Very important	2	11%	6	33%	1	7%	9	18%
	Somewhat important	4	22%	5	28%	5	33%	14	27%
	Slightly important	2	11%	2	11%	3	20%	7	14%
	Not important at all	9	50%	5	28%	6	40%	20	39%
	Don’t know	0	0%	0	0%	0	0%	0	0%
	Refused	1	6%	0	0%	0	0%	1	2%
Q23. In 2017, did you	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	

		Legacy Wave		Expansion Wave		Refill Wave		Total	
make any changes in your energy use habits that would conserve electricity in your home?		***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 240)***
	Yes	43	54%	25	31%	37	46%	105	44%
	No	36	45%	54	68%	41	51%	131	55%
	Don't know	1	1%	1	1%	2	3%	4	2%
	Refused	0	0%	0	0%	0	0%	0	0%

		Legacy Wave		Expansion Wave		Refill Wave	
	Response	***Count***	***Percent (n = 63)***	***Count***	***Percent (n = 31)***	***Count***	***Percent (n = 55)***
Q24. What actions or changes have you made? [DO NOT READ. PROBE FOR MULTIPLE]	Turned up the thermostat in summer to reduce AC use	2	3%	3	10%	7	13%
	Turned down the thermostat in winter to reduce heating use	14	22%	5	16%	12	22%
	Changed AC filter	0	0%	0	0%	0	0%
	Changed furnace filter	0	0%	0	0%	1	2%
	Clear areas around heating/cooling vents	2	3%	0	0%	1	2%
	Turned off lights in unoccupied rooms	12	19%	9	29%	15	27%
	Line-dry clothes	0	0%	0	0%	0	0%
	Run clothes washer with full load	0	0%	0	0%	0	0%
	Run dishwasher with full load	0	0%	0	0%	0	0%

	Used cold water setting on clothes washer	1	2%	0	0%	1	2%
	Used cold water setting on dishwasher	0	0%	0	0%	0	0%
	Unplug electronics when not in use	5	8%	1	3%	5	9%
	Turn off computers overnight	1	2%	0	0%	0	0%
	Take shorter showers	1	2%	0	0%	1	2%
	Turned down water heater setpoint	1	2%	0	0%	1	2%
	Sealed leaks and drafts	2	3%	0	0%	1	2%
	Cleaned refrigerator coils	0	0%	0	0%	0	0%
	Increased refrigerator/freezer temperature	0	0%	0	0%	0	0%
	Used heat blocking materials on windows / shaded windows during hot daytime	2	3%	0	0%	0	0%
	Increased use of fans to reduce use of AC	1	2%	1	3%	0	0%
	Shifted use off-peak	0	0%	0	0%	1	2%
	Other _____	19	30%	11	35%	8	15%
	Don't know	0	0%	1	3%	1	2%
	Refused	0	0%	0	0%	0	0%

Q25. How important was information from the Home Energy Report from Pacific Power in your decision to take these actions to conserve energy?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Percent (n = 43)***	***Count***	***Percent (n = 24)***	***Count***	***Percent (n = 36)***	***Count***	***Percent (n = 103)***
	Very important	13	30%	9	38%	10	28%	32	31%
	Somewhat important	13	30%	7	29%	9	25%	29	28%
	Slightly important	3	7%	5	21%	7	19%	15	15%
	Not important at all	13	30%	3	13%	9	25%	25	24%
	Don’t know	1	2%	0	0%	1	3%	2	2%
	Refused	0	0%	0	0%	0	0%	0	0%
Q26. On a scale of 1 to 5, Where “1” means “not At all knowledgeable” And “5” means “very Knowledgeable”, how Knowledgeable are you	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Response (n =80)***	***Count***	***Response (n = 80)***	***Count***	***Response (n = 80)***	***Count***	***Response (n = 240)***
	Mean value	80	3.91	79	9.76	80	3.90	239	3.86
	Don’t know	0	0%	1	1%	0	0%	1	<1%

About ways to save Energy in your home?	Refused	0	0%	0	0%	0	0%	0	0%

Q27. How would you rate your household's efforts to save electricity in your home? Using a scale of 1 to 5, where "1" means "you have not done much" and "5" means "you have done almost everything you can" to lower your monthly electricity bill in your home.	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Response (n =80)***	***Count***	***Response (n = 80)***	***Count***	***Response (n = 80)***	***Count***	***Response (n = 240)***
	Mean value	67	3.55	70	3.53	72	3.74	209	3.60
	Don't know	0	0%	0	0%	0	0%	0	0%
	Refused	0	0%	0	0%	0	0%	0	0%

Q28. What motivated you to save electricity in your home?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Percent (n = 71)***	***Count***	***Percent (n = 71)***	***Count***	***Percent (n = 72)***	***Count***	***Percent (n = 214)***
	Reduce costs/bill	63	89%	60	85%	62	86%	185	86%
	Conservation/good for environment	6	8%	8	11%	11	15%	25	12%
	Make my use similar to my neighbors	2	3%	2	3%	1	1%	5	2%
	Other	5	7%	6	8%	3	4%	14	7%
	Don't know	2	3%	4	6%	5	7%	11	5%
	Refused	0	0%	0	0%	0	0%	0	0%

Q29. How much time Would you say you spend reading the Home Energy Report?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 240)***
	0	5	6%	6	8%	5	6%	16	7%

