NAVIGANT

Utah
Home Energy Reports Program
2014-2015 Evaluation Report

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EXECUTIVE SUMMARY

Program Description

Rocky Mountain Power Utah's Home Energy Reports (HER) program is designed to generate energy savings by providing residential customers with information about their specific energy use as well as related energy conservation suggestions and tips. The information is provided in the form of bi-monthly[1] mailed reports that illustrate the following:

- How customers' recent energy use compares to their energy use in the past.

- Tips on how customers can reduce energy consumption, some of which are tailored to each customer's unique circumstances.

- Information on how customers' energy use compares to that of neighbors with homes with similar household characteristics.

In other studies, this type of information has shown that customers are stimulated to reduce their energy use, creating average energy savings in the 1% to 2% range depending on local energy use patterns.[2]

An important feature of the program is that it is a randomized controlled trial (RCT). Eligible customers are randomly assigned to a treatment group or a control group to estimate changes in energy use due to the program. As an opt-out implementation model, customers do not choose to participate, but they can opt-out if they do not wish to receive the reports—i.e., customers can request removal from the program. Figure 1 illustrates the program design.

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[1] Customers in both waves received six reports in 2014 and four reports in 2015. In 2015, reports were not sent from August to December. Reports were restarted in January 2016 on a quarterly, rather than bimonthly, schedule.

[2] See for example:

Allcott, Hunt. 2011. *Social Norms and Energy Conservation.* Journal of Public Economics, Vol 95 (9-10), pp. 1,082–1,095.

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

Rosenberg, Mitchell, G.K. Agnew, and K. Gaffney. *Causality, Sustainability, and Scalability – What We Still Do and Do Not Know about the Impacts of Comparative Feedback Programs*. Paper prepared for 2013 International Energy Program Evaluation Conference, Chicago. 2013.

Figure 1. HER Program Design
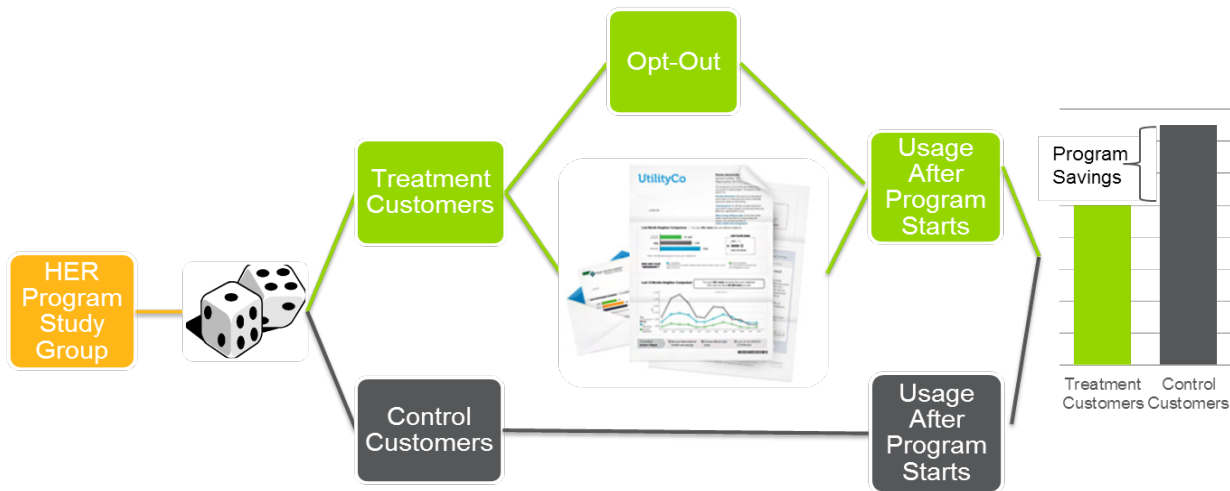
Source: Navigant

The HER program consists of the following two waves:

1. Legacy Wave, launched in July 2012
2. Expansion Wave, launched in September 2014

For the purpose of this evaluation, the program launch is defined as the beginning of the month in which reports were first generated for a given wave.

Total Savings by Wave and Year

Summaries of total evaluated program savings are shown in Table 1, which shows total program savings, and Table 2, which shows savings broken out by wave. Navigant considered three evaluation periods for each wave: 2014, 2015, and the two years combined. Navigant estimated each time period (i.e. year 2014, year 2015, and 2014-2015 together) as a separate analysis because there is additional information and statistical power in running the two years together rather than just adding together the results of year 2014 and year 2015. Since each time period was run as a separate analysis, the savings totals for year 2014 and year 2015 does not sum to the savings over the total combined time period of 2014-2015 together. In 2014, the Legacy Wave ran for all 12 months, but the Expansion Wave ran for only four months. The number of treatment customers is the number at the start of each evaluation period.

Table 1 includes

*   "Verified Evaluation Savings" which are the savings found in the evaluation before accounting for savings that may be double counted with other programs.

*   "Reported Savings" which came from Rocky Mountain Power's cost-effectiveness inputs for 2014 and 2015. For the 2014-2015 column, 2014 and 2015 were summed together.

- "Realization Rate" which was calculated by comparing reported savings to the verified evaluation savings (prior to adjusting for doubling counting) which is the most accurate comparison as the reported savings do not account for double counting.

- "Percent Savings" which are the absolute savings converted to a percent,

- Verified Net Savings which are the savings from the evaluation adjusted for savings that are double counted with other programs.

As found in Table 1 and Table 2 below, the need to account for savings that are double counted with other energy efficiency programs arises because the HER program may change the participation rate in other energy efficiency programs; this change in participation is referred to as uplift. Uplift estimates may be positive, meaning the HER program increased the participation in other programs; or negative, meaning the HER program decreased participation in other programs. In the case of positive uplift, the savings from uplift are subtracted from the HER program in order to avoid double counting the savings in both the HER program and another energy efficiency program. In the case of negative uplift, the savings from uplift are added to the HER program to avoid biasing the baseline usage downward and thus underestimating savings. The methodology for calculating uplift is described in more detail in Section 2.3. Detailed results of the uplift analysis are in Section 5.3.

Table 1. Program Electric Savings*,**

Type of Statistic	Total Across Both Waves		
	2014	2015	2014-2015
Number of Treatment Customers	303,822	289,242	303,822
Verified Evaluation Savings (MWh), Prior to Uplift Adjustment	37,882	56,366	95,039
Reported Savings (MWh)	38,860	56,615	95,475
Realization Rate	97%	100%	100%
Percent Savings	1.15%	1.73%	1.60%
Verified Net Savings (MWh), After Uplift Adjustment	**38,014**	**56,386**	**95,190**

*All savings are at the site.
** Navigant estimated each time period (i.e. year 2014, year 2015, and 2014-2015 together) as a separate analysis; the savings totals for year 2014 and year 2015 do not sum to the savings over the total combined time period of 2014-2015 together.
Source: Navigant analysis

Table 2. Program Electric Savings by Wave†*

Type of Statistic	Legacy Wave			Expansion Wave		
	2014	2015	2014-2015 (24 Months)	2014 (Sept.-Dec.)	2015	2014-2015 (16 Months)
Number of Treatment Customers	84,067	79,052	84,067	219,755	210,190	219,755
Verified Evaluation Savings (MWh)	34,357	31,414	66,046	3,525	24,952	28,993
Percent Savings	2.71%	2.70%	2.71%	0.56%	1.37%	1.18%
Verified Net Savings (MWh)‡	**34,505**	**31,549**	**66,331**	**3,509**	**24,836**	**28,859**

†All savings are at the site.
*Navigant estimated each time period (i.e. year 2014, year 2015, and 2014-2015 together) as a separate analysis; the savings totals for year 2014 and year 2015 do not sum to the savings over the total combined time period of 2014-2015 together.
‡Verified net savings are savings after netting out savings double-counted with other energy efficiency programs.
Source: Navigant analysis

Program Cost-Effectiveness

The cost-effectiveness of utility-funded programs in Utah is typically analyzed using tests prescribed by the California Standard Practice Manual.[3] While the program was cost-effective in 2014 and 2015, the results were stronger in 2014. The main driver for the impact to cost-effectiveness in 2015 was that avoided costs derived from PacifiCorp's 2015 Class 2 DSM Decrement Study were significantly lower than those from the 2013 IRP. Detailed information on the cost-effectiveness results are included in Section 7 of this report. Table 3 includes results from the cost-benefit tests for 2014, 2015, and for the two years combined[4].

Table 3. Cost-Benefit Results by Evaluation Period

Evaluation Period	PTRC	TRC	UCT	RIM	PCT
2014	2.43	2.21	2.21	0.51	-
2015	1.28	1.17	1.17	0.34	-
2014-2015	**1.66**	**1.51**	**1.51**	**0.40**	**-**

Source: Navigant analysis

The program passes all cost-effectiveness tests with the exception of the Ratepayer Impact (RIM) test.[5]

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[3] The California Standard Practice Manual is an industry accepted manual; it identifies the cost and benefit components and cost-effectiveness calculation procedures from several major perspectives: participant, ratepayer impact measure (RIM), and total resource cost (TRC). Definitions and methodologies of these cost-effectiveness tests can be found at http://www.energy.ca.gov/greenbuilding/documents/background/07-J_CPUC_STANDARD_PRACTICE_MANUAL.PDF.

[4] Due to the complexity of running the cost-effectiveness test for a combination of years using one set of avoided costs, Navigant's analysis combined the results of the individual program year analyses to arrive at a combination of the two years. Therefore, the savings presented throughout the report are slightly different than the savings used for the 2014-2015 cost-effectiveness tests. This approach is consistent with previous evaluations for the HER program.

[5] The Ratepayer Impact Test (RIM) measures the impact a conservation program will have on utility rates. It is not uncommon for a program to fail the RIM test.

The Utility Cost Test is the primary criterion in Utah and the program remains cost-effective from the perspective over the 24 month evaluation period.

Key Findings and Recommendations

This section summarizes key findings and recommendations.

Impact Evaluation

Finding 1. Table 4 below shows the total evaluated energy savings in megawatt hours (MWh), after adjusting for uplift,[6] for each wave in each time period. For the Legacy Wave, savings remained relatively stable across the two years as this wave had been in place since 2012. Increases in Expansion Wave savings reflect the start of this wave in late 2014 and ramp-up into 2015.

Table 4. Total MWh Savings by Wave and Year*

Wave	2014	2015	2014-2015
Legacy	34,505	31,549	66,331
Expansion	3,509	24,836	28,859
Total	38,014	56,386	95,190

* Navigant estimated each time period (i.e. year 2014, year 2015, and 2014-2015 together) as a separate analysis; the savings totals for year 2014 and year 2015 do not sum to the savings over the total combined time period of 2014-2015 together.
Source: Navigant analysis

Finding 2. Table 5 below shows energy savings as a percentage of baseline consumption for each wave in each time period. Looking at savings since program inception in 2012, these savings indicate that the Legacy Wave appears to have leveled off, as is common for a mature program, at around 2.7% savings. Savings for the Legacy Wave from 2012 onwards are shown in Figure 5-2 in the main body of this report. The Expansion Wave demonstrates increasing savings over time as is frequently found with newer waves.

Table 5. Percentage Savings by Wave and Year*

Wave	2014	2015	2014-2015
Legacy	2.71%	2.70%	2.71%
Expansion	0.56%	1.37%	1.18%
Weighted Average	1.15%	1.73%	1.60%

* Navigant estimated each time period (i.e. year 2014, year 2015, and 2014-2015 together) as a separate analysis; the percentage savings for year 2014 and year 2015 do not average to the percentage savings over the total combined time period of 2014-2015 together.

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[6] Uplift occurs when HER treatment customers participate in Rocky Mountain Power's other energy efficiency programs at a higher or lower rate than they would have in the absence of the HER program. Savings driven by uplift (positive or negative) must be subtracted from the HER savings to avoid double-counting and ensure accurate savings. Uplift is discussed in more detail in Section 2.3.

Source: Navigant analysis

Recommendation 1. Future refill waves should target the highest usage customers not already in the program. Prior to adding future refill waves, the program should verify that the allocation of households across the treatment and control groups is consistent with a RCT.

Finding 3. Total double-counted savings were -151 MWh (or 0.16% of total savings) for the Appliance Recycling and Home Energy Savings (HES) programs across 2014 and 2015, which means that treatment customers were slightly less likely than control customers to participate in other Rocky Mountain Power energy efficiency programs[7], and thus, double-counting of energy savings does not appear to be a concern for this program at this time. Additionally, Navigant found no evidence of double-counting in the upstream energy efficient lighting portion of the HES program.

Cost-Effectiveness Evaluation

Finding 4. The program was cost-effective in 2014, 2015 and the combination of program years. Lower avoided costs in 2015 impacted the program's cost-effectiveness for the 2015 and the joint 2014-2015 evaluation period, however, the program passes all cost-effectiveness tests with the exception of the Ratepayer Impact test.

Process Evaluation

Finding 5. As shown in Table 6 below, survey respondents reported high levels of satisfaction with Rocky Mountain Power overall. Respondents in the Expansion Wave reported the highest levels of satisfaction.

Finding 6. Treatment respondents in the Legacy Wave reported lower satisfaction with the HER program (54%) compared to the Expansion Wave respondents (71%), as shown in Table 6 below. The Legacy treatment group had less confidence that the reports were accurate and cited neighbor comparisons as the least valuable component of the reports. Lower satisfaction ratings with the HER program appear to be correlated with higher energy use, with Legacy Wave respondents (selected for their high average usage) reporting lower overall satisfaction. This is a common finding for HER program evaluations. Control respondents do not receive reports from the HER program and were not asked this question.

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[7] The double counting results are discussed in more detail in Section 5.3.

Table 6. Summary of Satisfaction Findings

	Legacy Wave		Expansion Wave	
	Control	Treatment	Control	Treatment
Satisfaction with Rocky Mountain Power	81%	83%	91%	91%
Satisfaction with the HER program	-	54%	-	71%

† Percentages given above reflect percent satisfied (rating of 6 or higher on a scale from 1 to 10)
Source: Navigant analysis

1. INTRODUCTION

1.1 Program Description

Rocky Mountain Power's Utah Home Energy Reports (HER) program is designed to generate energy savings by providing residential customers with information about their specific energy use and related energy conservation suggestions and tips. The information is provided in the form of bi-monthly[8] mailed reports that illustrate the following:

- How customers' recent energy use compares to their energy use in the past

- Tips on how customers can reduce energy consumption, some of which are tailored to each customer's unique circumstances

- Information on how customers' energy use compares to that of neighbors with homes with similar household characteristics

In other studies, this type of information has shown that customers are stimulated to reduce their energy use, creating average energy savings in the 1% to 2% range depending on local energy use patterns.[9]

An important feature of the program is that it is a randomized controlled trial (RCT). Eligible customers are randomly assigned to a treatment group or a control group to estimate changes in energy use due to the program. As an opt-out implementation model, customers do not choose to participate, but they can opt-out if they do not wish to receive the reports—i.e., customers can request removal from the program. Figure 1-1 illustrates the program design.

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[8] Customers in both waves received six reports in 2014 and four reports in 2015. In 2015, reports were not sent from August to December. Reports were restarted in January 2016 on a quarterly, rather than bimonthly, schedule.

[9] See for example:

Allcott, Hunt. 2011. *Social Norms and Energy Conservation.* Journal of Public Economics, Vol 95 (9-10), pp. 1,082–1,095.

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

Rosenberg, Mitchell, G.K. Agnew, and K. Gaffney. *Causality, Sustainability, and Scalability – What We Still Do and Do Not Know about the Impacts of Comparative Feedback Programs.* Paper prepared for 2013 International Energy Program Evaluation Conference, Chicago. 2013.

Figure 1-1. HER Program Design
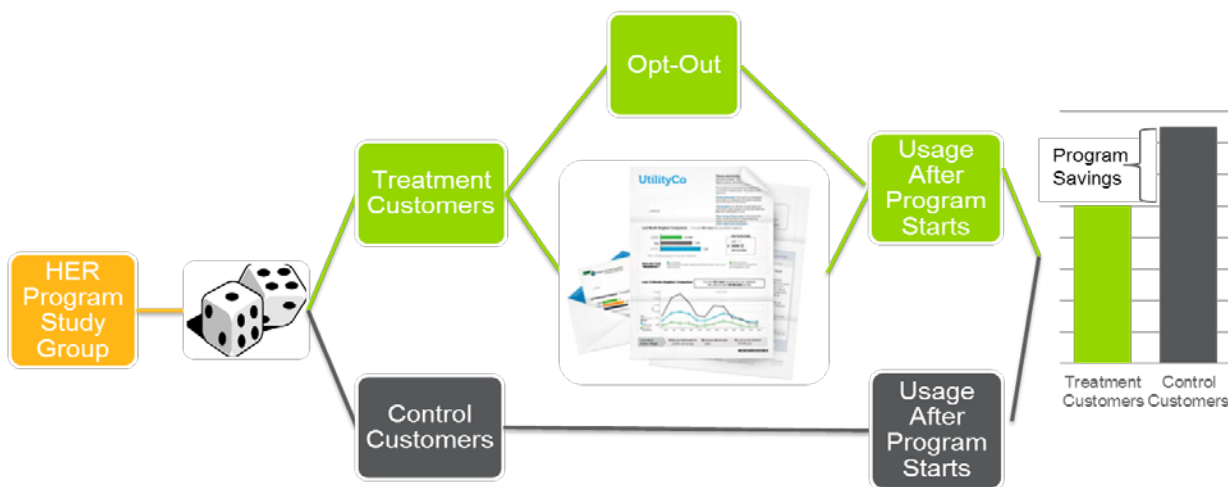
Source: Navigant

The HER program consists of the following two waves:

1. Legacy Wave, launched in July 2012
2. Expansion Wave, launched in September 2014

For the purpose of this evaluation, the program launch is defined as the beginning of the month in which reports were first generated for a given wave.

Figure 1-2 shows average usage during the year before the program began for each wave. The Legacy Wave is made up of higher usage customers who averaged 46 kWh per day in their pre-program period from July 2011 to June 2012. The Expansion Wave had average usage of 26 kWh per day from September 2013 to August 2014.

Figure 1-2. Average Daily Pre-Period Usage by Wave
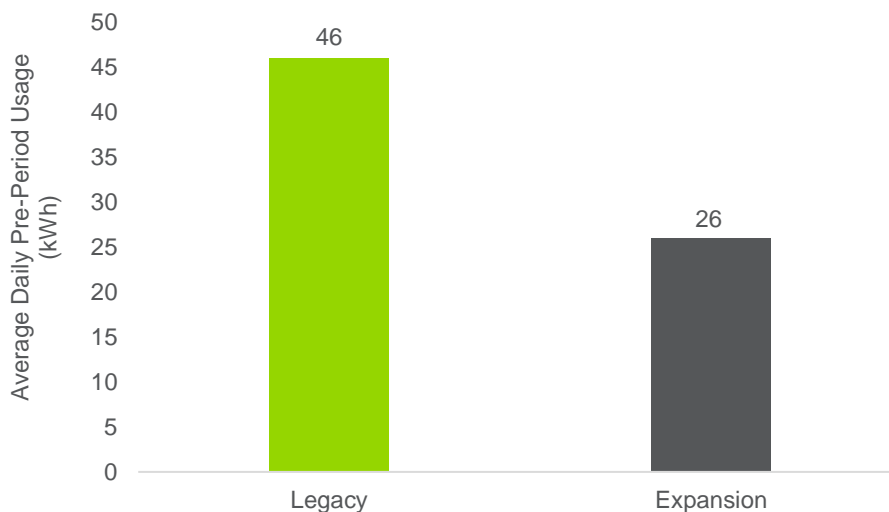
Source: Navigant analysis

Customers in the Legacy Wave received six reports in 2014 while customers in the Expansion Wave received two, and both waves received four reports in 2015. In 2015, reports were not sent to either wave from August to December.[10] For the Legacy Wave, the lapse in reports did not appear to have any impact on the savings in 2015 compared to 2014. Since there was not a full year of savings in 2014 for the Expansion Wave, there was not enough information to access whether or not the lapse had an impact on savings in 2015.

There are two sources of decay in program participation over time. The first is customers who opt out of the program. Figure 1-3 shows the number of treatment customers opting out of the program each month by wave and the cumulative percentage of opt outs since the start of the program. Since the start of each wave, 1.25% of treatment customers have chosen to opt out of the Legacy Wave and 0.35% have opted out of the Expansion Wave. After 12 months in the program, 0.71% of Legacy Wave treatment customers had opted out compared to 0.34% of Expansion Wave treatment customers, meaning the opt-out rate has gone down for the newer wave. This could be because the type of customer in each wave is different as illustrated by their average pre-program usage, or because customers have become more accepting of

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[10] Reports were restarted in January 2016 on a quarterly, rather than bimonthly, schedule.

energy efficiency programs over time such that they were less likely to opt out in 2014 and 2015 as compared to 2012.