	1 minute or less	23	29%	23	29%	19	24%	65	27%
	2, few, couple minutes	8	10%	12	15%	12	15%	32	13%
	3 to 5 minutes	3	4%	2	3%	6	8%	11	5%
	5 to 10 minutes	15	19%	19	24%	19	24%	53	22%
	10 to 15 minutes	15	19%	7	9%	6	8%	28	12%
	15 to 20 minutes	1	1%	5	6%	3	4%	9	4%
	20 to 30 minutes	4	5%		0%	2	3%	6	3%
	1 to 2 hours	1	1%		0%		0%	1	0%
	3 to 4 hours	1	1%		0%		0%	1	0%
	Don't know	1	1%	4	5%	5	6%	10	4%
	Refused	3	4%	2	3%	3	4%	8	3%

		Legacy Wave		*Expansion Wave*		*Refill Wave*		*All Waves*	
	Response	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 240)***
Q30. How many reports Would you like to receive Per year? ***Would you say…***	More often than currently sent	2	3%	5	6%	6	8%	13	5%
	The same currently sent	47	59%	53	66%	50	63%	150	63%
	Less than you're Currently sent	17	21%	13	16%	17	21%	47	20%
	No reports at all	14	18%	7	9%	4	5%	25	10%
	Don't know	0	0%	2	3%	3	4%	5	2%
	Refused	0	0%	0	0%	0	0%	0	0%
Q31. On a scale of 1 to 5 where "1" is "very dissatisfied" and "5" is "very satisfied", how satisfied would you say you are with the following Home Energy report items? Please	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Response***	***Count***	***Response***	***Count***	***Response***	***Count***	***Response***
	The energy saving tips provided in your report	65	3.62	70	3.46	69	3.93	204	3.67
	The accuracy of the report	66	3.20	70	3.19	69	4.13	205	3.51

note that if you do not feel you are able to provide a score you may say "I don't know"	in characterizing your home's energy use								
	The savings on your bill after acting on recommendations in the report	61	2.82	58	3.22	66	3.58	185	3.22
	The level of detail in the report	70	3.41	73	3.63	68	3.90	211	3.64
	The program overall	78	3.45	76	3.68	67	4.17	231	3.77

Q33. Now thinking about your experiences with Pacific Power as your electric utility, how satisfied would you say you are with Pacific Power? Please use a scale of 0 to 10, where "0" means "extremely dissatisfied" and "10" means "extremely satisfied".	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Response (n =80)***	***Count***	***Response (n = 80)***	***Count***	***Response (n = 80)***	***Count***	***Response (n = 240)***
	Mean value	80	7.39	80	7.31	80	8.09	240	7.60
	Don't know	0	0%	0	0%	0	0%	0	0%
	Refused	0	0%	0	0%	0	0%	0	0%
Q35. Do you own or rent the home in which you live?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 240)***
	Own	69	86%	64	64%	48	60%	181	75%
	Rent	4	5%	11	11%	26	33%	41	17%
	Don't know	0	0%	1	1%	0	0%	1	<1%
	Refused	7	9%	4	5%	6	7%	17	7%
Q36. Which of the following brackets contains your age?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 240)***

	18-24	1	1%	1	1%	1	1%	3	1%
	25-34	1	1%	5	6%	10	13%	16	7%
	35-44	3	4%	8	10%	11	14%	22	9%
	45-54	15	19%	12	15%	6	8%	33	14%
	55-64	10	13%	9	11%	13	16%	32	13%
	65 or over	42	53%	39	49%	33	41%	114	48%
	Don't know	0	0%	0	0%	0	0%	0	0%
	Refused	8	10%	6	8%	6	8%	20	8%

Q37. How many people live in your household full time?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Response (n =80)***	***Count***	***Response (n = 80)***	***Count***	***Response (n = 80)***	***Count***	***Response (n = 240)***
	Mean value	71	2.73	73	2.62	73	2.11	219	2.48
	Don't know	0	0%	2	3%	0	0%	2	1%
	Refused	9	11%	5	6%	7	9%	21	9%
Q38. I'm going to read Off a list of income ranges. Please indicate which range your total pre-tax household income falls.	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 240)***
	Less than $25,000	6	8%	6	8%	16	20%	28	12%
	$25,000-$49,999	15	19%	19	24%	15	19%	49	20%
	$50,000-$74,999	12	15%	13	16%	6	8%	31	13%
	$75,000-$99,999	7	9%	7	9%	7	9%	21	9%
	$100,000-$149,999	4	5%	5	6%	3	4%	12	5%
	$150,000 or above	1	1%	0	0%	2	3%	3	1%
	Don't know	6	8%	6	8%	9	11%	21	9%
	Refused	29	36%	24	30%	22	28%	75	31%
Q39. What is the highest level of education you have completed?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 240)***
	Up to 8th grade	1	1%	2	3%	2	3%	5	2%
	Some high school	6	8%	4	5%	2	3%	12	5%

	High school or GED	20	25%	15	19%	14	18%	49	20%
	Some college	18	23%	20	25%	13	16%	51	21%
	Associates degree	5	6%	5	6%	12	15%	22	9%
	Bachelor's degree	9	11%	13	16%	13	16%	35	15%
	Graduate/Professional	10	13%	13	16%	14	18%	37	15%
	Don't know	1	1%	0	0%	1	1%	2	1%
	Refused	10	13%	8	10%	9	11%	27	11%

12.2 Control Group Survey Tabulations

		Legacy Wave		*Expansion Wave*		*Refill Wave*		*All Waves*	
	Response	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 240)***
Q4. How would you say your energy use compares to other homes of similar size in your neighborhood? Is your usage…	Significantly higher	4	5%	5	6%	2	3%	11	5%
	Somewhat higher	6	8%	6	8%	6	8%	18	8%
	About the same	24	30%	27	34%	24	30%	75	31%
	Somewhat lower	7	9%	15	19%	19	24%	41	17%
	Significantly lower	3	4%	4	5%	6	8%	13	5%
	Don't know	36	45%	23	29%	23	29%	82	34%
	Refused	0	0%	0	0%	0	0%	0	0%
		Legacy Wave		*Expansion Wave*		*Refill Wave*		*All Waves*	
	Response	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 240)***
Q5. How would you say your home compares to your neighbors in terms of energy efficiency? Is your home…	Somewhat energy efficient	14	18%	22	28%	19	24%	55	23%
	Average	25	31%	24	30%	28	35%	77	32%
	Somewhat inefficient	12	15%	6	8%	6	8%	24	10%
	Very inefficient	1	1%	4	5%	2	3%	7	3%
	Don't know	13	16%	9	11%	12	15%	34	14%
	Refused	1	1%	0	0%	1	1%	2	1%
	Somewhat energy efficient	14	18%	22	28%	19	24%	55	23%

		Legacy Wave		Expansion Wave		Refill Wave		All Waves	
Q6. Have you heard of wattSmart energy efficiency programs offered by Pacific Power?	**Response**	**Count**	**Percent (n = 80)**	**Count**	**Percent (n = 80)**	**Count**	**Percent (n = 80)**	**Count**	**Percent (n = 240)**
	Yes	50	63%	53	66%	41	51%	144	60%
	No	27	34%	27	34%	37	46%	91	38%
	Don't know	3	4%	0	0%	2	3%	5	2%
	Refused	0	0%	0	0%	0	0%	0	0%
		Legacy Wave		**Expansion Wave**		**Refill Wave**		**All Waves**	
Q7. Home Energy Savings?	**Response**	**Count**	**Percent (n = 50)**	**Count**	**Percent (n = 53)**	**Count**	**Percent (n = 41)**	**Count**	**Percent (n = 240)**
	Yes	37	74%	38	72%	30	73%	105	73%
	No	13	26%	15	28%	9	22%	37	26%
	Don't know	0	0%	0	0%	2	5%	2	1%
	Refused	0	0%	0	0%	0	0%	0	0%
		Legacy Wave		**Expansion Wave**		**Refill Wave**		**All Waves**	
Q8. Low Income Weatherization?	**Response**	**Count**	**Percent (n = 50)**	**Count**	**Percent (n = 53)**	**Count**	**Percent (n = 41)**	**Count**	**Percent (n = 240)**
	Yes	26	52%	30	57%	23	56%	79	55%
	No	21	42%	23	43%	15	37%	59	41%
	Don't know	2	4%	0	0%	3	7%	5	3%
	Refused	1	2%	0	0%	0	0%	1	1%
		Legacy Wave		**Expansion Wave**		**Refill Wave**		**All Waves**	
Q10. wattSmart Business?	**Response**	**Count**	**Percent (n = 50)**	**Count**	**Percent (n = 53)**	**Count**	**Percent (n = 41)**	**Count**	**Percent (n = 240)**
	Yes	24	48%	31	58%	16	39%	71	49%
	No	23	46%	22	42%	23	56%	68	47%
	Don't know	3	6%	0	0%	2	5%	5	3%
	Refused	0	0%	0	0%	0	0%	0	0%

Q12. How many CFLs	**Response**	**Legacy Wave**	**Expansion Wave**	**Refill Wave**	**All Waves**

have been purchased for your household in 2017?		*Count*	*Response (n = 80)*	*Count*	*Response (n = 80)*	*Count*	*Response (n = 80)*	*Count*	*Response (n = 240)*
	Mean value	64	3.55	72	4.01	64	2.70	200	3.45
	Don't know	16	20%	8	10%	16	20%	40	20%
	Refused	0	0%	0	0%	0	0%	0	0%
Q13. Of the [x] CFLs purchased, how many of them have been installed?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Response (n = 31)***	***Count***	***Response (n = 34)***	***Count***	***Response (n = 31)***	***Count***	***Response (n = 96)***
	Mean value	30	6.33	33	7.09	30	5.52	93	5.81
	Don't know	1	3%	1	3%	1	3%	3	3%
	Refused	0	0%	0	0%	0	0%	0	0%
Q14. How many LEDs have been purchased for your household in 2017?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Response (n = 80)***	***Count***	***Response (n = 80)***	***Count***	***Response (n = 80)***	***Count***	***Response (n = 240)***
	Mean value	68	8.56	73	7.38	69	3.59	210	6.40
	Don't know	12	15%	6	8%	11	14%	29	12%
	Refused	0	0%	1	1%	0	0%	1	0%
Q15. Of the [x] LEDs purchased, how many of them have been installed?	***Response***	***Legacy Wave***		***Expansion Wave***		***Refill Wave***		***All Waves***	
		Count	***Response (n =52)***	***Count***	***Response (n = 54)***	***Count***	***Response (n = 33)***	***Count***	***Response (n = 139)***
	Mean value	51	5.84	53	9.64	33	5.97	137	7.98
	Don't know	1	2%	1	2%	0	0%	2	1%
	Refused	0	0%	0	0%	0	0%	0	0%