Figure 1-3. Customers Opting Out of the HER Program by Wave
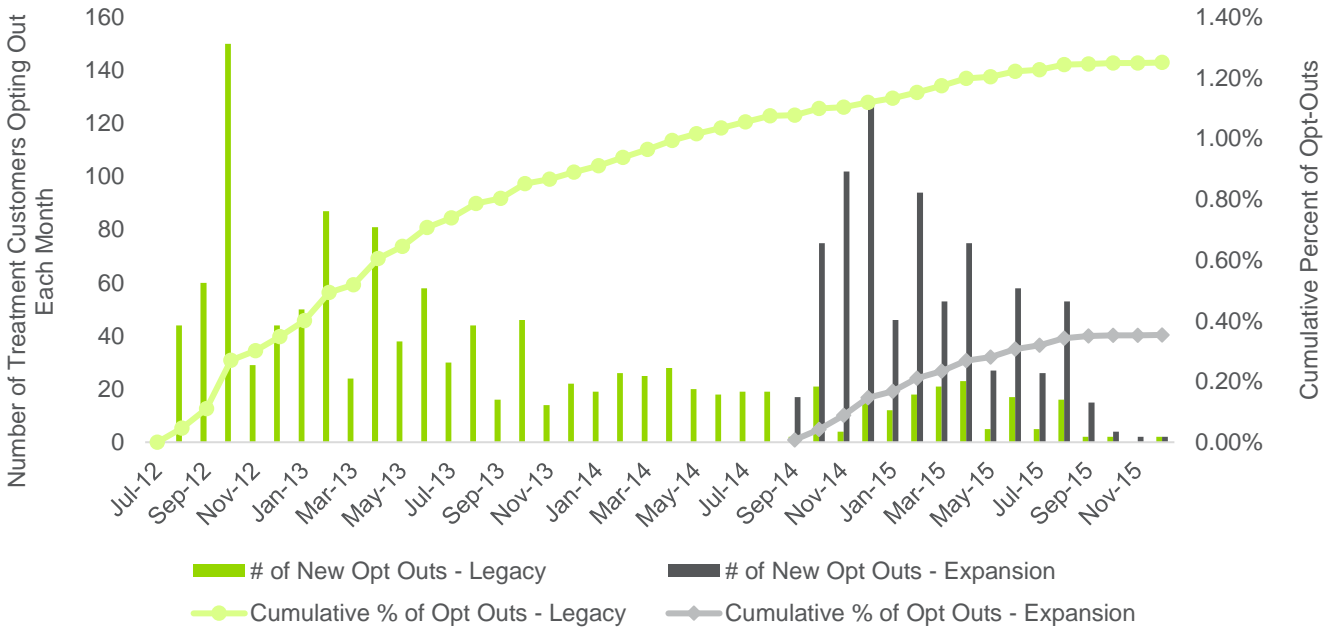
Source: Navigant analysis

The second source of decay is customers who move from their residence. Figure 1-4 shows the cumulative percentage of move outs by wave over the course of the program for both treatment and control groups. The rate of customer loss per month is virtually the same for treatment and control customers in each wave; however, the move-out rate differs across waves. From the start of each wave to December 2015, approximately 20% of both treatment and control customers in the Legacy Wave and approximately 17% of the Expansion Wave had been shed from the program due to move outs. Over the first 12 months of each wave, the Legacy Wave lost 7% of both treatment and control customers due to move outs and the Expansion Wave lost 13%. The Expansion Wave had a higher move-out rate than the Legacy Wave; this is likely due to differences in the type of customers in each wave—for example, customers with lower average energy usage may change residences more frequently than those with higher usage.

Figure 1-4. Cumulative Percentage of Move Outs by Wave
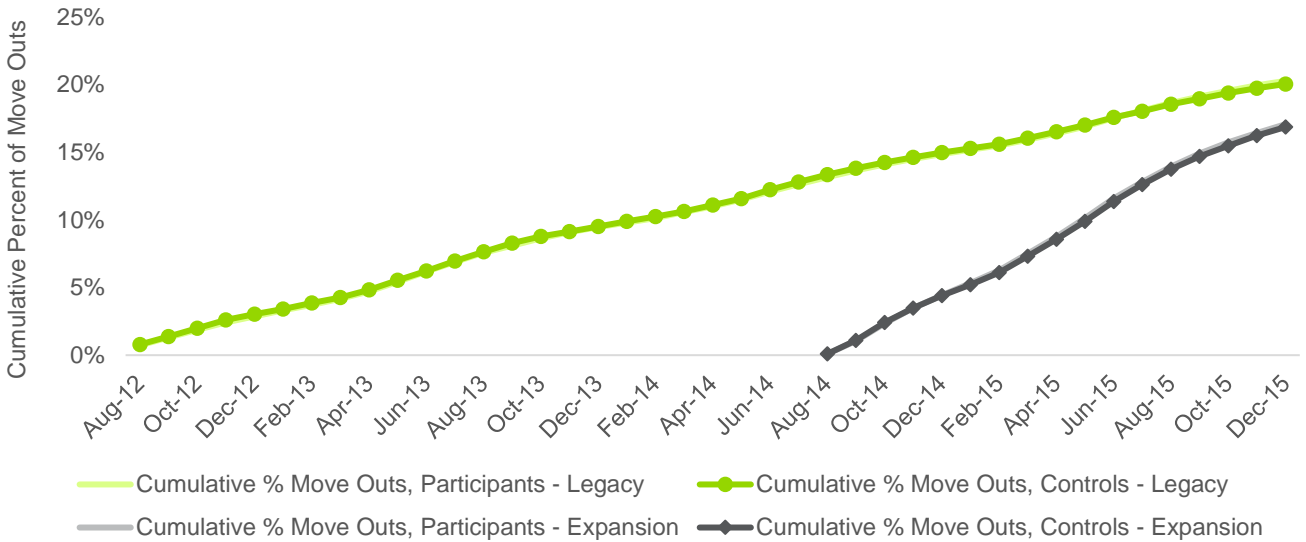
Source: Navigant analysis

1.2 Evaluation Objectives

The primary objectives of the analysis in this report are to determine the extent to which treatment customers in the HER program reduced their energy consumption due to the program and to determine the cost-effectiveness of the program.

Secondary objectives include:

- Investigating the effect of the HER program on energy awareness, engagement, and satisfaction;

- Reporting on treatment customer satisfaction with the HER program;

- Reporting on behavioral and information effects of the HER program, including effects on customer awareness and purchases of energy-efficient appliances and customer awareness of Rocky Mountain Power's energy efficiency programs.

2. IMPACT EVALUATION APPROACH

The impact evaluation approach Navigant employed in this analysis is consistent with the methodology described in the SEE Action report,[11] relying on statistical analysis appropriate for RCTs. This evaluation has three primary components:

1. Checking that the allocation of customers to treatment and control groups is consistent with an RCT

2. Regression analysis to quantify program savings

3. Quantification of double-counted savings from participation uplift in other energy efficiency programs

Each of these three components was completed for each wave of the program. This section describes these components in more detail.

2.1 Statistical Consistency of the Program with an RCT

Navigant tested the statistical consistency of each wave with an RCT prior to this evaluation. To do so, Navigant compared the monthly energy usage of the treatment and control groups during the 12-month period prior to the start of each program wave.[12] If the allocation of households across the treatment and control groups is truly random, the two groups should have the same distribution of energy usage for each of the 12 months before the start of the program. To check this, Navigant compared the mean energy usage for each of the 12 months before the start of each program wave. As an additional check, Navigant conducted a regression analysis in which average daily usage in the pre-program period was a function of monthly binary variables and a binary participation variable.

The results of the analyses performed prior to this evaluation indicated that the allocation of program households across the treatment and control groups was consistent with an RCT design for each of the program waves. The consistency of the Legacy Wave with an RCT was tested in the 18-month evaluation report[13] and the Expansion Wave was tested as part of this analysis.

Figure 2-1 depicts the average energy usage for treatment and control households of the Expansion Wave for the 12 months prior to the start of the HER program. The gray line indicates the average energy usage for control customers and the green dashed line indicates the average energy usage for treatment customers. The two lines are nearly identical, indicating no difference in average usage patterns for the treatment and control groups.

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[11] Todd, A., E. Stuart, S. Schiller, and C. Goldman. *Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations.* Lawrence Berkeley National Laboratory. May 2012. Available at: http://behavioranalytics.lbl.gov/

[12] The 12-month pre-period is July 2011 to June 2012 for the Legacy Wave and September 2013 to August 2014 for the Expansion Wave.

[13] Navigant Consulting, Inc. *Utah Home Energy Reporting Program 18 Month Evaluation Report (8/1/2012-1/31/2014).* 2014. Presented to Rocky Mountain Power.

Figure 2-1. Expansion Wave Average Daily Consumption during the Pre-Program Year
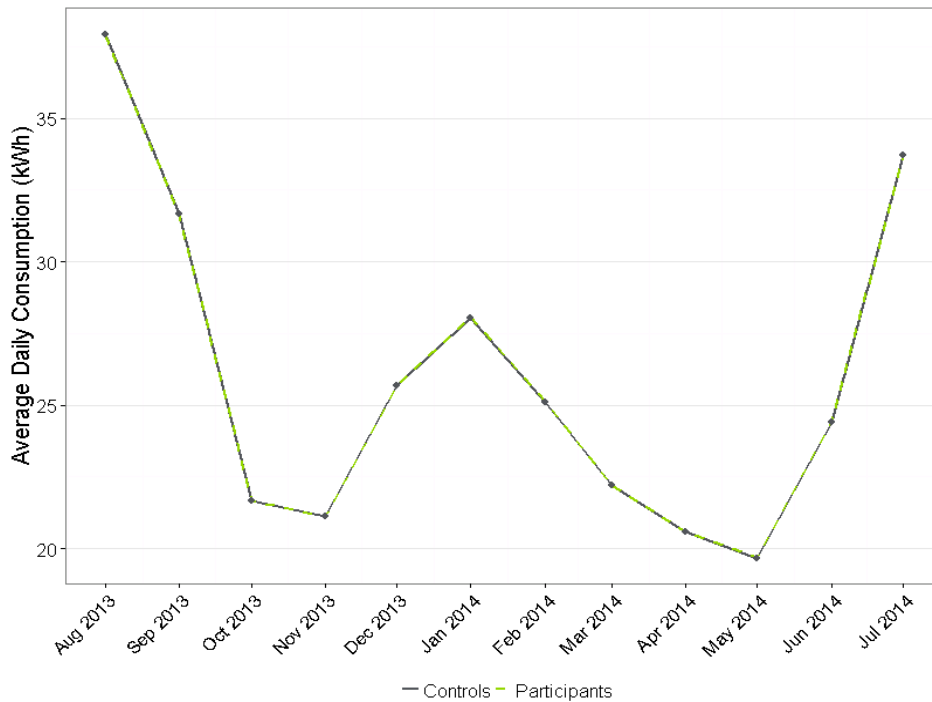
Source: Navigant analysis

Navigant also conducted a statistical test on the difference in the mean energy usage in each of the 12 pre-program months and found no statistically significant differences at the 90% confidence level. As an additional check, Navigant conducted a regression analysis in which average daily usage in the pre-program period was a function of monthly binary variables and a binary treatment customer variable. The parameter on the treatment customer variable was not significant at the 90% confidence level, indicating no statistical difference in energy use between the treatment and control groups prior to the start of the program.

In light of these results, Navigant used statistical methods appropriate for use with RCTs to quantify the energy savings for the program as detailed in the following sections.

2.2 Net Impact Evaluation Methodology

A key feature of the RCT design for the HER program is that the analysis estimates net savings, not gross savings. While some customers that receive reports may have taken energy-conserving actions or purchased high-efficiency equipment in the absence of the program, the random selection of program treatment customer (as opposed to voluntary participation) assures that, on average, their behavior would have been no different in the absence of the program than the actual average behavior of the control group. Thus, there is no free-ridership, and no net-to-gross adjustment is necessary.

Navigant separately estimated savings for 2014, 2015, and the combined 2014-2015 period. Table 2-1 summarizes the analysis periods for each wave. For the Expansion Wave, the combined 2014-2015

period covered the first 16 months of the program. For the Legacy Wave, the combined 2014-2015 period included 24 months and covered the period 19 to 42 months (2.5 to 4.5 years) after the start of the wave in August 2012.

Table 2-1. Analysis Periods

Wave	Start Date	Analysis Periods
Legacy Wave	07-01-2012	2014
		2015
		24 months (2014-2015)
Expansion Wave	09-01-2014	Sept. 2014-Dec. 2014
		2015
		16 months (Sept. 2014- 2015)

Source: Navigant analysis

Navigant estimated program impacts using two approaches: a post-program regression (PPR) analysis with lagged controls and a linear fixed-effects regression (LFER) analysis applied to monthly billing data. Although the two models are structurally different, both generate unbiased estimates of program savings in an RCT. Navigant estimated the PPR and LFER models for 2014, 2015, and the aggregation of the two years. Navigant used the PPR results for reporting total program savings but ran both models as a robustness check.[14]

The PPR model combines cross-sectional and time-series data in a panel dataset and uses the post-program data only with lagged energy use for the same calendar month of the pre-program period to pick up customer-specific effects and as a control for any small systematic differences between the treatment and control customers. In particular, energy use in calendar month *m* of the post-program period is framed as a function of both the treatment variable and energy use in the same calendar month of the pre-program period. The underlying logic is that systematic differences between treatment and control customers will be reflected in differences in their past energy use, which is highly correlated with their current energy use. Formally, the model is shown in Equation 2-1.

Equation 2-1. PPR Model

$$ADC_{kt} = \beta_1 Treatment_k + \sum_j \beta_{2j} Month_{jt} + \sum_j \beta_{3j} Month_{jt} \cdot ADClag_{kt} + \varepsilon_{kt}$$

Where,

ADC_{kt} = Average daily consumption in kWh for customer *k* during billing cycle *t*

$Treatment_k$ = Binary variable indicating whether customer *k* was in the treatment group (taking a value of 1) or in the control group (taking a value of 0)

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[14] Navigant prefers to report out the PPR model for two reasons. One, the implementer is also using a post-only model for evaluation. Two, although both the LFER and PPR models generate unbiased estimates of program savings, as an empirical matter—based on Navigant's past analyses and those in the academic literature—estimated savings from the PPR model tend to have lower standard errors than those from the LFER model, though the differences are usually very small.

Month$_{jt}$	= Set of binary variables taking a value of 1 if the observation of billing cycle *t* is in month *j* and 0 otherwise
ADUlag$_{kt}$	= Customer *k*'s energy use in the same calendar month of the pre-program year as the calendar month of month *t*
ε$_{kt}$	= Cluster-robust error term for customer *k* during billing cycle *t.* Cluster-robust errors account for heteroscedasticity and autocorrelation[15] at the customer level

In this model β_1 is the estimate of average daily energy savings due to the program.

A minor complication to the use of this model in the analysis of savings over longer than a 12-month period is that the time lapse to the same pre-program calendar month is 12 months for some months of the post period and 24 months for others. In the last evaluation of this program,[16] Navigant tested whether there was a difference between a 12-month lag and a 24-month lag by including two lag dummy variables. There was no statistically different effect across the two lag lengths; thus, only one lag is included for this analysis.

The LFER model also combines cross-sectional and time-series data in a panel dataset. The regression essentially compares pre- and post-program billing data for treatment and control customers to identify the effect of the program. The customer-specific constant term (fixed effect) is a key feature of the LFER analysis and captures all customer-specific effects on energy usage that do not change over time, including those that are unobservable. Similar to the pre-period lag in the PPR model, the fixed effect represents an attempt to control for any small systematic differences between the treatment and control groups that might occur due to chance. Specifically, Navigant estimated the regression model in Equation 2-2.

Equation 2-2. LFER Model

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

Where,

α_{0k}	= Customer-specific fixed effect (constant term) for customer *k*, which controls for all customer-specific effects on energy usage that do not change over time
Post$_t$	= Binary variable indicating whether bill cycle *t* is in the post-program period (taking a value of 1) or in the pre-program period (taking a value of 0)

All other variables are as defined in the PPR model. Average daily savings are indicated by the parameter α_2.

Finally, to investigate how savings vary with usage level, Navigant divided the program treatment and control customers in each wave into three equal-sized segments based on their usage during the pre-program year and estimated Equation 2-1 separately for each segment (high, medium, and low).

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[15] Ordinary Least Squares (OLS) regression models assume the data are homoscedastic and not autocorrelated. If either of these assumptions is violated the resulting standard errors of the parameter estimates are likely underestimated. A random variable is heteroscedastic when the variance is not constant. A random variable is autocorrelated when the error term in one period is correlated with the error terms in at least some previous period.

[16] See footnote 13.

2.3 Uplift Analysis Methodology

Behavior based programs may increase or decrease participation in other energy efficiency programs. If another energy efficiency programs claims the increased savings, the savings cannot be double counted in the HER program. Uplift estimates the participation rate stemming from the HER program to other energy efficiency programs in order to avoid double counting savings in other energy efficiency programs. Applying uplift is standard practice in the Uniform Methods Project ("UMP").[17]

The home energy reports include energy-saving tips, some of which encourage treatment customers to enroll in other energy efficiency programs offered by Rocky Mountain Power. If participation rates in other energy efficiency programs are the same for HER treatment and control groups, the savings estimates from the regression analysis are already net of savings from the other programs, as this indicates the HER program had no effect on participation in the other energy efficiency programs. Thus, there would be no need to make any adjustment to the savings.

However, if the HER program affects participation rates in other energy efficiency programs, then portfolio savings differ from the simple summation of savings in the HER program and other energy efficiency programs. For instance, if the HER program increases participation in other energy efficiency programs, the increase in savings may be allocated to either the HER program or the other energy efficiency program but cannot be allocated to both programs simultaneously.

On the other hand, if the HER program generates negative participation in other energy efficiency programs, a negative spillover—as might happen, for instance, if the HER program encourages behaviors or actions that reduce a customer's motivation for participating in other energy efficiency programs —then there is no double-counting of savings. The negative savings associated with this negative spillover should be included as HER program savings because they represent a downward bias in the statistical estimate of HER program savings. In other words, because the statistical analysis does not account for the lower rate of energy efficiency participation by HER treatment customers, estimated savings are lower than actual savings by an amount equal to the negative savings. Net verified savings are equal to the program savings less uplift savings.

Navigant used a difference-in-difference (DID) approach, illustrated in Figure 2-2, to estimate uplift in Rocky Mountain Power's Utah energy efficiency programs over the longest analysis period for each wave. This method uses differences between the treatment and control groups in the rate of change in energy efficiency program participation to calculate the uplift in energy efficiency program participation due to the HER program. For instance, if the average annualized rate of participation in an energy efficiency program during the HER program was 5% for the treatment group and 3% for the control group and the rate of participation during the year before the start of the HER program was 2% for the treatment group and 1% for the control group, then the annualized rate of uplift due to the HER program was 1%, as found in the calculation (5%-2%)-(3%-1%)=1%. The DID statistic generates an unbiased estimate of uplift when the baseline average rate of participation is the same for the treatment and control groups or when they are different due only to differences between the two groups in time-invariant factors.

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[17] National Renewable Energy Laboratory (NREL). 2015. Chapter 17: Residential Behavior Protocol. In *The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures.* < *http://energy.gov/sites/prod/files/2015/02/f19/UMPChapter17-residential-behavior.pdf*>

Figure 2-2. Uplift Analysis
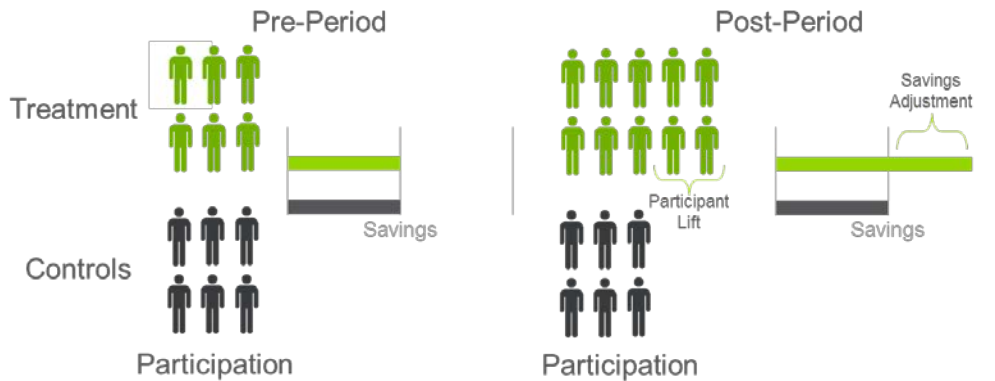
Source: Navigant

The DID statistic described above is the incremental change in the rate at which treatment customers join other energy efficiency programs because of the HER program. To get the change in participation or participant lift (measure in number of people) in the other energy efficiency programs, this DID rate is multiplied by the total number of treatment customers. The participant lift is multiplied by the median annual savings for the other energy efficiency program[18] to the double-counted savings in kWh.