		Legacy Wave	***Expansion Wave***	***Refill Wave***	***All Waves***

Q16. In 2017, did you purchase any energy efficient equipment or make energy efficiency upgrades to your home that would reduce your electricity usage?	*Response*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 240)*
	Yes	23	29%	19	24%	10	13%	52	22%
	No	54	68%	59	74%	69	86%	182	76%
	Don't know	3	4%	2	3%	1	1%	6	3%
	Refused	0	0%	0	0%	0	0%	0	0%

	Response	Legacy Wave		Expansion Wave		Refill Wave	
		Count	Percent (n = 31)	Count	Percent (n = 27)	Count	Percent (n = 11)
Q17. What purchases or upgrades did you make in 2017? Please only include purchase or upgrades that would reduce your electricity usage. [DO NOT READ. PROBE FOR MULTIPLE]	Replaced an air conditioner/HVAC unit (AC, heat pump, window unit)	0	0%	3	11%	3	27%
	Tuned-up or serviced an air conditioner/HVAC unit	0	0%	2	7%	0	0%
	Installed and/or replaced an evaporative cooler	0	0%	0	0%	0	0%
	CFLs/compact fluorescent lighting	0	0%	1	4%	0	0%
	LED bulbs	6	19%	3	11%	2	18%
	Clothes washer	3	10%	2	7%	0	0%
	Clothes dryer	2	6%	3	11%	0	0%
	Dishwasher	2	6%	2	7%	0	0%
	Furnace fan	0	0%	1	4%	0	0%
	Other fans (whole-house, attic fan, box fans, ceiling fans)	0	0%	1	4%	0	0%
	Refrigerator	3	10%	3	11%	0	0%
	Freezer	1	3%	1	4%	0	0%
	Pool equipment – heaters, pumps, variable speed drives or controls	1	3%	0	0%	0	0%
	Programmable thermostat	0	0%	0	0%	0	0%
	Smart thermostat / Wi-Fi thermostat / NEST / Ecobee	0	0%	1	4%	0	0%
	Water heater – storage tank, tankless, heat pump water heater	1	3%	0	0%	2	18%
	Windows – double pane, triple pane, low-e windows, storm windows	2	6%	1	4%	1	9%
	Solar screens	0	0%	0	0%	0	0%
	Efficient electronics	0	0%	0	0%	0	0%
	Insulation (attic insulation, wall insulation, floor insulation)	4	13%	1	4%	3	27%
	Solar panels / solar PV	0	0%	0	0%	0	0%
	Other _____	6	19%	2	7%	0	0%
	Don't know	0	0%	0	0%	0	0%
	Refused	0	0%	0	0%	0	0%

		Legacy Wave	Expansion Wave	Refill Wave	All Waves

Q18. In the last two years, have you made any changes in your energy use habits that would conserve electricity in your home?	*Response*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 240)*
	Yes	34	43%	32	40%	29	36%	95	40%
	No	44	55%	46	58%	50	63%	140	58%
	Don't know	2	3%	2	3%	1	1%	5	2%
	Refused	0	0%	0	0%	0	0%	0	0%

	Response	Legacy Wave Count	Legacy Wave Percent (n = 43)	Expansion Wave Count	Expansion Wave Percent (n = 47)	Refill Wave Count	Refill Wave Percent (n = 42)
19. What actions or changes have you made? [DO NOT READ. PROBE FOR MULTIPLE]	Turned up the thermostat in summer to reduce AC use	7	16%	3	6%	3	7%
	Turned down the thermostat in winter to reduce heating use	8	19%	11	23%	11	26%
	Changed AC filter	0	0%	0	0%	0	0%
	Changed furnace filter	0	0%	1	2%	0	0%
	Clear areas around heating/cooling vents	0	0%	1	2%	1	2%
	Turned off lights in unoccupied rooms	10	23%	10	21%	11	26%
	Line-dry clothes	0	0%	0	0%	1	2%
	Run clothes washer with full load	0	0%	0	0%	1	2%
	Run dishwasher with full load	1	2%	0	0%	1	2%
	Used cold water setting on clothes washer	0	0%	1	2%	0	0%
	Used cold water setting on dishwasher	0	0%	0	0%	0	0%
	Unplug electronics when not in use	2	5%	4	9%	2	5%
	Turn off computers overnight	0	0%	0	0%	0	0%
	Take shorter showers	0	0%	0	0%	0	0%
	Turned down water heater setpoint	3	7%	0	0%	0	0%
	Sealed leaks and drafts	1	2%	1	2%	2	5%
	Cleaned refrigerator coils	0	0%	1	2%	0	0%
	Increased refrigerator/freezer temperature	0	0%	0	0%	0	0%
	Used heat blocking materials on windows / shaded windows during hot daytime	1	2%	0	0%	1	2%
	Increased use of fans to reduce use of AC	0	0%	0	0%	0	0%
	Shifted use off-peak	0	0%	1	2%	0	0%
	Other _____	10	23%	13	28%	8	19%
	Don't know	0	0%	0	0%	0	0%
	Refused	0	0%	0	0%	0	0%

		Legacy Wave	Expansion Wave	Refill Wave	All Waves

Q20. Overall, on a scale of "1 to 5" where "1" means "Not at all knowledgeable" and "5" means "Very knowledgeable," how knowledgeable are you about ways to save energy in your home?	*Response*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 240)*
	1 (Not at all knowledgeable)	3	4%	2	3%	3	4%	8	3%
	2	5	6%	4	5%	8	10%	17	7%
	3	27	34%	25	31%	26	33%	78	33%
	4	21	26%	25	31%	18	23%	64	27%
	5 (Very knowledgeable)	20	25%	22	28%	20	25%	62	26%
	Don't know	3	4%	1	1%	4	5%	8	3%
	Refused	1	1%	1	1%	1	1%	3	1%