Navigant examined the uplift associated with two energy efficiency programs: Appliance Recycling and Home Energy Savings (HES). It is not possible to state definitively the double-counted savings between the HER program and the portion of the HES program involving upstream energy efficient lighting (EEL) because it is not feasible to develop appropriate tracking data. A survey conducted as part of the program evaluation included two questions designed to provide an upper bound on the double-counting of these savings. The first asked about the number of installed CFLs and LEDs in the room in which the respondent is located while answering the survey. The second asked the respondent to walk through the residence, counting first the number of all lights turned on and then counting the number of lights turned on that are CFLs or LEDs (importantly, all surveys were conducted in the evening). If there is a statistical difference in the average deployment and/or use of EEL between treatment and control customers, the evaluation team assumes that this difference is due entirely to the HES program. These observed differences are then extrapolated to average annual differences in energy use which are entirely attributed to the EEL program; the evaluation team then obtains an upper bound on the estimate of double-counted savings.

2.4 Verified Net Program Savings

Verified net savings are calculated via Equation 2-3.

Equation 2-3. Calculation of Verified Net Savings

$$\text{Verified Net Savings} = \frac{-\beta_1 \ast \text{Number of Program Days}}{1,000} - \text{Double-Counted Savings}$$

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[18] The median annual savings are calculated based on savings in the other energy efficiency program for HER treatment customers during the HER post-program period, i.e. the time after the HER program began running.

Where,

β_1 = Parameter from Equation 2-1 that indicates average daily impacts from the PPR model in kWh (thus division by 1,000 to convert the value to MWh)

The number of program days is the sum across all treatment customers of the number of days during the specified period that a treatment customer's account was active.[19]

2.5 Data Used in the Impact Analysis

In preparation for the impact analysis, Navigant cleaned the data provided by the HER program implementer, Opower. The evaluation team verified the number of treatment customers for each analysis from the initial dataset by removing customers who moved out of their residences before the start of the analysis period. Using this definition, the 2014 analysis and the combined 2014-2015 analysis had the same number of treatment customers, but the 2015 analysis had fewer due to customers who moved out before the start of 2015. These customers had zero observations in the post period and thus had zero savings. The verified treatment customers for each wave are summarized in Table 2-2.

Table 2-2. Verified Treatment Customers

Wave	Treatment Customers in Initial Dataset	Analysis Periods	Verified Treatment Customers in Each Analysis
Legacy Wave	93,979 Treatment 29,821 Control	2014	84,067 Treatment 26,678 Control
		2015	79,052 Treatment 25,063 Control
		24 months (2014-2015)	84,067 Treatment 26,678 Control
Expansion Wave	219,978 Treatment 52,487 Control	Sept. 2014-Dec. 2014	219,755 Treatment 52,428 Control
		2015	210,190 Treatment 50,167 Control
		16 months (Sept. 2014-2015)	219,755 Treatment 52,428 Control

Source: Navigant analysis

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

- Observations with fewer than 20 days or more than 40 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

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[19] Only treatment customers with an active account accrue savings—when a treatment customer moves out, they stop accruing savings toward the program. Treatment Customers who opt out of the program remain in the analysis because they might continue to generate savings after they opt-out.

- Observations outside of the evaluation period, including 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.[20]

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[20] As an example, the median usage for the 24-month analysis of the Legacy Wave was 38.4 kWh per day, and so observations with usage greater than 384 kWh or less than 3.84 kWh per day were excluded from the analysis.

3. PROCESS EVALUATION APPROACH

As part of Rocky Mountain Power's Utah HER program analysis, Navigant conducted a telephone survey to look at the energy habits of the program's control and treatment customers in the program. The primary objective of the survey was to investigate the effect of the HER program on energy awareness, engagement, and satisfaction. Navigant drew comparisons between the treatment groups as well as between wave cohorts to determine the effects of the program over time. Secondary objectives included exploring the effect of the HER program on customer awareness and purchase of energy efficient appliances and customer awareness of Rocky Mountain Power's energy efficiency programs and branding.

Navigant wrote the survey and contracted with a research firm, The Dieringer Research Group (DRG), to program and field the survey between January and February 2016. Prior to survey launch, Navigant worked with DRG to perform continuous quality control checks on programming logic and data output. In addition to these technical reviews, Navigant conducted a training with the DRG call center staff to review survey objectives, rehearse, and provide client-specific context where appropriate. The evaluation team reviewed survey recordings from a limited number of soft-launch respondents before launching a full rollout of the survey.

To increase accuracy of Navigant's Live Audit survey battery (see Section 6.1), DRG conducted the phone interviews strictly between the hours of 5 p.m. and 9 p.m. local time.

Appendix A presents a copy of the final survey instrument.

3.1 Survey Sample Size

Navigant designed the sample to meet a desired confidence/precision of 90/10 on binary questions. The focus on the difference in responses between cohorts reflects the understanding that it is this difference that represents the effect of the HER program on respondent behaviors and attitudes.

Navigant targeted 480 completed surveys divided evenly between the Legacy and Expansion Waves and between the treatment and control groups. This target was designed to allow for statistical testing at the 90 percent confidence interval using the Chi-squared test. The confidence level achieved for each individual question is noted throughout the results in Section 6.

3.2 Survey Response Rates and Analysis

To achieve the surveys in each of the four cohorts, Navigant provided DRG with a list of 3,000 randomly selected customers for each targeted cohort. Table 3-1 below provides a summary of the completion outcome.

Table 3-1. Survey Targets and Achieved Completes

Cohort	Target	Achieved	Amount of Sample Provided	Total in Population
Legacy Control	120	121	3,000	26,678
Legacy Treatment	120	120	3,000	84,067
Expansion Control	120	124	3,000	52,428
Expansion Treatment	120	121	3,000	219,755
Total	**480**	**486**	**12,000**	**382,928**

Source: Navigant

4. COST-EFFECTIVENESS EVALUATION APPROACH

Program cost-effectiveness was evaluated for 2014, 2015, and the overall 24-month evaluation period. The cost-effectiveness of utility-funded programs in the state is typically analyzed using tests prescribed by the California Standard Practice Manual.[21] The UCT is the primary criterion in Utah for evaluating a program's cost-effectiveness.

For the purposes of this evaluation, Rocky Mountain Power specifically required the following cost-effectiveness tests:

- Participant Cost Test (PCT)

- Utility Cost Test (UCT)

- Ratepayer Impact (RIM)

- Total Resource Cost Test (TRC)

- PacifiCorp's Total Resource Cost Test (PTRC)

Navigant initialized and validated the cost-effectiveness model used for this evaluation. This model was calibrated using prior inputs and outputs from the previous evaluation cycle to ensure that similar inputs yielded similar outputs. Navigant worked through a range of input assumptions pertaining to avoided cost data formats, financial assumptions regarding discount and escalation rates, participant costs and benefits, and other input parameters.

Cost-effectiveness inputs of program cost, program savings by measure, and measure life were provided by Rocky Mountain Power staff, including data obtained from the 2013 IRP (for the 2014 analysis) and the 2015 Class 2 DSM Decrement Study (for the 2015 analysis[22]).

Table 4-1 below presents details of these tests. Table 4-2 below provides an overview of cost-effectiveness input values used by Navigant in the cost-effectiveness analysis.

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[21] The California Standard Practice Manual is an industry-accepted manual; it identifies the cost and benefit components and cost-effectiveness calculation procedures from several major perspectives: Participant, Ratepayer Impact Measure (RIM), and Total Resource Cost (TRC). Definitions and methodologies of these cost-effectiveness tests can be found at http://www.energy.ca.gov/greenbuilding/documents/background/07-J_CPUC_STANDARD_PRACTICE_MANUAL.PDF.

[22] The 2014-2015 cost-effectiveness testing is a summation of the PY2014 and PY2015 analyses and therefore utilized the cost-effectiveness inputs from each program year.

Table 4-1. Details of Cost Effectiveness Tests[23]

Test	Acronym	Key Question Answered	Summary Approach
Participant Cost Test	PCT	Will the participants benefit over the measure life?	Comparison of costs and benefits of the customer installing the measure
Utility Cost Test	UCT	Will utility revenue requirements increase?	Comparison of program administrator costs to supply-side resource costs
Ratepayer Impact Measure	RIM	Will utility rates increase?	Comparison of program administrator costs and utility bill reductions to supply side resource costs
Total Resource Cost Test	TRC	Will the total costs of energy in the utility service territory decrease?	Comparison of program administrator and customer costs to utility resource savings
PacifiCorp Total Resource Cost Test	PTRC	Will the total costs of energy in the utility service territory decrease when a proxy for benefits of conservation resources is included?	Comparison of program administrator and customer costs to utility resource savings with a 10% benefits adder.

Source: Navigant analysis

Table 4-2. HER Program Cost Effectiveness Evaluation Input Values

Parameters	2014	2015	2014-2015
Discount Rate for all B/C Tests	6.88%	6.66%	6.66%
Inflation Rate for all B/C Tests	1.90%	1.90%	1.90%
Line Loss Factor - Energy (%)	9.32%	9.32%	9.32%
Residential Energy Rate ($/kWh)	$0.1084	$0.1105	-
Gross Customer Costs	$0	$0	$0
Program Delivery	$1,128,795	$2,507,560	$3,636,355
Evaluation, Marketing, Development	$68,598	$26,400	$94,999
Utility Administrative	$65,847	$57,584	$123,431
Incentive Costs	$0	$0	$0

Source: Navigant analysis

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[23] "Understanding Cost Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy – Makers" NAPEE, November 2008. http://www.epa.gov/cleanenergy/documents/suca/cost-effectiveness.pdf.

5. IMPACT EVALUATION RESULTS

This section includes results from the impact evaluation.

Overall verified net program savings from January 2014 to December 2015, after adjusting for uplift, was 95,190 MWh. Of this, 66,331 MWh (70%) were from the Legacy Wave and 28,859 MWh (30%) were from the Expansion Wave. The LFER and PPR models generated similar results for program savings in all three time periods for each wave. Navigant uses the PPR model's results for reporting total program savings.

Table 5-1 shows total HER program savings across both waves in each of the three evaluation time periods: 2014, 2015, and the two years combined. Navigant estimated each time period (i.e. year 2014, year 2015, and 2014-2015 together) as a separate analysis because there is additional information and statistical power in running the two years together rather than just adding together the results of year 2014 and year 2015. Since each time period was run as a separate analysis, the savings totals for year 2014 and year 2015 does not sum to the savings over the total combined time period of 2014-2015 together. In 2014, the Legacy Wave ran for all 12 months, but the Expansion Wave ran for only four months. The number of treatment customers is the number at the start of each evaluation period.

Table 5-1. Total Program Savings in Each Time Period†*

Type of Statistic	Total Across All Three Waves		
	2014	2015	2014-2015
Number of Treatment Customers	303,822	289,242	303,822
Verified Evaluation Savings (MWh)	37,882	56,366	95,039
Percent Savings	1.15%	1.73%	1.60%
Verified Net Savings (MWh)‡	**38,014**	**56,386**	**95,190**

†All savings are at the site.
* Navigant estimated each time period (i.e. year 2014, year 2015, and 2014-2015 together) as a separate analysis; the savings totals for year 2014 and year 2015 do not sum to the savings over the total combined time period of 2014-2015 together.
‡Verified net savings are savings after netting out savings double-counted with other energy efficiency programs.
Source: Navigant analysis

Detailed findings are included in the sections below.

5.1 Verified Net Program Impact Results

Table 5-2 presents verified net savings results from the HER program. Total verified net program savings from January 2014 to December 2015 were 95,190 MWh. Weighted average percentage savings across the two waves was 1.60%, meaning that on average the treatment group consumed 1.60% less energy than the control group in the analysis period. However, the average hides considerable variation across the two waves. The Legacy Wave had average savings of 2.71%, and the Expansion Wave had average savings of 1.18%.

Table 5-2. Net Program Savings and Uplift of Savings in Other Energy Efficiency Programs*

Type of Statistic	Legacy Wave			Expansion Wave		
	2014	2015	2014-2015 (24 Months)	2014 (Sept-Dec)	2015	2014-2015 (16 Months)
Number of Treatment Customers†	84,067	79,052	84,067	219,755	210,190	219,755
Number of Control Customers†	26,678	25,063	26,678	52,428	50,167	52,428
Percent Savings	2.71%	2.70%	2.71%	0.56%	1.37%	1.18%
Standard Error	*0.15%*	*0.17%*	*0.15%*	*0.11%*	*0.10%*	*0.09%*
90% Confidence Bound	*[2.46%, 2.95%]*	*[2.43%, 2.98%]*	*[2.47%, 2.96%]*	*[0.38%, 0.75%]*	*[1.21%, 1.53%]*	*[1.03%, 1.33%]*
Average Savings per Customer (kWh)	1.15	1.12	1.14	0.13	0.35	0.30
Standard Error	*0.06*	*0.07*	*0.06*	*0.03*	*0.02*	*0.02*
90% Confidence Bound	*[1.05, 1.26]*	*[1.01, 1.24]*	*[1.04, 1.25]*	*[0.09, 0.18]*	*[0.31, 0.39]*	*[0.26, 0.33]*
Verified Net Savings Prior to Uplift Adjustment (MWh)	34,357	31,414	66,046	3,525	24,952	28,993
Standard Error	*1,884*	*1,941*	*3,607*	*707*	*1,757*	*2,225*
90% Confidence Bound	*[31,259, 37,456]*	*[28,222, 34,607]*	*[60,113, 71,979]*	*[2,362, 4,688]*	*[22,062, 27,842]*	*[25,333, 32,653]*
Savings Uplift in Other Energy Efficiency Programs (MWh) ‡	-148	-135	-285	16	116	134
Verified Net Savings (MWh)	**34,505**	**31,549**	**66,331**	**3,509**	**24,836**	**28,859**

* Navigant estimated each time period (i.e. year 2014, year 2015, and 2014-2015 together) as a separate analysis; the savings totals for year 2014 and year 2015 do not sum to the savings over the total combined time period of 2014-2015 together.
†See Section 2.5 for the derivation of the customer counts presented here (and used in the analysis) from the raw customer counts.
‡ The savings uplift rate from the aggregated 2014-2015 analysis is applied to 2014 and 2015 to get uplift savings in each year[24].
Source: Navigant analysis

There are two sources of variation across the waves: the length of time they have been in the program and the baseline usage. The Legacy Wave had been in the program for 2.5 years at the start of 2014 and thus had plenty of time to ramp up before the start of this analysis. The Expansion Wave started in late 2014 and will likely continue to see savings ramp up into 2016. Additionally, the Legacy Wave is made up of higher energy users than the Expansion Wave, and higher users typically realize higher percentage

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[24] The uplift rate for the 2014-2015 analysis was calculated by dividing the 2014-2015 savings uplift by the 2014-2015 verified net savings prior to uplift. The savings uplift for 2014 and 2015 individually was calculated by multiplying the 2014-2015 uplift rate by the verified net savings prior to uplift for each year. For example, for the Legacy Wave the 2014-2015 uplift rate was -285 / 66,046 = -.0043 (or -0.43%). Thus 2014 uplift was 34357 * -0.0043 = -148 and 2015 uplift was 31,414 * 0.0043 = -135.

savings as a result of home energy reports, as discussed in Section 5.5. Figure 5-1 shows the savings for the Legacy Wave after 18 months (from the previous evaluation) compared to the savings for the Expansion Wave after 16 months. Although the timeframe for the Expansion Wave is slightly shorter, it is clear that the Expansion Wave has lower savings than the Legacy Wave. This is likely because the Expansion Wave is made up of lower energy usage customers.

Figure 5-1. Comparison of Early Period Savings
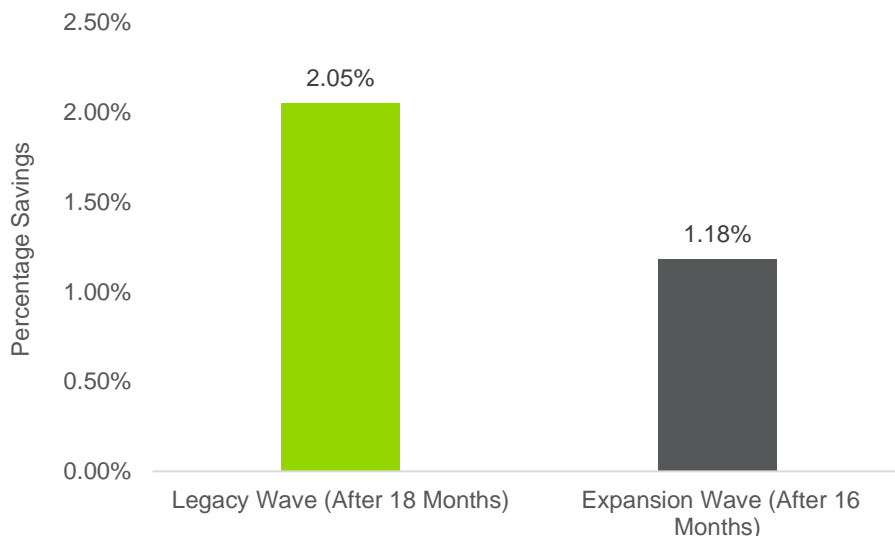
Source: Navigant analysis

Figure 5-2 shows the evolution of savings over time for each wave. The Expansion Wave shows a similar ramp up from 2014 to 2015 as the Legacy Wave did from 2012 to 2013. If the Expansion Wave pattern continues to mimic the Legacy Wave, Navigant would expect the Expansion Wave to continue to ramp up in savings through 2016 and level off in 2017. The Legacy Wave had similar savings in 2014 and 2015, indicating that savings may have reached a steady state for that wave and savings may continue to stay at about 2.7% for the next few years. Based on these savings over time, it does not appear that the suspension of reports in late 2015 had much, if any, impact on program savings.

Figure 5-2. Savings through Time
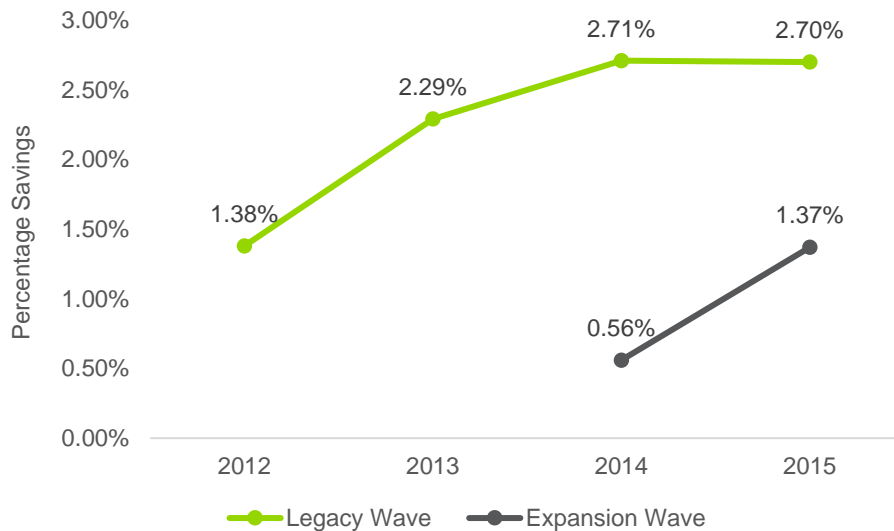
Source: Navigant analysis

5.2 Impact Parameter Estimates

Parameter estimates for the estimated models are presented in Appendix B. In all cases, the estimate of savings from the PPR model and the LFER model were similar.

5.3 Uplift of Savings in Other Energy Efficiency Programs

PPR program savings include savings resulting from the uplift in participation in other energy efficiency programs caused by the HER program. To avoid double-counting of savings, program savings due to this uplift must be counted toward either the HER program or the other energy efficiency programs but not both. The uplift of savings in other energy efficiency programs during the 2014-2015 evaluation period was a small proportion of the total savings: -151 MWh or -0.16%.

Navigant considered uplift for Rocky Mountain Power's Appliance Recycling and HES programs. Table 5-3 shows the incremental change in treatment customers in other energy efficiency programs because of the HER program, and Table 5-4 shows the double-counted savings in the HER program because of this change in participation. Detailed tables of the uplift results are included in Appendix C.