Q21. How would you rate your household's efforts to save electricity in your home? Using a scale of 1 to 5, with 1 meaning "you have not done much" and 5 meaning "you have done almost everything you can" to lower your monthly energy bill in your home.	*Response*	*Legacy Wave*		*Expansion Wave*		*Refill Wave*		*All Waves*	
		Count	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 240)*
	1 (have not done much)	5	6%	3	4%	5	6%	13	5%
	2	4	5%	6	8%	6	8%	16	7%
	3	24	30%	26	33%	26	33%	76	32%
	4	28	35%	25	31%	14	18%	67	28%
	5 (have done almost everything you can)	18	23%	18	23%	26	33%	62	26%
	Don't know	0	0%	1	1%	0	0%	1	0%
	Refused	1	1%	1	1%	3	4%	5	2%

	Response	*Legacy Wave*		*Expansion Wave*		*Refill Wave*	
		Count	*Percent (n = 79)*	*Count*	*Percent (n = 77)*	*Count*	*Percent (n = 71)*

22. What motivated you to save electricity in your home? [DO NOT READ. MARK ALL INDICATED]	Reduce electricity costs / reduce electric bill	66	84%	63	82%	53	75%
	Conservation / good for environment	9	11%	8	10%	6	8%
	Make my usage more similar to my neighbors	0	0%	0	0%	0	0%
	Other _____[RECORD VERBATIM]	4	5%	6	8%	9	13%
	Don't know	0	0%	0	0%	2	3%
	Refused	0	0%	0	0%	1	1%

		Legacy Wave		***Expansion Wave***		***Refill Wave***		***All Waves***	
	Response	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 240)***
Q23. Now thinking about your experiences with Pacific Power as your electric utility, how satisfied would you say you are with Pacific Power? Please use a scale of 0 to 10, where "0" means "extremely dissatisfied" and "10" means "extremely satisfied".	0 (Extremely dissatisfied)	2	3%	1	1%	4	5%	7	3%
	1	0	0%	0	0%	1	1%	1	0%
	2	1	1%	1	1%	1	1%	3	1%
	3	5	6%	4	5%	3	4%	12	5%
	4	7	9%	3	4%	1	1%	11	5%
	5	7	9%	7	9%	6	8%	20	8%
	6	3	4%	1	1%	4	5%	8	3%
	7	13	16%	12	15%	8	10%	33	14%
	8	21	26%	20	25%	20	25%	61	25%
	9	10	13%	12	15%	13	16%	35	15%
	10 (Extremely satisfied)	11	14%	19	24%	19	24%	49	20%

		Legacy Wave		***Expansion Wave***		***Refill Wave***		***All Waves***	
Q24. Do you own or rent the home in which you live?	***Response***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 240)***
	Own	70	88%	69	86%	46	58%	185	77%
	Rent	5	6%	7	9%	27	34%	39	16%

	Don't know	1	1%	2	3%	0	0%	3	1%
	Refused	4	5%	2	3%	7	9%	13	5%

		Legacy Wave		*Expansion Wave*		*Refill Wave*		*All Waves*	
Q25. Which of the following brackets contains your age?	***Response***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 80)***	***Count***	***Percent (n = 240)***
	18-24	2	3%	0	0%	0	0%	2	1%
	25-34	0	0%	5	6%	6	8%	11	5%
	35-44	4	5%	10	13%	6	8%	20	8%
	45-56	14	18%	13	16%	5	6%	32	13%
	55-64	12	15%	17	21%	13	16%	42	18%
	65 or over	43	54%	33	41%	42	53%	118	49%
	Don't know	0	0%	0	0%	1	1%	1	0%
	Refused	5	6%	2	3%	7	9%	14	6%

		Legacy Wave		Expansion Wave		Refill Wave		All Waves	
	Response	Count	Percent (n = 80)	Count	Percent (n = 80)	Count	Percent (n = 80)	Count	Percent (n = 240)
Q26. How many people live in your household full time?	1	18	23%	17	21%	42	53%	77	32%
	2	37	46%	35	44%	16	20%	88	37%
	3	9	11%	9	11%	7	9%	25	10%
	4	7	9%	7	9%	3	4%	17	7%
	5	4	5%	4	5%	1	1%	9	4%
	6	1	1%	3	4%	1	1%	5	2%
	7	0	0%	2	3%	0	0%	2	1%
	8	0	0%	0	0%	1	1%	1	0%
	9	0	0%	0	0%	1	1%	1	0%
	10	1	1%	0	0%	0	0%	1	0%
	Don't know	0	0%	0	0%	0	0%	0	0%
	Refused	3	4%	3	4%	8	10%	14	6%
		Legacy Wave		Expansion Wave		Refill Wave		All Waves	
	Response	Count	Percent (n = 80)	Count	Percent (n = 80)	Count	Percent (n = 80)	Count	Percent (n = 240)
Q27. I'm going to read off a list of income ranges, please indicate which range your total pre-tax household income falls. This is the total annual income of your household:	Less than $25,000	10	13%	10	13%	25	31%	45	19%
	$25,000 - $49,999	17	21%	6	8%	17	21%	40	17%
	$50,000 – $74,999	5	6%	17	21%	4	5%	26	11%
	$75,000 - $99,999	7	9%	12	15%	2	3%	21	9%
	$100,000-$149,999	5	6%	14	18%	2	3%	21	9%
	$150,000 or above	2	3%	5	6%	2	3%	9	4%
	Don't know	3	4%	4	5%	2	3%	9	4%
	Refused	31	39%	12	15%	26	33%	69	29%