Table 5-3. Change in Participation (People)

	Program		Total
	Appliance Recycling	HES	
Legacy	-197	-211	**-408**
Expansion	68	298	**366**
Total	**-129**	**87**	**-42**

Source: Navigant analysis

Table 5-4. Double-Counted Savings (kWh)

	Program		Total
	Appliance Recycling	HES	
Legacy	-242,812	-41,993	**-284,805**
Expansion	83,550	50,708	**134,258**
Total	**-159,262**	**8,715**	**-150,547**

Source: Navigant analysis

The double-counted savings, positive or negative, are subtracted from the net savings estimates from the regression analysis to get total verified savings.

The estimate of double-counted savings is most likely an overestimate because it presumes participation in the other energy efficiency programs occurred at the start of the program year. Although participation in other programs likely occurred throughout the program year, it is standard to subtract the annual savings from the HER program as a conservative estimate of double-counting.[25] The outcome is that double-counting of savings with other energy efficiency programs for which tracking data are available does not appear to be a significant issue for the HER program at this time.

5.3.1 Double-Counting of Savings with the HES Upstream EEL Program

Due to a lack of tracking data, it is not possible to state definitively the double-counted savings of the HER program and the HES upstream EEL delivery channel. Navigant's approach to this issue is to use a set of survey questions to examine whether the HER program is in fact serving to increase the use of EEL and, if so, to derive an upper bound on the double-counting of savings, as described in Section 2.3. The survey questions, referred to as a Live Audit battery, gather information on respondent's real-time lighting use by asking them to walk through their house and answer questions about the bulb types and number of lights. Navigant conducted a regression analysis on the results, controlling for time of day, room within the home, and number of bulbs turned on based on question dependency.

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[25] Under the assumption that participation in other programs occurred uniformly throughout the year, the double-counted savings would be approximately -35 MWh, half the estimate value of -70 MWh. The double-counted savings are small enough compared to the total HER savings that using -35, as opposed to -70, would not make a considerable difference in the total program savings.

As part of this battery, the evaluation team also collected information on real-time thermostat usage, with results presented in Section 6.1.

The first question of this battery asked respondents to count the number of CFL and LED bulbs installed in the room that the respondent occupied at the time of the survey. For the Legacy Wave, the analysis revealed that treatment respondents have 0.08 fewer CFL bulbs installed than control respondents. In the Expansion Wave, treatment respondents reported an average of 0.11 more CFL bulbs than the control group. Across both waves, treatment respondents reported having more LED bulbs installed than control respondents, with 0.34 more LED bulbs installed in the Legacy Wave and 0.25 more in the Expansion Wave. Figure 5-3 provides a summary of these results. None of these differences were statistically significant at the 90% confidence interval.

Figure 5-3. Difference in Efficient Bulbs Installed, Treatment Compared to Control Group

Source: Navigant analysis of customer survey; L2a and L2b

When looking at the number of lights of any type turned on in the entire home at the time of the survey, treatment respondents in both waves had fewer lights turned on. Figure 5-4 shows that Legacy treatment respondents had 1.3 fewer lights turned on, while the Expansion treatment respondents had 0.49 fewer lights turned on compared to their respective control groups. The evaluation team used these numbers to control for the number of CFL and LED bulbs turned on in the home to reduce variability across respondents and increase the accuracy of the comparison.

Figure 5-4. Difference in Number of Lights Turned On, Treatment Compared to Control Group
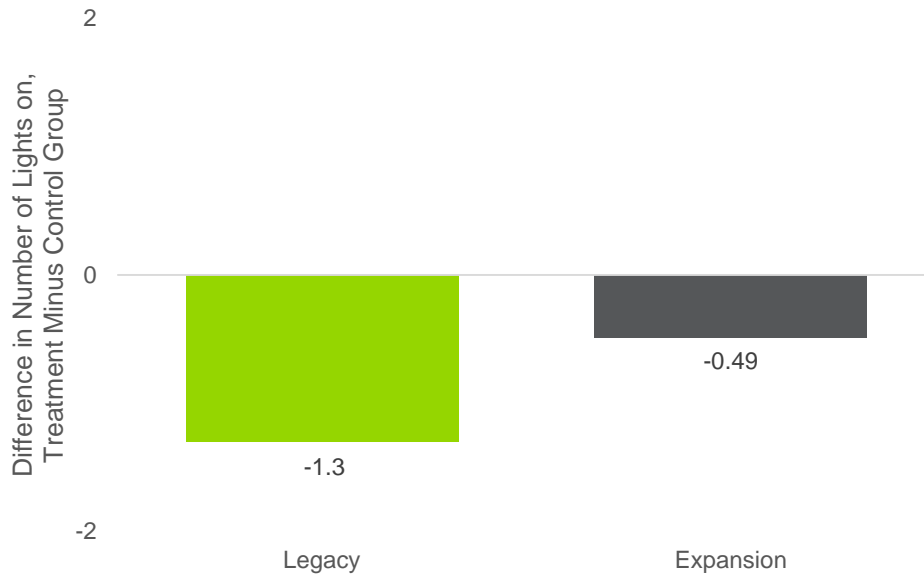
Source: Navigant analysis of customer survey; L3

For CFL bulbs, the Legacy treatment group had only 0.01 more CFL lights turned on across their home compared to the control group; the Expansion treatment group had 0.31 fewer CFL bulbs turned on. For LED bulbs, both treatment groups had more LED bulbs turned on in their home, with 0.91 more LED bulbs turned on in the Legacy Wave and 0.64 more in the Expansion Wave. Similar to the above findings, none of these differences were statistically significant at the 90% confidence interval.

Navigant also asked customers whether (a) they had seen materials encouraging them to purchase CFLs; (b) they had purchased at least one CFL in 2015; and (c) they had purchased at least one LED in 2015. Three-quarters of treatment customers and two-thirds of control customers in both the Legacy and Expansion Waves answered "Yes" to the first question. This difference was statistically significant at the 90% confidence level. For the second and third questions, there were no significant differences between treatment and control customers in their purchases of CFLs or LEDs. The percentage of customers who purchased CFLs ranged from 52% (Legacy control group) to 70% (Expansion control), and the percentage of customers who purchased LEDs ranged from 46% (Expansion treatment) to 54% (Expansion control).

In summary, there appears to be little difference between treatment and control customers in their installation and use of energy efficient light bulbs. Both treatment groups showed higher awareness of marketing materials encouraging them to purchase CFL and LED bulbs. However, the higher awareness did not seem to convert to more purchases or installations of efficient bulbs. Navigant concludes from these survey results that the HER program does not have a statistically significant effect on customer participation in the upstream lighting program and thus no double-counted savings are estimated.

5.4 Realization Rates

Navigant calculated realization rates by comparing reported savings to the verified net savings prior to uplift as reported in Table 5-2. Reported savings came from cost-effectiveness inputs supporting Rocky Mountain Power's reports. Figure 5-5 shows the realization rate in each year. The Expansion Wave realization rate in 2014 may be low due to the estimate using only four months of data in that year. Savings estimates with fewer months of data are typically less precise making it common to see more variation between the estimate of the evaluation team and the implementer.

Figure 5-5. Realization Rates
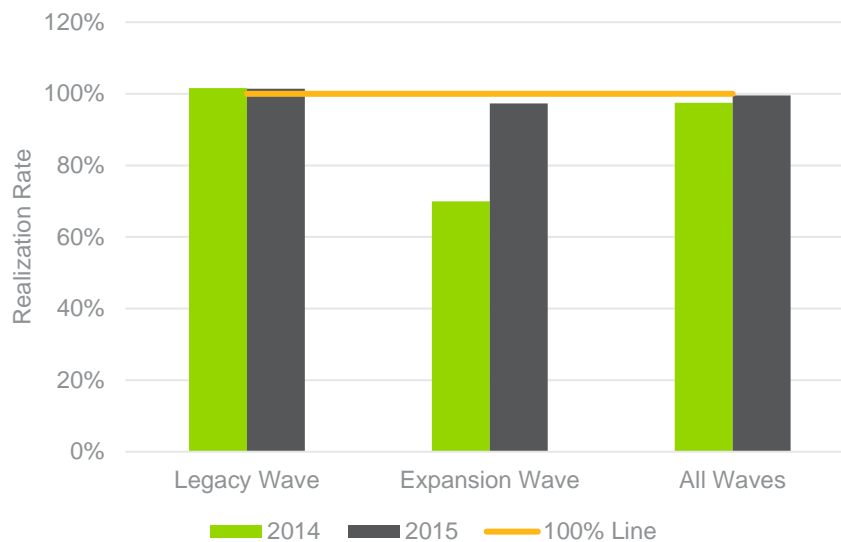
Source: Navigant analysis

Table 5-5 shows the inputs for the realization rate calculations including the evaluation savings and the reported savings for each year.

Table 5-5. Realization Rates

Year	Statistic	Legacy Wave	Expansion Wave	All Waves
2014	Evaluation Savings (MWh)	34,357	3,525	37,882
	Reported Savings (MWh)	33,822	5,038	38,860
	Realization Rate	102%	70%	97%
2015	Evaluation Savings (MWh)	31,414	24,952	56,366
	Reported Savings (MWh)	30,978	25,637	56,615
	Realization Rate	101%	97%	100%

Source: Navigant analysis

5.5 Analysis of Savings by Usage Level

Navigant analyzed how program savings varied with usage level by segmenting program treatment and control customers within each wave into three equally sized groups based on their pre-program usage level. This analysis was run on the aggregated 2014-2015 analysis period for each wave. Table 5-6 provides descriptive statistics and savings values for each of the three segments.

Table 5-6. Savings by Usage Level

Type of Statistic	Legacy Wave			Expansion Waves		
	Low Usage	Medium Usage	High Usage	Low Usage	Medium Usage	High Usage
Number of Treatment Customers	27,882	27,888	27,768	70,462	70,477	70,406
Number of Controls	8,809	8,803	8,921	16,786	16,771	16,840
Pre-Program Daily Usage Range (kWh)	6.0 to 38.5	38.5 to 47.2	47.2 to 230.9	2.5 to 21.6	21.6 to 27.7	27.7 to 177.7
Pre-Program Daily Usage Mean (kWh)	32.3	38.0	53.0	18.2	23.7	32.7
Percent Savings	2.40%	2.85%	2.76%	0.97%	1.02%	1.39%
Standard Error	*0.25%*	*0.23%*	*0.26%*	*0.16%*	*0.13%*	*0.16%*
90% Confidence Bound	*[1.99%, 2.82%]*	*[2.47%, 3.24%]*	*[2.34%, 3.18%]*	*[0.71%, 1.23%]*	*[0.80%, 1.24%]*	*[1.13%, 1.65%]*
Average Daily Savings per Customer (kWh)	0.79	1.11	1.49	0.18	0.24	0.46
Standard Error	*0.08*	*0.09*	*0.14*	*0.03*	*0.03*	*0.05*
90% Confidence Bound	*[0.65, 0.93]*	*[0.96, 1.26]*	*[1.26, 1.72]*	*[0.13, 0.23]*	*[0.19, 0.30]*	*[0.37, 0.54]*

Source: Navigant analysis

The percentage savings for each usage group are shown in Figure 5-6. The results are arranged with the lowest average usage group on the left and the highest average usage group on the right. As expected, on average, higher users save more. Across the waves some of the differences may be due to ramp up based on the length of time the wave has been in the program. This suggests that the highest users should be targeted if the program continues to expand.

Figure 5-6. Absolute and Percent Savings by Usage Level, 90% Confidence Interval
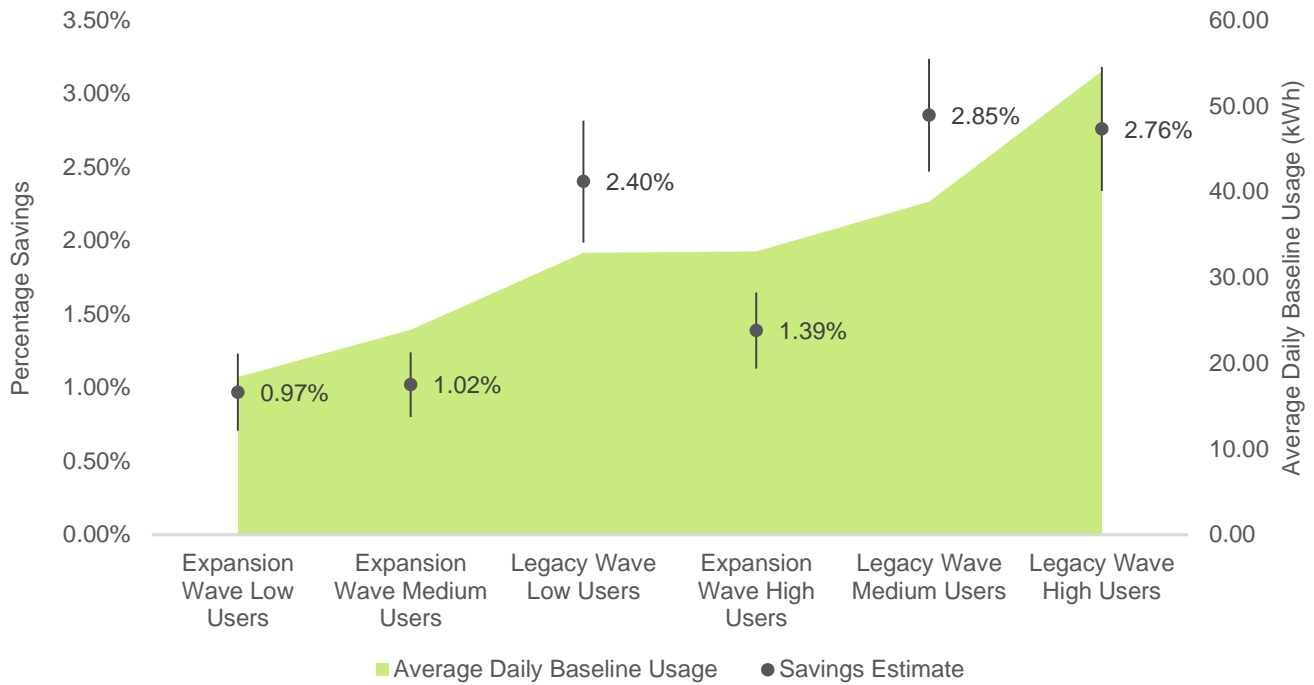
Source: Navigant analysis

6. PROCESS EVALUATION RESULTS

Navigant designed a customer survey of the treatment and control groups in the Legacy and Expansion Waves to explore the following objectives:

- The effect of the HER program on energy awareness, engagement, and satisfaction

- Customer satisfaction with the HER program

- Behavioral and informational effects of the HER program, including effects on customer awareness and purchase of energy efficient appliances and customer awareness of Rocky Mountain Power's energy efficiency programs

The following sections present findings related to these objectives. Appendix D includes information on the demographic characteristics of the survey respondents.

6.1 Real-Time Energy Thermostat Behavior

As part of the Live Audit battery discussed in Section 5.3.1, the evaluation team asked respondents a series of questions designed to determine real-time thermostat behavior practices. Navigant asked respondents to locate their thermostats during the survey and answer questions about the type of thermostat installed in their home[26], as well as the settings they currently have in place. The evaluation team conducted a regression analysis on the results, controlling for time of day in case temperature settings varied across the four-hour survey period.[27]

The majority of respondents reported that they have a digital thermostat installed in their home, as shown in Figure 6-1. Manual thermostats, defined as a thermostat with no digital display and no programming capabilities, were less common and found in 10% to 20% of households. The most sophisticated thermostats are smart Wi-Fi/programmable thermostats (smart thermostats), which feature more advanced programming options and allow for remote thermostat control. Respondents in the Expansion treatment group were statistically significantly less likely to have a smart thermostat installed than the Expansion control group or the Legacy treatment group. Just 5% of the Expansion treatment group had a smart thermostat installed compared to 14% of the Expansion control group and 12% of the Legacy treatment group. Both of these differences are statistically significant at the 90% confidence level.

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[26] Three types of thermostats were asked about in the survey: (1) a manual thermostat defined as a thermostat with a dial or lever that allows the user to adjust the temperature but which does not have a digital display; (2) a digital thermostat defined as a thermostat with a digital display that allows the user to adjust the temperature by pressing buttons; and (3) a smart/Wi-Fi programmable thermostat defined as a thermostat with a digital display that allows for remote control of your thermostat, examples include the Google Nest and the Honeywell Lyric.

[27] The evaluation team conducted surveys between 5 p.m. and 9 p.m. local time.

Figure 6-1. Home Thermostat Type
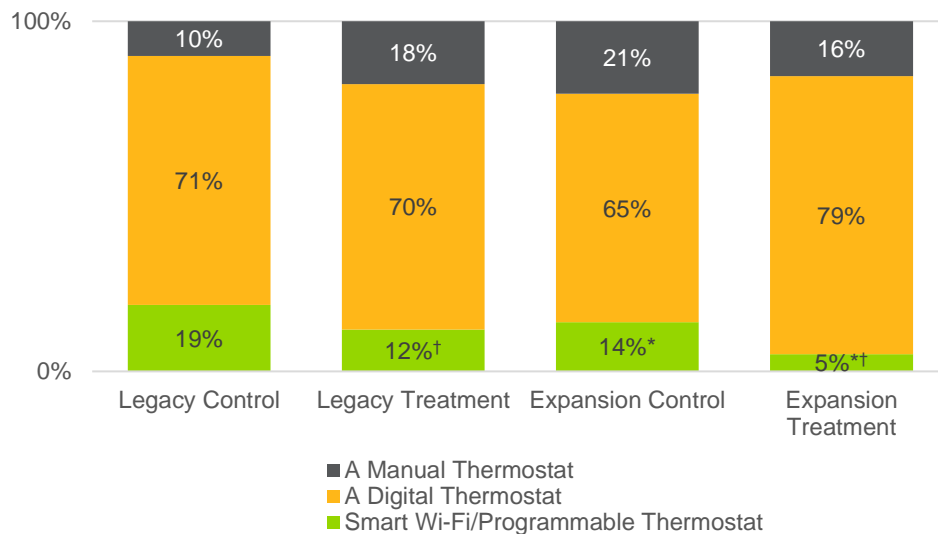
*Denotes a statistical difference between control and treatment groups within a wave
†Denotes a statistical difference between treatment groups across waves
Legacy Control n=121; Legacy Treatment n=120; Expansion Control n=124; Expansion Treatment n=121
Source: Navigant analysis of customer survey; L5

For those respondents who reported having a thermostat with programming capabilities, the majority, 70% to 76% across the different groups, indicated that, at the time of the survey, they were using programmed settings. Respondents in the control groups demonstrated slightly higher rates of programming, although the differences were not statistically significant; the Legacy treatment group was only 96 percent as likely to have programmed their thermostat compared to the Legacy control group, and the Expansion treatment group was only 83 percent as likely to have programmed their thermostat compared to the Expansion control group. The evaluation team found no difference between the two treatment cohorts.

In concluding the Live Audit battery, Navigant gathered information on current temperature settings for each cohort. Almost all respondents had their thermostats turned on, with the temperature setpoint programmed to an average of 68 to 69 degrees Fahrenheit. The actual temperature of respondents' homes ranged from 69 to 70 degrees Fahrenheit. There were no statistically significant differences in the thermostat settings or home temperature across the different groups.

6.2 Efficient Lighting Awareness and Purchasing

The evaluation team asked all respondents a series of questions designed to assess their awareness of the EEL options available.

The majority of respondents recalled receiving information from Rocky Mountain Power encouraging them to replace incandescent light bulbs with CFL and LED bulbs. Respondents in the treatment groups more frequently recalled receiving EEL recommendations from their utility. As shown in Figure 6-2, three-quarters of treatment group customers (75% and 76% of the Legacy and Expansion Waves, respectively) recalled receiving information from Rocky Mountain Power compared to two-thirds of the control group

respondents (64% and 66% of the Legacy and Expansion Waves, respectively). This difference in the recollection of the treatment group compared to the control group was statistically significant for each wave.