		Legacy Wave	Expansion Wave	Refill Wave	All Waves

Q28. What's the highest level of education you've completed? (DON'T READ)	*Response*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 80)*	*Count*	*Percent (n = 240)*
	Up to 8th grade	5	6%	0	0%	1	1%	6	3%
	Some high school	4	5%	4	5%	7	9%	15	6%
	High school or GED equivalent	22	28%	21	26%	24	30%	67	28%
	Some college	18	23%	11	14%	15	19%	44	18%
	Associate's degree	10	13%	8	10%	5	6%	23	10%
	Bachelor's college degree	7	9%	18	23%	7	9%	32	13%
	Graduate degree/professional degree/JD/MD	7	9%	12	15%	12	15%	31	13%
	Don't know	0	0%	2	3%	0	0%	2	1%
	Refused	7	9%	4	5%	9	11%	20	8%

13. Appendix E: Demographics

Figure 19: Own or Rent Home

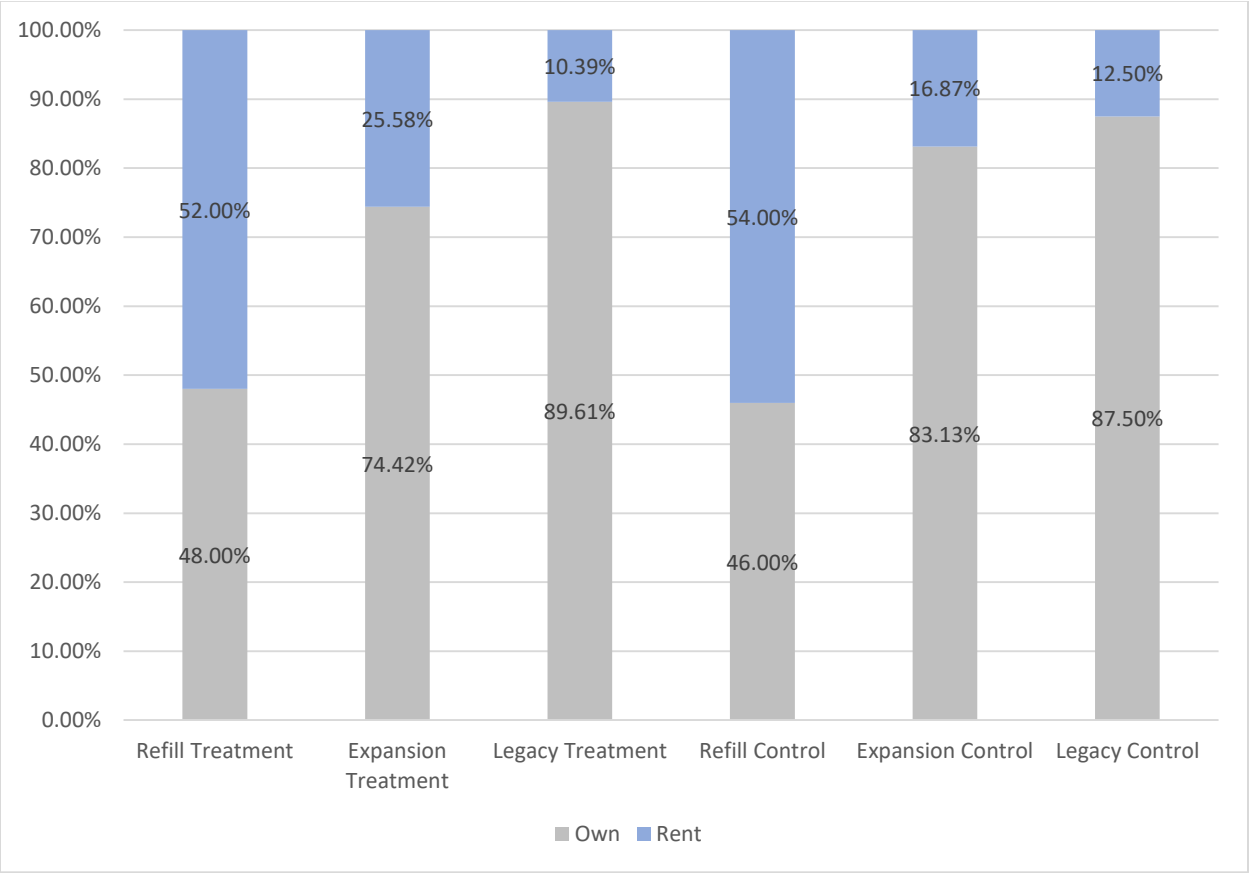

Figure 20: Pre-Tax Household Annual Income Range

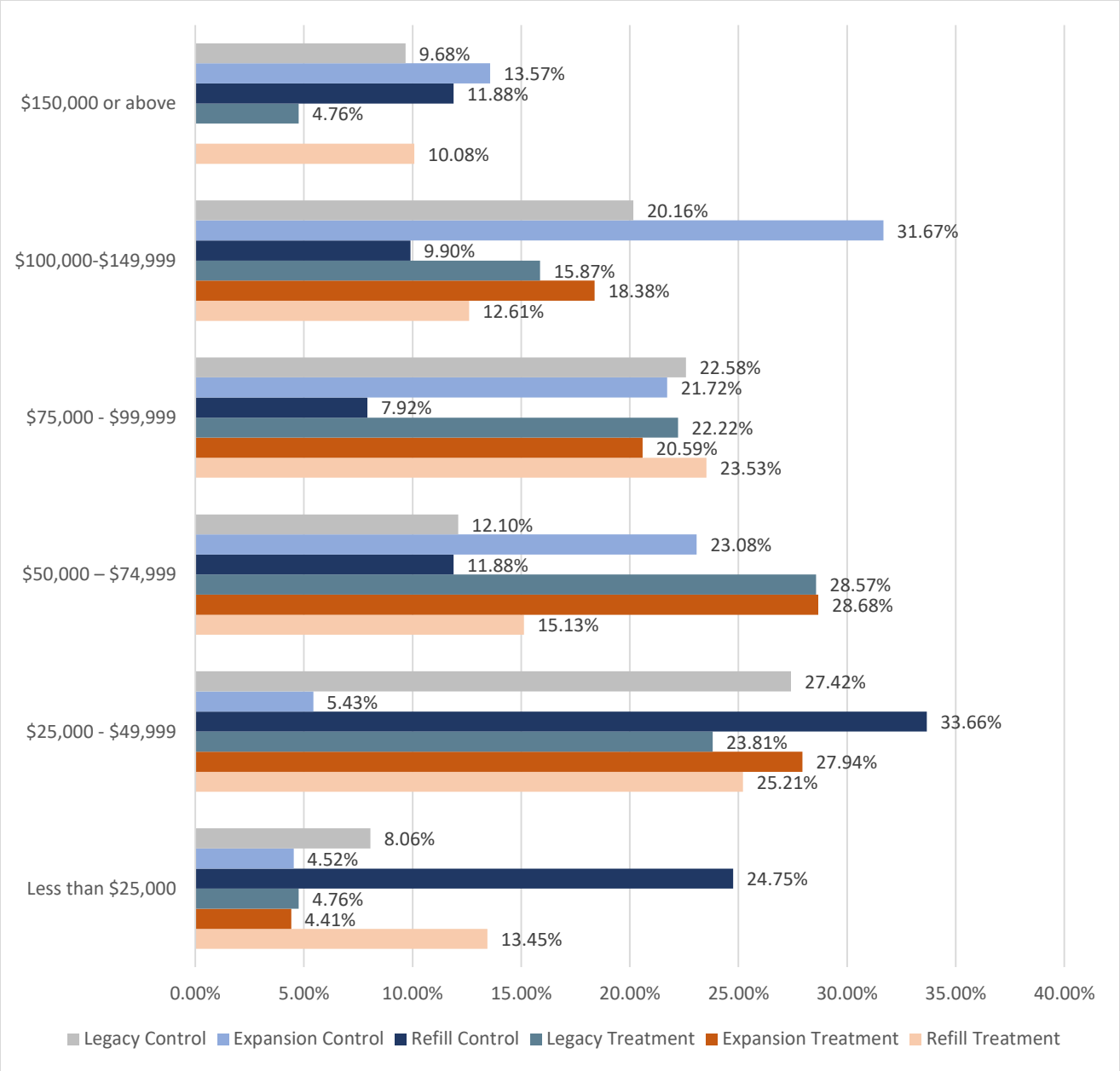

Figure 21: Highest Education Level of Respondent

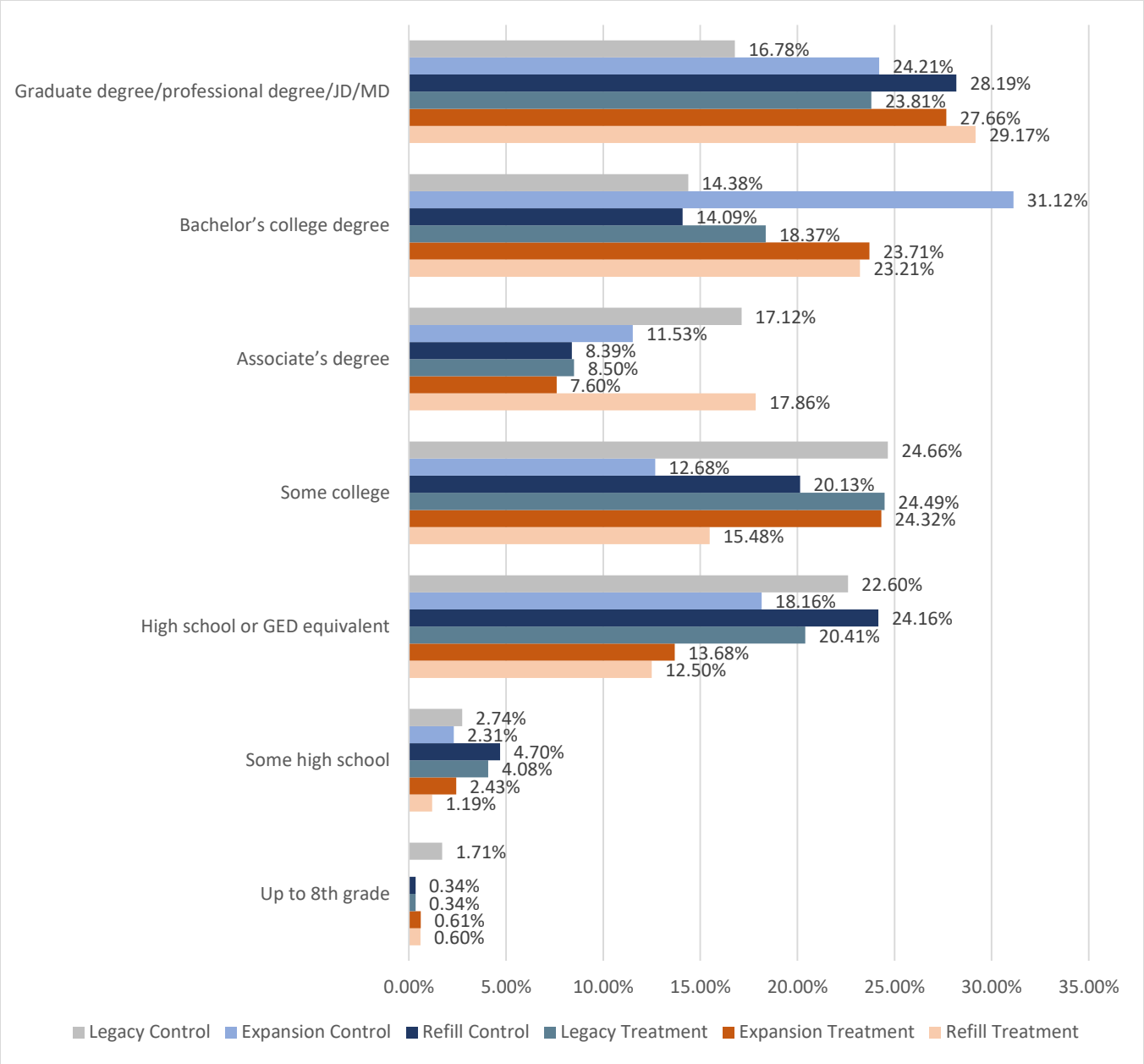

Figure 22: Age of Respondent

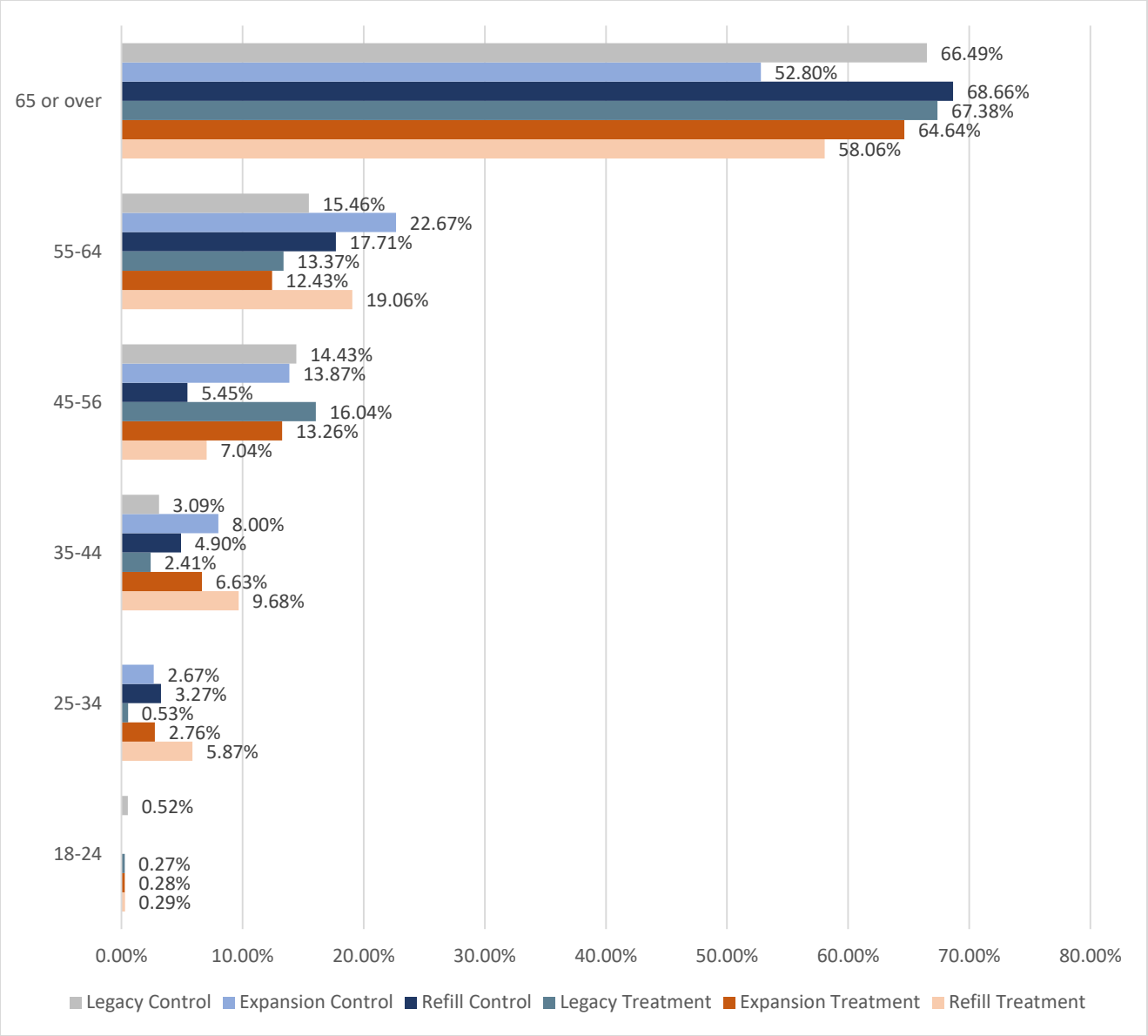

Figure 23: Number of People in Household Full-Time