Figure 6-2. Recall Information on Bulb Replacement
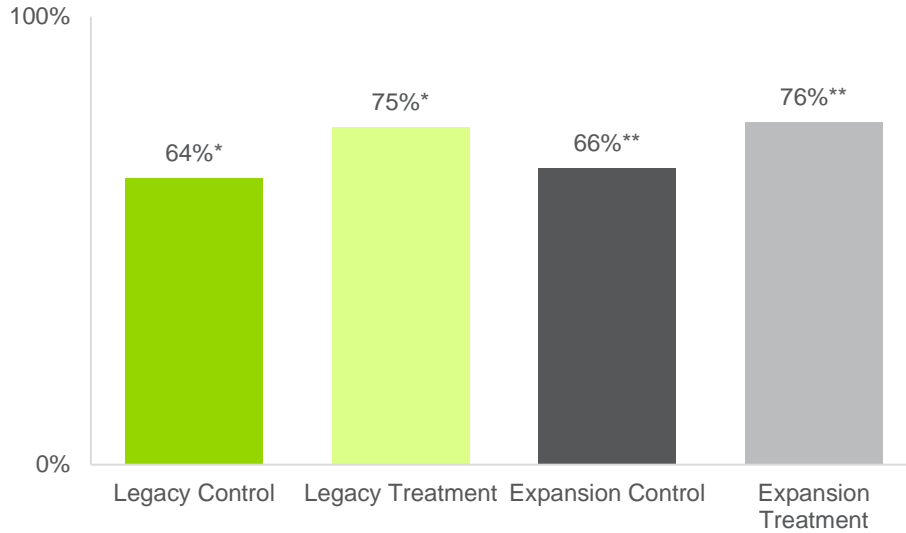
*Statistically significant difference between Legacy treatment and control groups.
**Statistically significant difference between Expansion treatment and control groups.
Legacy Control n=121; Legacy Treatment n=120; Expansion Control n=124; Expansion Treatment n=121
Source: Navigant analysis of customer survey; LP1

Respondents have adopted EEL at a moderate level over the past year. In the previous 12 months, Expansion Wave respondents purchased CFL bulbs at a higher but not statistically different rate as compared to Legacy respondents, while LED purchases during this time period were consistent across the two waves for both treatment and control customers.

Figure 6-3 shows the percentage of respondents in each wave and group who purchased EEL over the previous 12 months. About half of the respondents in the Legacy Wave purchased EEL in the past year, with 52% of control customers and 58% of treatment customers purchasing CFL bulbs, and 53% of control customers and 51% of treatment customers purchasing LED bulbs. In the Expansion Wave, CFL bulb purchases were more common than in the Legacy Wave: 70% of control customers purchased CFL bulbs compared to 62% of treatment customers. LED purchase rates in the Expansion Wave were similar to the earlier Legacy Wave, with 54% of control customers and 46% of treatment customers purchasing LED bulbs. None of these differences were statistically significant at the 90% confidence level.

Figure 6-3. Purchased CFLs or LEDs in Past 12 Months

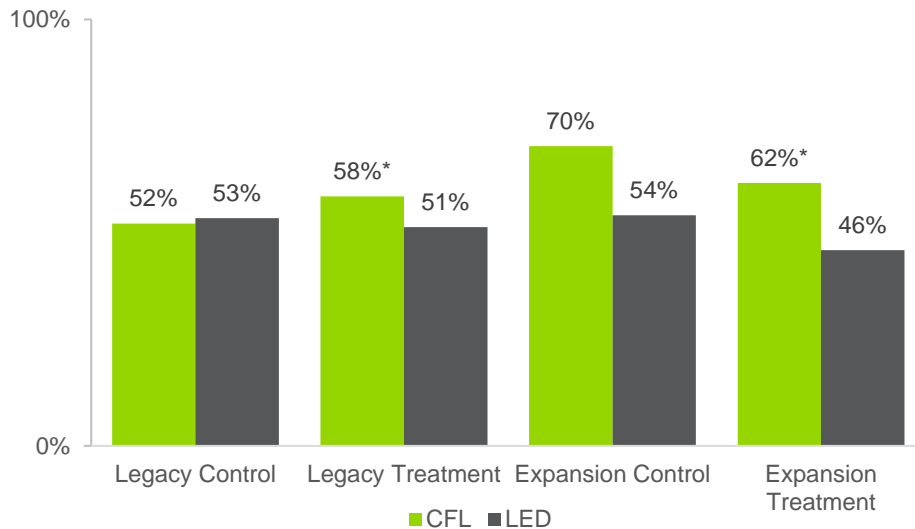*Statistically significant difference between treatment customers in the Legacy and Expansion Waves.
Legacy Control n=121; Legacy Treatment n=120; Expansion Control n=124; Expansion Treatment n=121
Source: Navigant analysis of customer survey; LP2, LP3

In addition to looking at whether or not a customer purchased a CFL or LED bulb, Navigant also considered the number of bulbs bought. Legacy Wave respondents purchased a higher volume of energy efficient light bulbs compared to Expansion Wave respondents. The difference between Legacy and Expansion Wave respondents' purchases was larger for LEDs than CFLs. For treatment group respondents, the difference between average purchases of LED bulbs by Legacy Wave respondents was statistically significant when compared to Expansion Wave respondents (15.2 and 10.9 LEDs purchased per household, respectively). Legacy and Expansion Wave treatment groups were not statistically significantly different in their purchase of CFLs (11.9 and 10.2 CFLs purchased per household, respectively).

Control group respondents from the Legacy Wave purchased an average of 13.5 CFL bulbs per household, and treatment group respondents purchased 11.9. This number is slightly higher than but not statistically different from Expansion Wave customers' CFL bulbs purchased per household. Control group respondents from the Expansion Wave purchased an average of 9.4 CFL bulbs, and treatment group respondents purchased a mean of 10.2. Treatment customers in both waves purchased slightly more LED bulbs than control customers, but none of the differences in LED purchases were statistically significant.

6.3 Energy Awareness and Attitudes

The evaluation team asked all respondents a series of questions designed to explore awareness of their energy usage and to assess their perception of energy-saving behaviors. Additionally, Navigant designed the questions to identify differences in behavior and awareness between control and treatment group respondents.

Figure 6-4 shows Legacy Wave respondents' awareness of and attitudes toward energy efficiency. Legacy Wave respondents showed statistically significant differences between the control and treatment groups in their awareness of energy-saving behaviors and whether they associated lower energy bills with conservation efforts. When asked whether they knew of things they could do to save energy beyond their current actions, 75% of control group respondents and 66% of treatment group respondents were aware of other potential energy-saving things they could do. The Legacy control group also indicated that they were more confident that their actions saved energy than the treatment group: 54% of control customers said their energy bill was noticeably lower when they made an extra effort to conserve compared to 43% of treatment customers. One possible explanation for this discrepancy is that the treatment group receives more granular and frequent information about their home's energy use with built-in comparisons month over month. Access to this data could mean that they are more attuned to changes in their energy use and thus may feel discouraged if savings are not as robust as they expected.

Figure 6-4. Energy Efficiency Attitudes and Awareness: Legacy Wave

I understand how my actions affect my energy use — 91% / 90%

I would be proud to have one of the most energy efficient houses in my neighborhood — 69% / 67%

I pay closer attention to my energy costs now than I did before receiving Home Energy Reports† — 55%

I know of additional things I could be doing to save energy — 75%* / 66%*

Improving my home's energy efficiency is a worthwhile investment — 90% / 86%

My energy bill is noticeably lower when I make an extra effort to conserve — 54%* / 43%*

■ Legacy Control ■ Legacy Treatment

†Asked only of treatment group respondents.
*Statistically significant difference between control and treatment respondents.
Legacy Control n=121; Legacy Treatment n=120
Source: Navigant analysis of customer survey; EA2e, EA2f, EA3a, EA3c, EA3d, EA3e

Figure 6-5 shows Expansion Wave respondents' attitudes and awareness toward energy efficiency. Expansion Wave respondents had similar attitudes and awareness of energy efficiency compared to Legacy Wave respondents. Nearly all Expansion Wave respondents also said they understood the effect of their actions, with 96% of the control group and 94% of the treatment group answering "yes" to the

associated question. Additionally, 77% of control group respondents and 75% of treatment group respondents were aware of additional energy-saving actions they could take.

Expansion Wave respondents showed a statistically significant difference between the control and treatment groups in whether their energy bills were noticeably lower when they make an extra effort to conserve. Expansion Wave treatment customers less frequently associated lower energy bills with extra conservation efforts, with 63% of control group respondents and 51% of treatment group respondents saying their energy bills were noticeably lower when they made an effort to conserve.

Figure 6-5. Energy Efficiency Attitudes and Awareness: Expansion Wave

†Asked only of treatment group respondents.
*Statistically significant difference between control and treatment respondents.
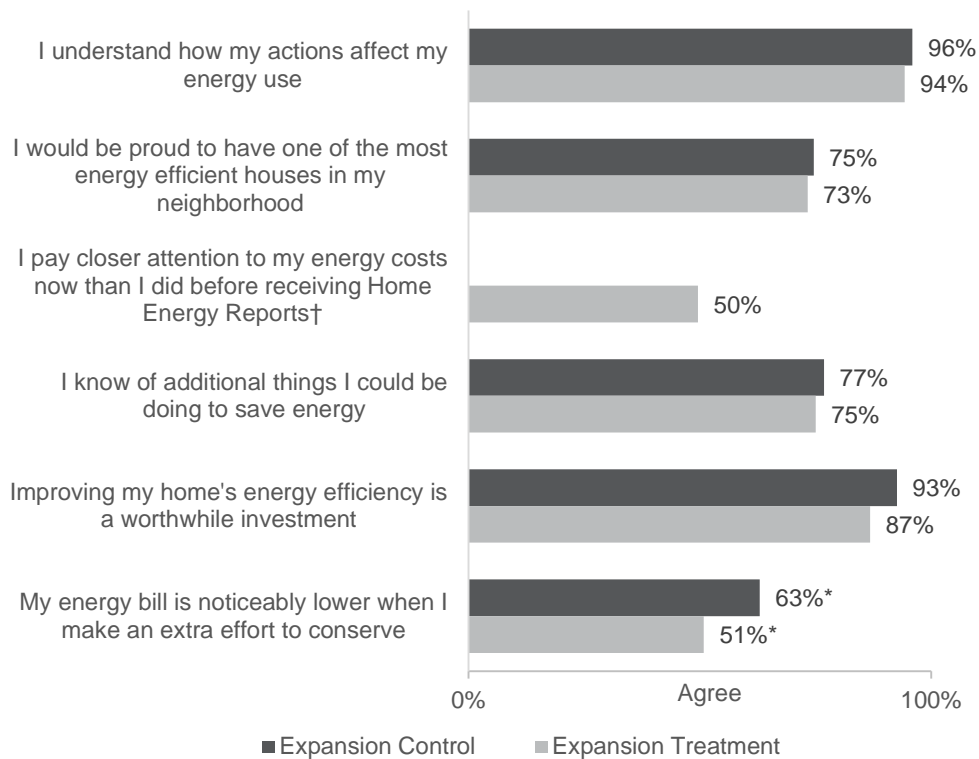Expansion Control n=124; Expansion Treatment n=121
Source: Navigant analysis of customer survey; EA2e, EA2f, EA3a, EA3c, EA3d, EA3e

To better assess respondents' feelings related to their home's energy consumption, Navigant asked respondents to rate their satisfaction with this consumption. Responses fell in the middle of the range for all of the groups, with mean ratings falling between 5.6 and 6.6 out of 10. For both the Legacy and Expansion Waves, the control group had higher satisfaction with their home's energy use. The difference between the Legacy control and Legacy treatment groups was statistically significant, with the control group giving a mean satisfaction rating of 6.1 compared to 5.6 for the treatment group. For the Expansion Wave, the difference between the treatment and control customers was not statistically significant. Figure 6-6 shows respondents' mean satisfaction with their home's electric energy consumption on a scale from 1 to 10.

One possible explanation for the lower satisfaction with energy consumption among treatment customers is that these customers receive frequent tips and granular comparisons that remind them that there is more that they could do to save energy; thus, these customers feel less satisfied after receiving this messaging. Navigant has observed similar outcomes in other HER program evaluations.

Figure 6-6. Satisfaction with Electric Energy Consumption
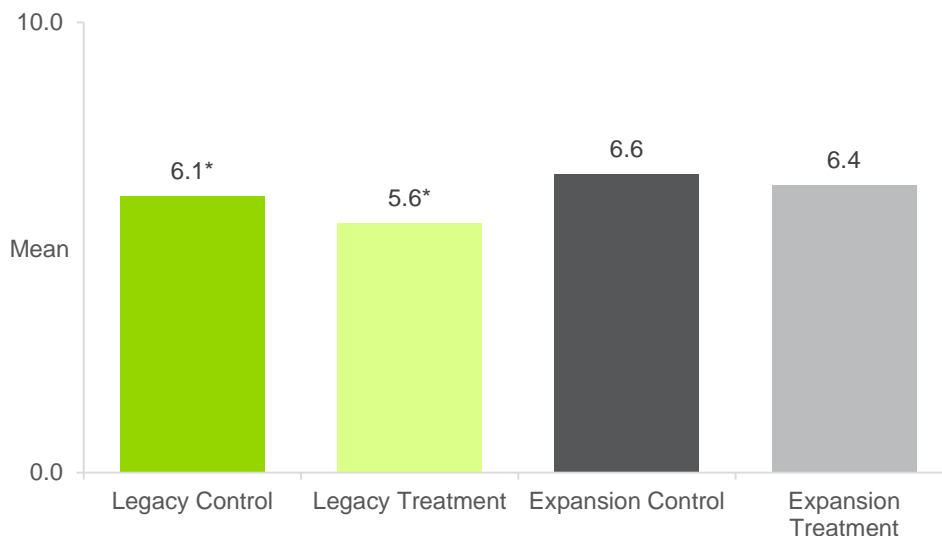
*Statistically significant difference between Legacy control and treatment groups.
Legacy Control n=121; Legacy Treatment n=120; Expansion Control n=124; Expansion Treatment n=121
Source: Navigant analysis of customer survey; EA4

When asked to elaborate on their home energy use satisfaction rating, treatment group respondents in both waves most frequently said that they chose that rating because they could make improvements, with 26% of Expansion Wave respondents and 22% of Legacy Wave respondents mentioning this reason. Additional reasons frequently mentioned by respondents included that they try to be efficient, they had high bills, and that they try to conserve but do not see changes reflected on their bill. Figure 6-7 shows treatment group respondents' reasons for their respective satisfaction ratings. The question associated with this figure was open-ended and respondents could mention multiple reasons.

Figure 6-7. Reason for Satisfaction Rating: Treatment Group Only
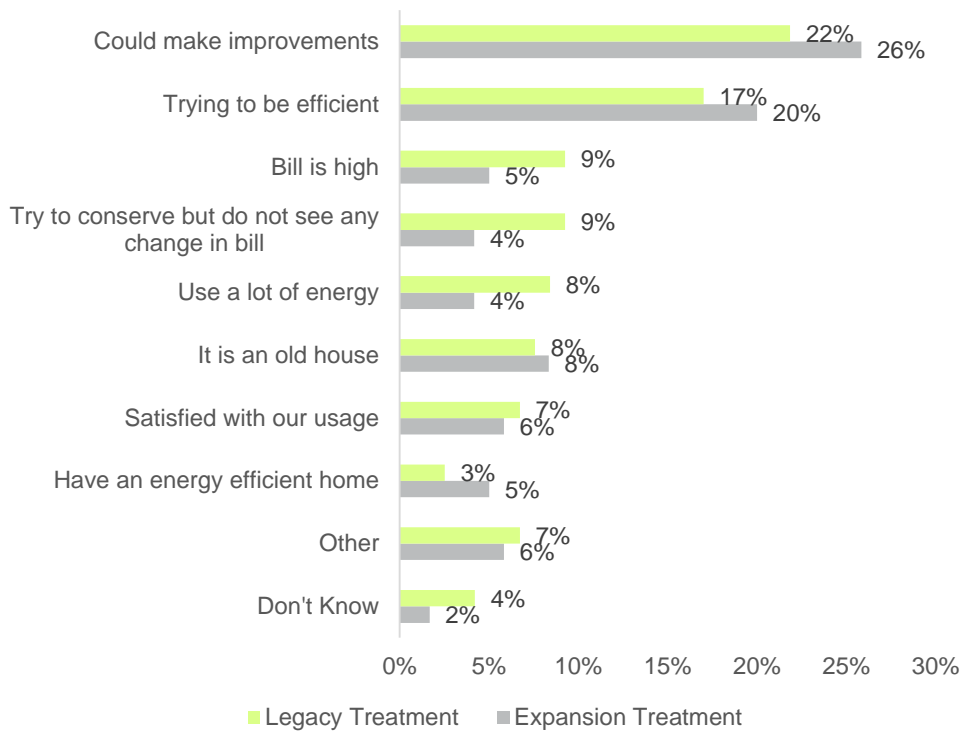
Multiple responses accepted; figure includes reasons mentioned by at least 5% of respondents.
Legacy Treatment n=120; Expansion Treatment n=121
Source: Navigant analysis of customer survey; EA4a

Approximately half of all survey respondents made energy efficient purchases or upgrades over the previous 12 months. In both waves, respondents in the treatment group made changes more frequently than those in the control group. For the Legacy Wave, 62% of treatment group respondents made energy efficient purchases or upgrades compared to 53% of control group respondents. For the Expansion Wave, 56% of treatment group respondents made energy efficient purchases or upgrades compared to 47% of control group respondents. Neither of these differences were statistically significant.

Across all waves and groups, survey respondents purchased LED light bulbs more frequently than any other energy efficient appliance or equipment. Legacy control group respondents purchased LEDs the least frequently, with 25% of respondents purchasing them in the previous 12 months compared to 33% of Legacy treatment group respondents and 34% of all Expansion Wave respondents. Legacy Wave respondents differed between control and treatment groups for several purchases, including CFLs (8% control and 18% treatment), insulation (11% control and 21% treatment), windows (6% control and 12% treatment), and dishwashers (21% control and 12% treatment).

Responses from the Expansion Wave differed less between the control and treatment groups. Respondents from both groups purchased new energy efficient equipment at similar rates; items with the largest differences in purchasing rates includes clothes washers (17% control and 10% treatment), windows (5% control and 9% treatment), and water heaters (2% control and 6% treatment). Figure 6-8

shows the most frequently purchased energy efficient appliances and equipment across both waves and groups.

Figure 6-8. Purchases Made in Past 12 Months
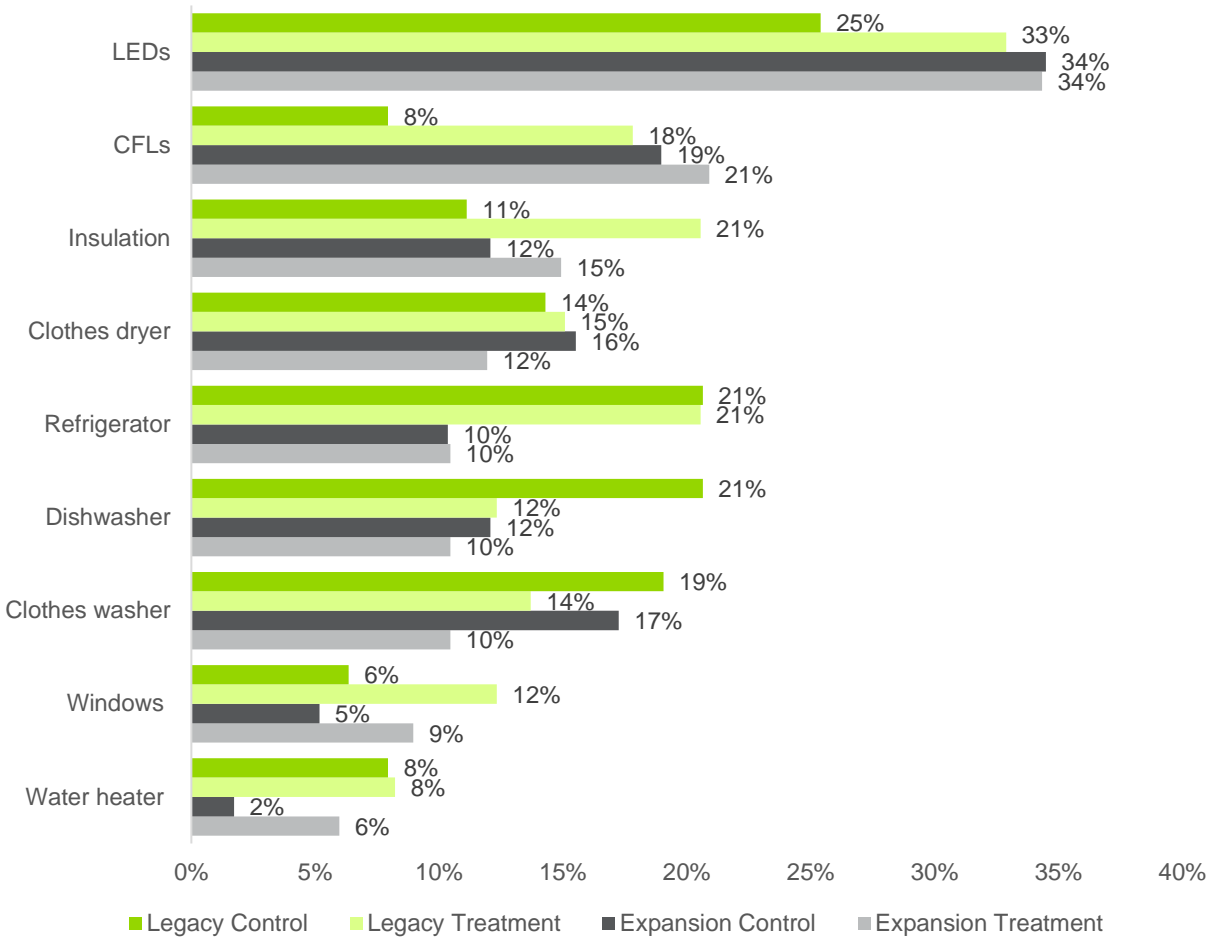
Multiple responses accepted; figure includes purchases mentioned by more than 5% of respondents.
Legacy Control n=121; Legacy Treatment n=120; Expansion Control n=124; Expansion Treatment n=121
Source: Navigant analysis of customer survey; EA5b

The evaluation team found that a slight majority of survey respondents had taken actions to reduce or minimize their electricity, gas, or water consumption over the previous year. This finding was true across all waves and groups: in the Legacy Wave, 62% of control group respondents had taken action compared to 56% of the treatment group. In the Expansion Wave, 60% of control group respondents had taken action compared to 64% of treatment group respondents.

Respondents most frequently said, "Turn off lights when not in use" when asked which actions or behavior changes they had made over the past year. In the Legacy Wave, approximately 30% of all respondents mentioned turning off lights; in the Expansion Wave, turning off lights was mentioned by more than 30% of treatment group respondents but by only 14% of control group respondents. Figure 6-9 shows the most frequently mentioned actions or behaviors taken over the previous 12 months.

Figure 6-9. Actions or Behavior Changes in Past 12 Months
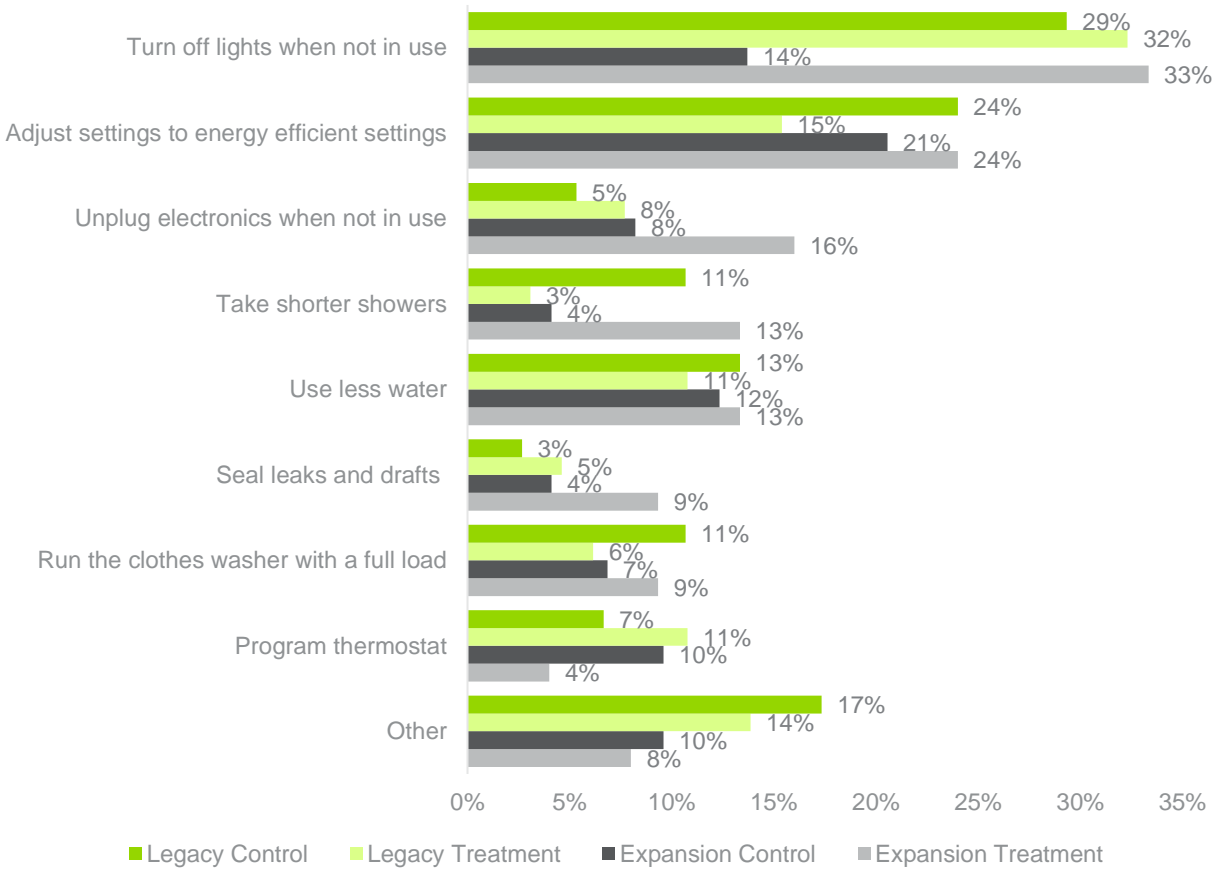
Multiple responses accepted; figure includes actions mentioned by more than 5% of respondents.
Legacy Control n=121; Legacy Treatment n=120; Expansion Control n=124; Expansion Treatment n=121
Source: Navigant analysis of customer survey; EA6b

6.4 Satisfaction with Utility

Overall, Rocky Mountain Power customers are highly satisfied with their utility. The research team asked respondents to rate their satisfaction with the utility on a scale from 1 to 10. For purposes of the evaluation, Navigant considered a rating of 6 or higher to indicate satisfaction.

Expansion Wave customers were slightly more satisfied with Rocky Mountain Power than Legacy Wave customers—less than 10% of Expansion Wave respondents gave a rating of 5 or less on a scale from 1 to 10. The difference across the waves was statistically significant for the treatment customers, with 81% of the Legacy treatment group giving a satisfied rating compared to 91% of the Expansion treatment group. A possible explanation for this difference in satisfaction is that the Legacy Wave respondents are higher users, meaning they likely have higher monthly electric bills, which could consequently reduce their satisfaction.

Figure 6-10 provides a breakdown of all satisfaction ratings, broken out into three categories to reflect "Excellent" ratings (9-10 rating), "Good" ratings (6-8), and "Negative" ratings (1-5). Across both waves and groups, a large proportion of respondents rated the utility as "Excellent," with approximately 40% of respondents falling into this range. The percentage of respondents who rated the utility as "good" varied between 41% (for Legacy control group customers) and 53% (for Expansion treatment group customers).

Figure 6-10. Overall Satisfaction with Utility

*Denotes statistical difference between treatment groups across waves
Legacy Control n=121; Legacy Treatment n=120; Expansion Control n=124; Expansion Treatment n=121
Source: Navigant analysis of customer survey; SAT1

When asked to elaborate on their satisfaction rating with Rocky Mountain Power, survey respondents most frequently said that they did not have any problems with the utility. Expansion group respondents gave this response more frequently than Legacy group respondents, particularly in the control group in which 45% of treatment respondents said they had no problems. Other positive responses mentioned were that power was working and reliable, the utility has good customer service, the prices are fair or affordable, and that the utility provides educational information. The most frequently mentioned negative issues were that the prices are too high or increasing, the utility is the only option, and that customers experience outages. Figure 6-11 shows respondents' reasons for their satisfaction rating with their utility.

Figure 6-11. Reasons for Utility Satisfaction Rating
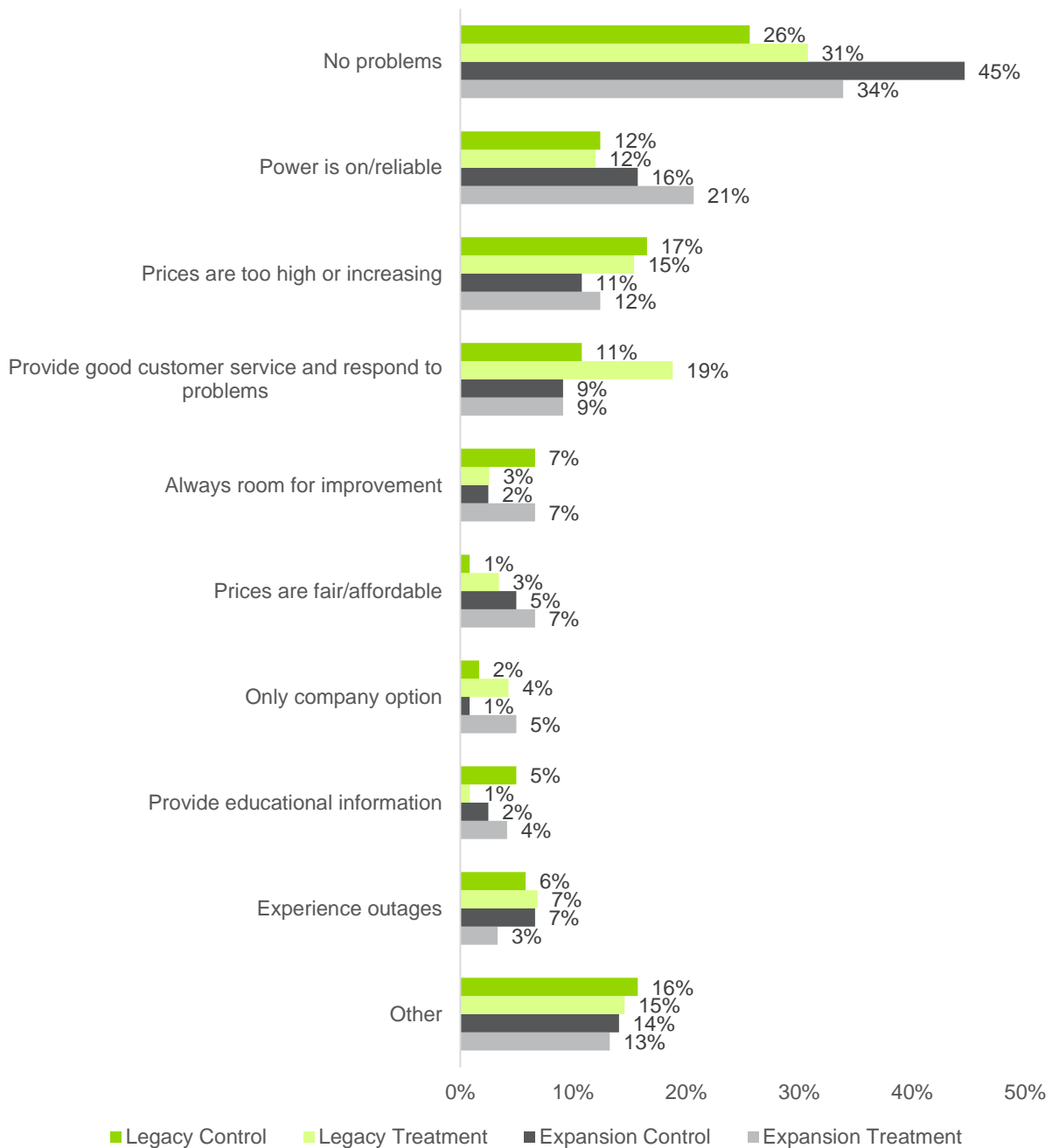
	Legacy Control	Legacy Treatment	Expansion Control	Expansion Treatment
No problems	26%	31%	45%	34%
Power is on/reliable	12%	12%	16%	21%
Prices are too high or increasing	17%	15%	11%	12%
Provide good customer service and respond to problems	11%	19%	9%	9%
Always room for improvement	7%	3%	2%	7%
Prices are fair/affordable	1%	3%	5%	7%
Only company option	2%	4%	1%	5%
Provide educational information	5%	1%	2%	4%
Experience outages	6%	7%	7%	3%
Other	16%	15%	14%	13%

■ Legacy Control ■ Legacy Treatment ■ Expansion Control ■ Expansion Treatment

Multiple responses accepted; figure includes reasons mentioned by at least 5% of respondents.
Legacy Control n=121; Legacy Treatment n=120; Expansion Control n=124; Expansion Treatment n=121
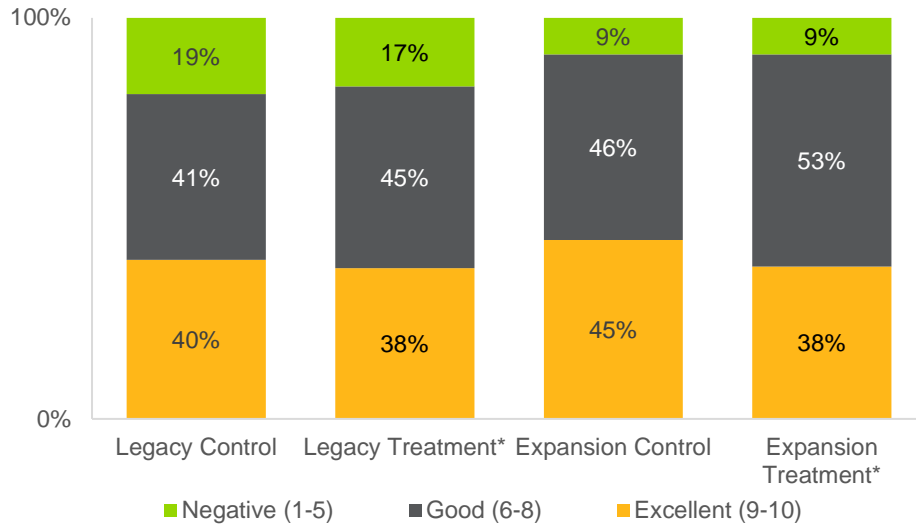*Source: Navigant analysis of customer survey; SAT1a*

6.5 Experience with the HER Program

To better explore customer experience with the program, the evaluation team asked treatment customers in both waves a series of questions specifically targeting the home energy reports and respondents' impressions of them.

On average, the majority of respondents receiving the home energy reports spend less than five minutes reading them, with a large portion falling into the two to five minute range. Figure 6-12 provides a complete summary of time spent reading the reports. Only 3% of the Legacy Wave and 2% of the Expansion Wave reported that they discard the reports before reading them, indicating that almost all program treatment customers consistently review the reports.

Respondents in the Expansion Wave reported spending more time reading the reports compared to their Legacy counterparts. Of Expansion respondents, 67% reported reading the reports for more than two minutes compared to only 60% of Legacy respondents; the difference is not statistically significant, however. This discrepancy may be due to length of time spent in the program—Legacy treatment customers are more accustomed to report content and can obtain information from the reports at a faster rate since they have been receiving them longer.

Figure 6-12. Length of Time Spent Reading Home Energy Reports
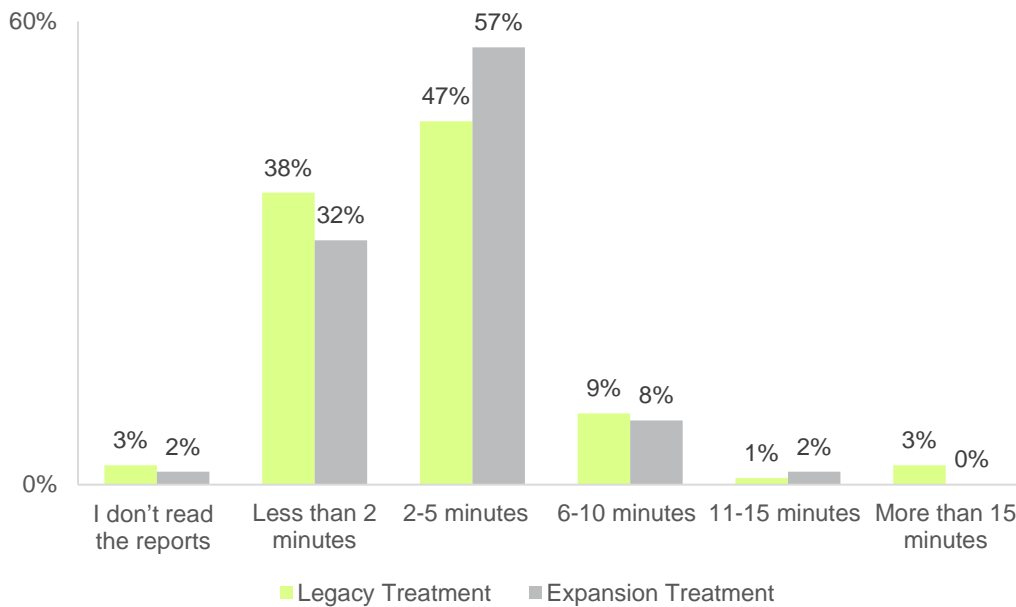
Legacy Treatment n=120; Expansion Treatment n=121
Source: Navigant analysis of customer survey; H1

The evaluation team also asked respondents to rate their satisfaction with the program on a scale from 1 to 10, where 1 was extremely dissatisfied and 10 was extremely satisfied. For purposes of the evaluation, Navigant considered a rating of 6 or higher to indicate satisfaction. Respondents in the Expansion Wave reported statistically significant higher rates of satisfaction than those in the Legacy Wave, with Expansion Wave respondents giving a mean satisfaction rating of 7.0 and Legacy Wave respondents giving a mean rating of 6.0.

Figure 6-13 provides a breakdown of all satisfaction ratings, broken out into three categories to reflect "Excellent" ratings (9-10 rating), "Good" ratings (6-8), and "Negative" ratings (1-5). Expansion respondents report higher "Excellent" ratings (26% for Expansion compared to 20% for Legacy), as well as higher "Good" ratings (45% for Expansion compared to 34% for Legacy).

Figure 6-13. Satisfaction with the Home Energy Report Program: Treatment Group Only
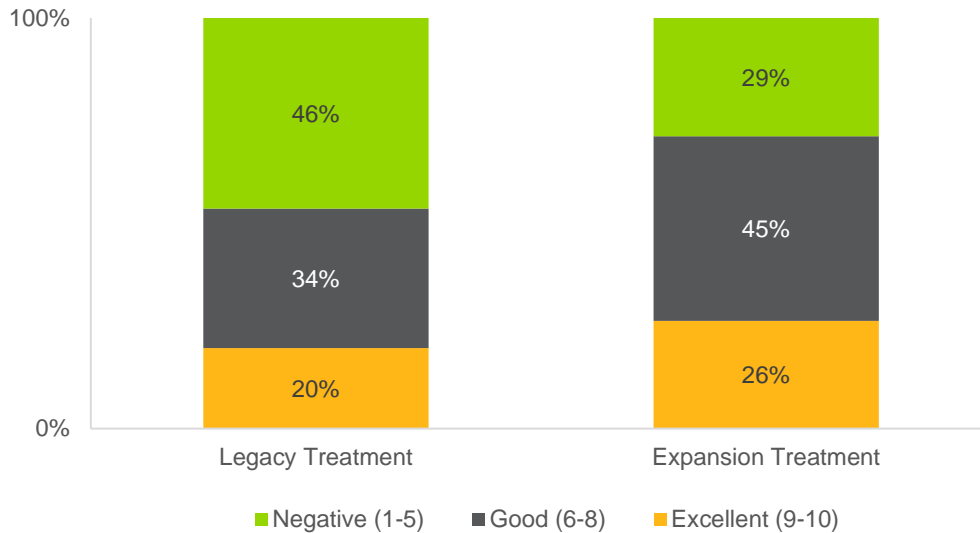
Legacy Treatment n=120; Expansion Treatment n=121
Note: The evaluation team recorded satisfaction ratings on a scale from 1 to 10.
Source: Navigant analysis of customer survey; H2

One explanation for this discrepancy is that the Legacy Wave consists of higher users compared to the Expansion Wave; therefore, this group likely receives less favorable feedback from the reports. Figure 6-14 provides detail on the explanations given by the respondents. Respondents in the Expansion Wave were more likely to indicate that the report is informative, clear, and detailed. Respondents in the Legacy Wave were more likely to indicate that the neighbor comparison is unfair, information in the reports is inaccurate, or that the report is unhelpful/has no impact.

Figure 6-14. Reasons for Program Satisfaction Rating: Treatment Only
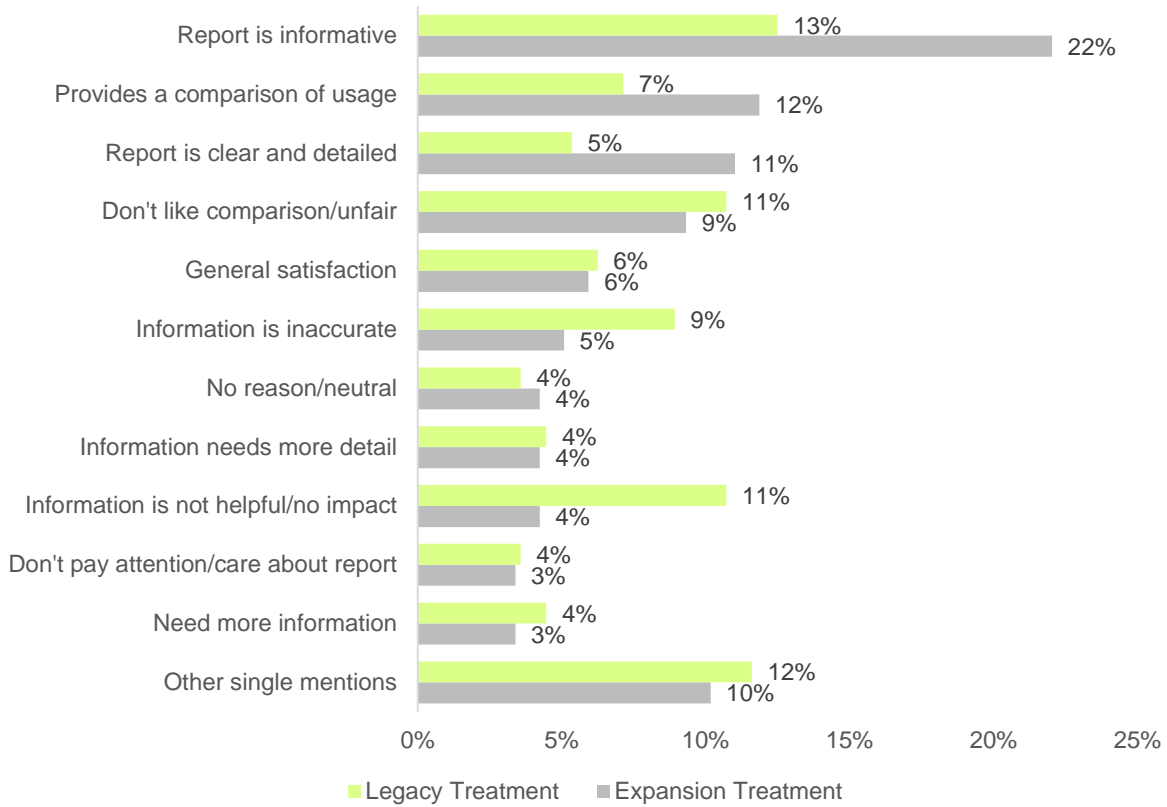
Reason	Legacy Treatment	Expansion Treatment
Report is informative	13%	22%
Provides a comparison of usage	7%	12%
Report is clear and detailed	5%	11%
Don't like comparison/unfair	11%	9%
General satisfaction	6%	6%
Information is inaccurate	9%	5%
No reason/neutral	4%	4%
Information needs more detail	4%	4%
Information is not helpful/no impact	11%	4%
Don't pay attention/care about report	4%	3%
Need more information	4%	3%
Other single mentions	12%	10%

Multiple responses accepted; figure includes reasons mentioned by at least 4% of respondents.
Legacy Treatment n=112; Expansion Treatment n=118
Source: Navigant analysis of customer survey; H2a

Concerning the accuracy of the home energy reports in terms of household energy usage, the majority of respondents in both waves consider the reports to be either extremely or moderately accurate. Respondents in the Legacy Wave, however, were significantly less likely to consider the reports accurate, as shown in Figure 6-15. Combining responses of extremely and moderately accurate, 61% of Legacy respondents consider the reports accurate compared to 74% of Expansion respondents. This difference was statistically significant at the 90% confidence level. Similar to findings related to satisfaction, it is likely that respondents in the Legacy Wave receive less favorable comparisons against their neighbors due to their higher energy use, and this negative feedback results in less willingness to trust that the reports are accurate.

Figure 6-15. Perceived Accuracy of Home's Energy Usage in Reports: Treatment Only
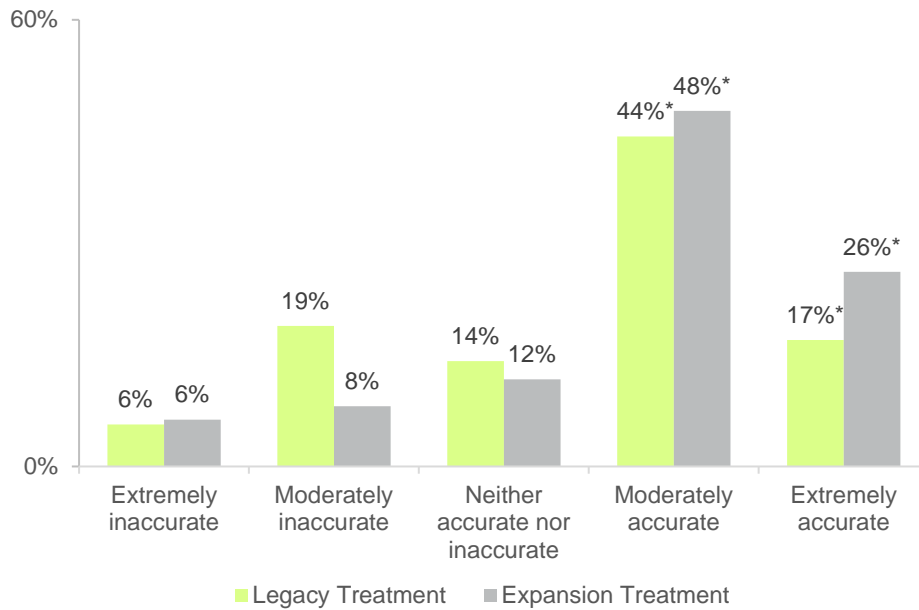
*Statistically significant difference between Legacy and Expansion Waves when extremely accurate and moderately accurate categories are combined.
Legacy Treatment n=120; Expansion Treatment n=121
Source: Navigant analysis of customer survey; H3

To determine which components of the reports are most useful to program treatment customers, the evaluation team asked respondents to identify both the most and least valuable components of the home energy reports. As shown in Figure 6-16, the Expansion respondents were more likely to consider the comparison to other homes the most valuable component of the report (45% of Expansion respondents versus 32% of Legacy respondents). Additionally, Legacy respondents were more likely to report that none of the report components were valuable (4% of Expansion respondents versus 16% of Legacy respondents). These differences were statistically significant at the 90% confidence level.

Figure 6-16. Most Valuable Component of the Home Energy Reports: Treatment Only
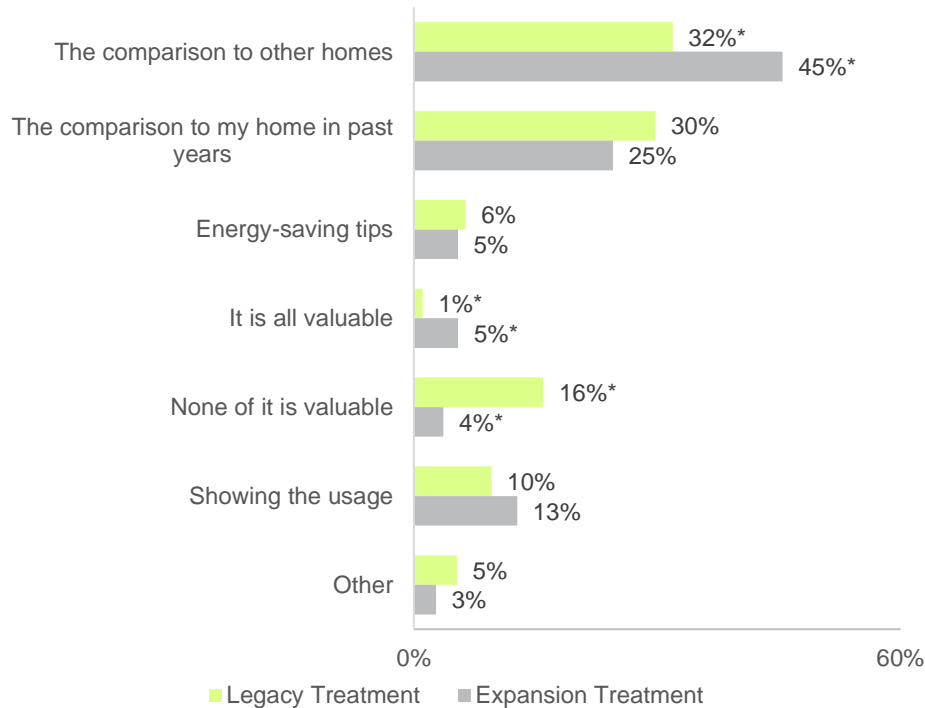
*Denotes a statistically significant difference between Legacy and Expansion Waves.
Multiple responses accepted; figure includes reasons mentioned by at least 4% of respondents.
Legacy Treatment n=94; Expansion Treatment n=110
Source: Navigant analysis of customer survey; H4

Similarly, Figure 6-17 shows that Legacy respondents were significantly more likely to consider the comparison to other homes as the least valuable component of the reports. These findings are informative when combined with the satisfaction findings presented earlier in the report. Legacy treatment customers, characterized as high energy users, consistently reported dissatisfaction with the neighbor comparisons where it is assumed that they receive negative feedback. Legacy Wave treatment group respondents said that the neighbor comparison was the least valuable report component 57% of the time, while Expansion Wave treatment group respondents mentioned it 39% of the time. This difference was statistically significant at the 90% confidence level. Additionally, the differences between the number of Legacy and Expansion Wave respondents who named the energy-saving tips or said it was all valuable were also statistically significant.

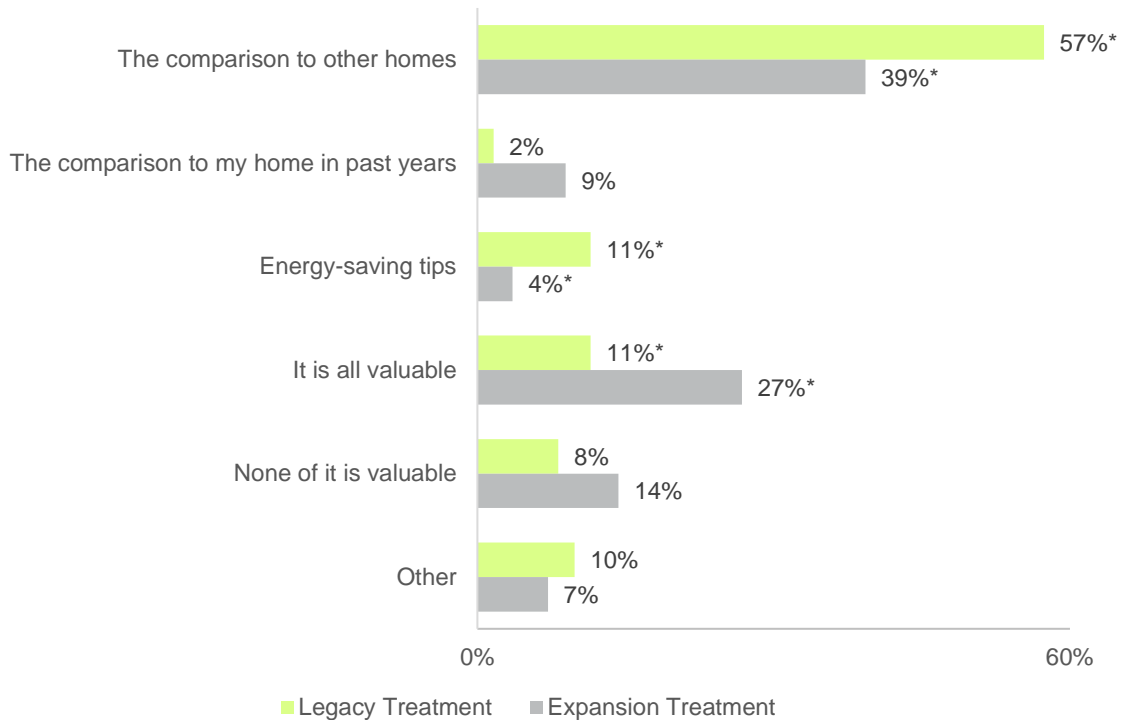**Figure 6-17. Least Valuable Component of the Home Energy Report: Treatment Only**

*Denotes a statistically significant difference between Legacy and Expansion Waves.
Multiple responses accepted; figure includes reasons mentioned by at least 10% of respondents.
Legacy Treatment n=61; Expansion Treatment n=63
Source: Navigant analysis of customer survey; H5

6.6 Other Program Awareness

The evaluation team asked respondents about their familiarity with Rocky Mountain Power's wattSmart brand, a branded umbrella title that encompasses all of the utility's residential and business energy efficiency programs.

Overall, respondents reported high levels of familiarity with the wattSmart brand, with nearly 75% of all respondents indicating that they were familiar. Respondents in the control group for both waves reported slightly higher levels of familiarity overall, with 82% (Legacy) and 80% (Expansion) of the control groups reporting familiarity compared to 73% (Legacy) and 76% (Expansion) of the treatment groups. None of these findings were statistically significant.

Approximately half of all respondents indicated that they have participated in at least one wattSmart program, as shown in Figure 6-18. The Legacy control group had the highest rate of program participation at 60%, while the Expansion treatment group had the lowest with only 48%. It is possible that the Legacy control group, being high energy users who do not receive monthly tips through the reports, more often seek out energy-saving programs on their own to reduce their energy consumption.

Figure 6-18. Respondent Familiarity with the wattSmart Brand
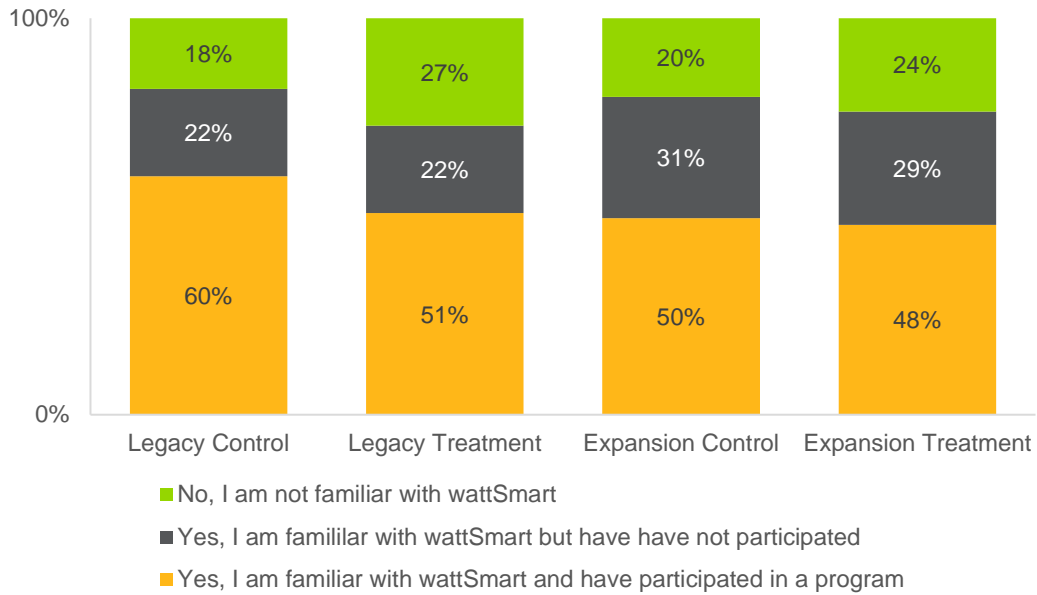
Legacy Control n=118; Legacy Treatment n=118; Expansion Control n=121; Expansion Treatment n=119
Source: Navigant analysis of customer survey; PA2

7. PROGRAM COST-EFFECTIVENESS

Navigant calibrated and updated the cost-effectiveness models based on evaluated net savings prior to uplift adjustment, as reported in Table 5-2. Navigant does not use savings after uplift adjustment because the adjustment reflects an issue of double-counting with other programs, rather than an issue of overstating program savings. That is, removing the savings associated with uplift would inaccurately penalizes the HER program by removing savings which are, at least partially, caused by the HER program which would make the HER program appear less effective than it is. As Table 7-1 indicates, the 2014 evaluation period the program is cost effective for four of the five standard cost tests, with the exception being the RIM test.

Table 7-1. HER Program 2014 Benefit-Cost Ratios

Benefit/Cost Test Performed	Levelized $/kWh	Costs	Benefits	Net Benefits	B/C Ratio
Total Resource Cost Test (PTRC) + Conversation Adder	$0.0350	$1,263,240	$3,070,305	$1,807,065	2.43
Total Resource Cost Test (TRC) No Adder	$0.0350	$1,263,240	$2,791,186	$1,527,946	2.21
Utility Cost Test (UCT)	$0.0350	$1,263,240	$2,791,186	$1,527,946	2.21
Rate Impact Test (RIM)		$5,447,713	$2,791,186	-$2,656,526	0.51
Participant Cost Test (PCT)		$0	$4,292,469	$4,292,469	-
Lifecycle Revenue Impacts ($/kWh)				$0.0001129440	
Discounted Participant Payback (years)					-

Source: Navigant analysis

As shown in Table 7-2 and Table 7-3 below, program costs for the 2015 evaluation period and for the 24-month outlook, are higher than those for 2014. While the analysis included the same methodology for each evaluation period, the exception is that the 2014 analysis used avoided costs from the 2013 IRP and the 2015 analysis used avoided costs from the 2015 Class 2 DSM Decrement Study[28]. The 2014 avoided costs were significantly higher for a one-year measure life ($0.067/kWh) than in 2015 ($0.049/kWh). However, even with the drop in avoided costs, the program remains cost-effective for all tests with the exception of the RIM test.

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[28] The 24 month outlook (2014-2015) cost-effectiveness testing is a summation of the PY2014 and PY2015 analyses and therefore utilized the cost-effectiveness inputs from each program year.

Table 7-2. HER Program 2015 Benefit-Cost Ratios

Benefit/Cost Test Performed	Levelized $/kWh	Costs	Benefits	Net Benefits	B/C Ratio
Total Resource Cost Test (PTRC) + Conversation Adder	$0.0482	$2,591,545	$3,325,190	$733,646	1.28
Total Resource Cost Test (TRC) No Adder	$0.0482	$2,591,545	$3,022,900	$431,356	1.17
Utility Cost Test (UCT)	$0.0482	$2,591,545	$3,022,900	$431,356	1.17
Rate Impact Test (RIM)		$8,938,343	$3,022,900	-$5,915,443	0.34
Participant Cost Test (PCT)		$0	$637,483	$637,483	-
Lifecycle Revenue Impacts ($/kWh)				$0.0002426105	
Discounted Participant Payback (years)				-	

Source: Navigant analysis

Table 7-3. HER Program 2014-2015 24-Month Benefit-Cost Ratios

Benefit/Cost Test Performed	Levelized $/kWh	Costs	Benefits	Net Benefits	B/C Ratio
Total Resource Cost Test (PTRC) + Conversation Adder	$0.0429	$3,854,785	$6,395,495	$2,540,711	1.66
Total Resource Cost Test (TRC) No Adder	$0.0429	$3,854,785	$5,814,087	$1,959,302	1.51
Utility Cost Test (UCT)	$0.0429	$3,854,785	$5,814,087	$1,959,302	1.51
Rate Impact Test (RIM)		$14,386,056	$5,814,087	-$8,571,969	0.40
Participant Cost Test (PCT)		$0	$4,929,952	$4,929,952	-
Lifecycle Revenue Impacts ($/kWh)				$0.0003515628	
Discounted Participant Payback (years)				-	

Source: Navigant analysis

8. KEY FINDINGS AND RECOMMENDATIONS

This section summarizes key findings and recommendations.

Impact Evaluation

Finding 1. Table 8-1 below shows the total evaluated energy savings in megawatt hours (MWh), after adjusting for uplift,[29] for each wave in each time period. For the Legacy Wave, savings remained relatively stable across the two years as this wave had been in place since 2012. Increases in Expansion Wave savings reflect the start of this wave in late 2014 and ramp-up into 2015.

Table 8-1. Total MWh Savings by Wave and Year*

Wave	2014	2015	2014-2015
Legacy	34,505	31,549	66,331
Expansion	3,509	24,836	28,859
Total	38,014	56,386	95,190

* Navigant estimated each time period (i.e. year 2014, year 2015, and 2014-2015 together) as a separate analysis; the savings totals for year 2014 and year 2015 do not sum to the savings over the total combined time period of 2014-2015 together.
Source: Navigant analysis

Finding 2. Table 8-2 below shows energy savings as a percentage of baseline consumption for each wave in each time period. Looking at savings since program inception in 2012, these savings indicate that the Legacy Wave appears to have leveled off, as is common for a mature program, at around 2.7% savings. Savings for the Legacy Wave from 2012 onwards are shown in Figure 5-2. The Expansion Wave demonstrates increasing savings over time as is frequently found with newer waves.

Table 8-2. Percentage Savings by Wave and Year*

Wave	2014	2015	2014-2015
Legacy	2.71%	2.70%	2.71%
Expansion	0.56%	1.37%	1.18%
Weighted Average	1.15%	1.73%	1.60%

* Navigant estimated each time period (i.e. year 2014, year 2015, and 2014-2015 together) as a separate analysis; the percentage savings for year 2014 and year 2015 do not average to the percentage savings over the total combined time period of 2014-2015 together.
Source: Navigant analysis

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[29] Uplift occurs when HER treatment customers participate in Rocky Mountain Power's other energy efficiency programs at a higher or lower rate than they would have in the absence of the HER program. Savings driven by uplift (positive or negative) must be subtracted from the HER savings to avoid double-counting and ensure accurate savings. Uplift is discussed in more detail in Section 2.3.

Recommendation 1. Future refill waves should target the highest usage customers not already in the program. Prior to adding future refill waves, the program should verify that the allocation of households across the treatment and control groups is consistent with a RCT.

Finding 3. Total double-counted savings were -151 MWh (or 0.16% of total savings) for the Appliance Recycling and Home Energy Savings (HES) programs across 2014 and 2015, which means that treatment customers were slightly less likely than control customers to participate in other Rocky Mountain Power energy efficiency programs[30], and thus, double-counting of energy savings does not appear to be a concern for this program at this time. Additionally, Navigant found no evidence of double-counting in the upstream energy efficient lighting portion of the HES program.

Cost-Effectiveness Evaluation

Finding 4. The program was cost-effective in 2014, 2015 and the combination of program years. Lower avoided costs in 2015 impacted the program's cost-effectiveness for the 2015 and the joint 2014-2015 evaluation period, however, the program passes all cost-effectiveness tests with the exception of the Ratepayer Impact test.

Process Evaluation

Finding 5. As shown in Table 8-3 below, survey respondents reported high levels of satisfaction with Rocky Mountain Power overall. Respondents in the Expansion Wave reported the highest levels of satisfaction.

Finding 6. Treatment respondents in the Legacy Wave reported lower satisfaction with the HER program (54%) compared to the Expansion Wave respondents (71%), as shown in Table 8-3 below. The Legacy treatment group had less confidence that the reports were accurate and cited neighbor comparisons as the least valuable component of the reports. Lower satisfaction ratings with the HER program appear to be correlated with higher energy use, with Legacy Wave respondents (selected for their high average usage) reporting lower overall satisfaction. This is a common finding for HER program evaluations. Control respondents do not receive reports from the HER program and were not asked this question.

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[30] The double counting results are discussed in more detail in Section 5.3.

Table 8-3. Summary of Satisfaction Findings

	Legacy Wave		Expansion Wave	
	Control	**Treatment**	**Control**	**Treatment**
Satisfaction with Rocky Mountain Power	81%	83%	91%	91%
Satisfaction with the HER program	-	54%	-	71%

† Percentages given above reflect percent satisfied (rating of 6 or higher on a scale from 1 to 10)
Source: Navigant analysis

APPENDIX A. SURVEY INSTRUMENT

PacifiCorp HER Participant and Non-Participant Telephone Survey Guide – Utah and Washington (Legacy and Expansion Waves) FINAL
December 15, 2015

Introduction I

May I speak with [CONTACT NAME]? (**IF NOT AVAILABLE, SAY:** May I speak with the person in your household who is most knowledgeable about your energy bill?) **[IF NO ONE AVAILABLE FROM HOUSEHOLD, SCHEDULE A CALL BACK.]**

Hello, I'm [YOUR NAME] of Dieringer Research, calling on behalf of [UTILITY NAME] about energy efficiency programs that [UTILITY NAME] offers its customers to save energy. I want to emphasize that this is not a sales call; [UTILITY NAME] would like to ask their customers some questions for research purposes only.

[IF AVAILABLE INDIVIDUAL IS NOT FROM THE HOUSEHOLD LISTED IN THE CONTACT LIST, THANK AND TERMINATE]

[UTILITY NAME] is interested in how to better design energy efficiency programs to save their customers money on their utility bills. They have found that one of the best sources of information is to survey customers like you. We are only gathering information and I will not sell you anything. We will keep your name and opinions confidential and the survey will only take 10 [to 15] minutes.

Your responses to our questions are strictly confidential. They will be averaged with those of other customers to evaluate the usefulness of [UTILITY NAME]'s energy efficiency programs. This call may be monitored for quality assurance purposes**.**

SA. Am I reaching you on a cell phone?

      1   Yes
      2   No

IF SA=1 PROCEED ELSE SKIP TO S1]

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

      1   Yes – Safe to talk
      2   No – Driving (schedule callback)

SCREENER

S1. We have your address listed as [INSERT ADDRESS HERE]. Could you please verify that this information is correct?

      1   Yes [CONTINUE]
      2   No [TERMINATE]
      98   Don't know [TERMINATE]

99   Refused [TERMINATE]

S2. Great, thanks. Are you the person in the household who reads the mail from [UTILITY NAME]? This might include the electric bill, letters about your account, and information about energy.

        1   Yes [CONTINUE]
        2   No
        98   Don't know
        99   Refused [TERMINATE]

[IF S2 = 2 or 98, CONTINUE, ELSE SKIP TO S3.]
S2A. *Can I speak to the person in your household that handles the mail your household receives from [UTILITY NAME]?"*

        1   Yes [RETURN TO INTRODUCTION]
        99   No/Refused [TERMINATE]

[ASK OF NON-PARTICIPANTS ONLY]
S3a. Do you recall receiving reports from [UTILITY NAME] in the mail that describe your home's electric energy use? They are different from your electric utility bill. They arrive in a different envelop, are printed on one piece of paper, include color charts and graphs about your electric energy use, and feature a neighbor comparison.

        1   Yes [CONTINUE]
        2   No [SKIP TO SCREENER BEFORE S4]
        98 Refused [SKIP TO SCREENER BEFORE S4]
        99 Don't know [SKIP TO SCREENER BEFORE S4]

S3b. Just to clarify, the reports you receive are from [UTILITY NAME]? And you receive them via the mail, not through a web portal?

        1   Yes [CONTINUE]
        2   No [RETURN TO S3a]
        98 Refused [CONTINUE]
        99 Don't know [CONTINUE]

S3c. How often do you receive these reports? [ASK OPEN ENDED]

        1   Monthly [TERMINATE]
        2   Quarterly [TERMINATE]
        3   Annually [TERMINATE]
        98 Refused [TERMINATE]
        99 Don't know [TERMINATE]

Just one more thing before we get started with the survey.
S4. Several of the questions I will ask concern the amount of energy efficient lighting in your home. We know from past experience that responses to these questions are most accurate when respondents are free to walk around their home looking at the lighting. Are you on a cordless phone? [NOTE TO SURVEYOR: IF THERE IS A QUESTION ABOUT THE LEGITIMACY OF THE SURVEY, THE PARTICIPANT MAY CALL Nikki Karpavich of [UTILITY NAME] at 801-220-4439.]

1   Yes [CONTINUE]
2   No [TERMINATE]
[IF S4 = 2, CONTINUE, ELSE SKIP TO L1.]

S5. Can we call you back on another number where you are free to move around the house?

1   Yes [SCHEDULE CALLBACK]
2   No [TERMINATE]

LIVE AUDIT

Thank you for confirming.
L1.   I want to start by asking you about the lights in the room that you're currently in.
What type of room is it? (DO NOT READ LIST.)

1   Kitchen
2   Dining Room
3   Living Room
4   Bedroom
5   Family Room
6   Bathroom
7   Basement
8   Garage
9   Other: _____
98   Don't know
99   Refused

L2a. Please look around at the lights in the room you are currently in. How many of the light bulbs in the room are compact fluorescent lights, which are often called CFLs? These are the bulbs with the spiral shape. I can wait if you need a minute to look around the room.

Number: ____
998   Don't know

999   Refused

L2b. In the same room that you are in, how many of the light bulbs are LED lights, which stands for light emitting diodes. These are often more expensive than other bulbs and generally look like a regular light bulb.

Number: ____
998   Don't know

999   Refused

L3. Now I want to ask about the total number of lights that are currently turned on in your home and the number of those that are CFLs and the number that are LEDs.

Let's begin with the **total** number of lights that are currently on. Beginning with the room you're currently in, please walk through your home and count the number of lights *of any type* that are *currently* turned on. Please don't turn off any of the lights that are currently on, because when you're done I'm going to ask you another question about the light bulbs that are currently on. If you need to put down the phone for this, I can wait. **[IF RESPONDENT ASKS ABOUT WHETHER TO COUNT LIGHTS THEY TURN ON TO HELP THEM GO THROUGH THE HOME, THE ANSWER IS NO –ONLY COUNT LIGHTS THAT ARE ALREADY ON. IF THE RESPONDENT ASKS ABOUT MULTIPLE BULBS CONNECTED TO THE SAME LIGHT SWITCH (I.E., ONE SWITCH TURNS ON THREE BULBS), COUNT EACH BULB SEPARATELY. HOLIDAY LIGHTS, WHICH ARE OFTEN LEDS, SHOULD NOT BE COUNTED]**

      Number: _____
          998   Don't know

          999   Refused

L4. Next, please count the number of **CFLs and LEDs** currently turned on in your home. Please don't include any lights you turned on as part of your walkthrough and keep a separate count for each bulb type.

          L4a. Number of CFLs on: _____
          998   Don't know
          999   Refused

          L4b. Number of LEDs on: _____
          998   Don't know
          999   Refused

Now, I'd like to ask you about a few other household appliances.

L5. Please go to your home's thermostat. If you have more than one, go to the one that controls the temperature for the space in your home that is most frequently occupied. Is this thermostat: (READ LIST.) (READ DESCRIPTIONS AS NECESSARY)
A manual thermostat (with a dial or lever that allows you to adjust the temperature; but does <u>not</u> have a digital display)?
A digital thermostat (with a digital display that allows you to adjust the temperature by pressing buttons)?
A smart/Wi-Fi programmable thermostat (with a digital display that allows for remote control of your thermostat)? Examples include the Google Nest and the Honeywell Lyric.

          1   A manual thermostat
          2   A digital thermostat
          3   A smart/Wi-Fi programmable thermostat
          98   Don't know (DO NOT READ)
          99   Refused (DO NOT READ)

[ASK IF L5=2 or 3]

L5a. Have the programming options been set to automatically adjust throughout the day or week?

  1 Yes
  2 No
  3 [L5=2 ONLY] My thermostat does not have programming options
  98 Don't know
  99 Refused

L6. Please look at your thermostat. To what temperature is it currently set?
[READ AS NECESSARY FOR DIGITAL THERMOSTATS] The temperature setting should have the words "set to" or "temperature set" above the number
[READ AS NECESSARY FOR MANUAL THERMOSTATS] The temperature setting should be shown alongside the lever that you use to adjust the temperature.

  Set temperature: _____
  997 Thermostat is turned off
  998 Don't know
  999 Refused

L7. What is the thermostat reading for the actual temperature of your home right now? This may be the same as the temperature your thermostat is set to, but may be different if your home has not yet reached the set temperature or your thermostat is turned off.

[READ AS NECESSARY FOR DIGITAL THERMOSTATS] The actual temperature may have the words "indoor" or "inside" above the number, and the numbers may be larger in size than the "set to" temperature.

[READ AS NECESSARY FOR MANUAL THERMOSTATS] The actual temperature should be shown with an indicator alongside a scale of numbers; this indicator cannot be moved by using the lever.

  Actual temperature: _____
  998 Don't know
  999 Refused

EFFICIENT LIGHTING AWARENESS AND PURCHASES

LP1. In the past 12 months, do you recall seeing information from [UTILITY NAME] that encourages you to replace traditional incandescent light bulbs with CFLs and LEDs to save energy?

  1 Yes
  2 No
  98 Don't know
  99 Refused

LP2. To the best of your recollection, has your household purchased CFL bulbs in the past 12 months?

  1 Yes

2   No
98   Don't know
99   Refused

[IF LP2=1, CONTINUE. ELSE SKIP TO LP3.]
LP2a. About how many CFLs has your household purchased in the last 12 months?
        Number of CFLs purchased in past year: _____

        998   Don't know
        999   Refused

LP3. Has your household purchased LEDs in the past 12 months?

        1   Yes
        2   No
        98   Don't know
        99   Refused

[IF LP3=1, CONTINUE. ELSE SKIP TO EA1.]
LP3a. About how many LEDs has your household purchased in the past 12 months?
        Number of LEDs purchased in past year: _____

        998   Don't know
        999   Refused

ENERGY AWARENESS

EA1. Are you familiar with the ENERGY STAR label for appliances, such as televisions, dishwashers, and clothes washers and dryers that meet national energy efficiency standards?

        1   Yes
        2   No
        98   Don't know
        99   Refused

EA2/3. Please tell me how much you agree or disagree with these statements on a scale from 1 to 10, where 1 means you strongly disagree and 10 means you strongly agree. (*Note – numbering reflects an earlier version of the survey instrument*)

        [RANDOMIZE ORDER, SHOW SCALE WITH END LABELS, 98 Refused, 99 Don't know]
EA2e.   I understand how actions taken by me and others in my household result in
                higher or lower energy use.
EA2f.   It would make me proud to have one of the most energy efficient houses in my
                neighborhood.
EA3a.   I pay closer attention to my energy costs now than I did 2 years ago before
                receiving Home Energy Reports. [ASK ONLY OF PARTICIPANTS]

ER3c.   I know about other things I could be doing to save energy, beyond what I'm already doing.

EA3d.   Improving my home's energy efficiency is a worthwhile investment.

EA3e.   My energy bill is noticeably lower when I make an extra effort to conserve.

EA4. How would you rate your level of satisfaction with your home's electric energy consumption on a scale from 1 to 10, where 1 means you are extremely dissatisfied and 10 means you are extremely satisfied?

[SHOW SCALE WITH END LABELS, 98 Refused, 99 Don't know]

EA4a. Why did you give that rating? (OPEN-ENDED)

EA5a. Have you made any energy efficient purchases or upgrades to your home in the past 12 months? (DO NOT READ LIST.)

    1   Yes
    2   No
    98   Don't know
    99   Refused

[IF EA5A=1, CONTINUE. ELSE SKIP TO EA6.]

EA5b. What purchases or upgrades have you made? (DO NOT READ LIST. ENTER ALL THAT APPLY.)

    1   Air conditioner (i.e., window unit, central air, room air conditioner, ductless air conditioner)
    2   Clothes dryer
    3   Clothes washer
    4   Dehumidifier
    5   Dishwasher
    6   Electronics (i.e., television, laptop, desktop computer, home office equipment)
    7   Furnace fan
    8   Other fans (i.e., whole-house fan, attic fan, solar attic fan, box fans, ceiling fans)
    9   Heat pump (for heating or cooling home; i.e., a "regular" heat pump, geothermal heat pump, or ductless heat pump)
    10   Insulation
    11   CFLs/compact fluorescent bulbs
    12   LED light bulbs
    13   Other lights (outdoor solar lights, dimming lights, motion sensors, occupancy sensors)
    14   Pool equipment (i.e., heater, pool pump, variable speed pool pump)
    15   Refrigerator
    16   Freezer
    17   Programmable thermostat
    18   Water heater (i.e., "regular" water heater, solar water heater, geothermal water heater, drain water heat recovery system, heat pump water heater, tankless water heater)
    19   Windows (i.e., double pane, storm windows, strategically placed new windows)
    20   Other [SPECIFY]
    98   Don't know
    99   Refused

EA6a. In the past 12 months, have you taken any action to reduce or minimize your electric, gas, or water consumption? (DO NOT READ LIST.)

1   Yes
2   No
98   Don't know
99   Refused

[IF EA6A=1, CONTINUE. ELSE SKIP TO EA7.]
EA6B. What actions or behavior changes have you made? (DO NOT READ LIST. ENTER ALL THAT APPLY.)

1   Line-dry clothes
2   Run the clothes dryer with a full load
3   Run the clothes washer with a full load
4   Wash laundry in cold water

5   Air dry dishes
6   Run dishwasher with a full load

7   Adjust settings to energy efficient settings
8   Use power save modes on computers
9   Shut down computer at night
10   Plug electronics into smart strip
11   Unplug chargers when not in use
12   Unplug electronics when not in use
13   Play video games for fewer hours per day
14   Use computer for fewer hours per day
15   Use electronics [unspecified type] for fewer hours per day
16   Watch TV for fewer hours per day

17   Change AC filter
18   Change furnace filter
19   Clean refrigerator coils
20   Clear areas around heating and cooling vents
21   Keep ac unit clear of debris
22   Maintain equipment to run efficiently
23   Insulate water heater and/or pipes (i.e., install a water heater blanket, insulate water pipes)
24   Seal leaks and drafts (i.e., leaky doors, windows, refrigerator seals, fireplaces, air ducts, air conditioner units, outlets and light switches)
25   Set heating to lower temperature, set air conditioner to higher temperature
26   Take shorter showers
27   Turn off lights when not in use
28   Use less air conditioning
29   Use window shades (i.e., to let heat from sun in on cold days, and/or keep heat from sun out on warm days)

30   Decrease water heater thermostat
31   Program thermostat (i.e., program to reduce heating and/or cooling when away from home or asleep)

32   Other [SPECIFY]
98   Don't know

99   Refused

EA7. Next, I'd like to shift gears and ask you if you own a business? (DO NOT READ LIST.)

1   Yes
2   No
98   Don't know
99   Refused

[IF EA7=1, CONTINUE. ELSE SKIP TO SAT1.]
EA8a. Have you made any energy efficient purchases for your business in the past 12 months? (DO NOT READ LIST.)

1   Yes
2   No
98   Don't know
99   Refused

[IF EA8A=1, CONTINUE. ELSE SKIP TO SAT1.]
EA8b. What purchases or upgrades have you made? (DO NOT READ LIST. ENTER ALL THAT APPLY.)

1   Air to air heat exchanger
2   Boiler
3   Boiler controls
4   Boiler tune-up
5   Ceiling insulation
6   CFL/LED bulbs
7   Chiller
8   Door gaskets on walk-in coolers and freezers
9   Double pane windows
10   ECM motor
11   Energy management system
12   ENERGY STAR freezers
13   ENERGY STAR refrigerators
14   Furnace tune-up
15   Gas furnace
16   Hot water boiler pipe wrap
17   Hot water boilers
18   Hot water heater tune-up
19   Hot water heating system
20   HVAC controls
21   Infrared heater
22   LED exit signs
23   LED refrigerated case lighting
24   Lighting controls
25   Occupancy sensors
26   Roof insulation
27   Steam boiler pipe wrap
28   Strip curtains on walk-in cooler and freezer doors
29   Variable frequency drives

30   Wall insulation
31   Other [SPECIFY]
98   Don't know
99   Refused

[ASK IF EA8a = 1 AND IF PARTICIPANT TYPE = 1]
EA9. On a scale from 1-10, where 1 is not at all influential and 10 is extremely influential, how influential was information received through your home energy reports on your decision to make these upgrades?
[SHOW SCALE WITH END LABELS, 98 Refused, 99 Don't know]

SATISFACTION

SAT1. On a scale from 1-10, where 1 is extremely dissatisfied and 10 is extremely satisfied, how would you rate your overall satisfaction with [UTILITY NAME]?

[SHOW SCALE WITH END LABELS, 98 Refused, 99 Don't know]

SAT1a. Why did you give that rating? [OPEN-ENDED]

HOME ENERGY REPORTS [PARTICIPANTS ONLY]

H1. On average, how long do you or members of your household spend reading the Home Energy Report? Would you say…

1   Less than 2 minutes
2   2-5 minutes
3   6-10 minutes
4   11-15 minutes
5   More than 15 minutes
6   I don't read the reports
7   Other [SPECIFY]
98   Don't know
99   Refused

H2. On a scale of 1 to 10, with 1 being extremely dissatisfied and 10 being extremely satisfied, how would you rate your satisfaction with the home energy reports? You may use any number from 1 to 10.

[SHOW SCALE WITH END LABELS, 98 Refused, 99 Don't know]

H2a. Why did you give that rating? [OPEN-ENDED]

H3. How accurate do you think the home energy reports are in terms of your home's energy usage? Would you say they are… (READ LIST.)

1   Extremely accurate
2   Moderately accurate
3   Neither accurate nor inaccurate

    4   Moderately inaccurate
    5   Extremely inaccurate
    98   Don't know
    99   Refused

H4. What do you consider to be the MOST valuable piece of information in the home energy reports?

        1   The comparison of my home's energy use to other homes
        2   The comparison of my home's energy use to my home in previous years
        3   The energy saving tips
        4   It's all valuable
        5   None of it is valuable
        6   Other [SPECIFY] (DO NOT READ)
        98   Don't know (DO NOT READ)
        99   Refused (DO NOT READ)

H5. What do you consider to be the LEAST valuable piece of information in the home energy reports?

[PROGRAM TO REMOVE THE OPTION SELECTED IN H4]

        1   The comparison of my home's energy use to other homes
        2   The comparison of my home's energy use to my home in previous years
        3   The energy saving tips
        4   It's all valuable
        5   None of it is valuable
        6   Other [SPECIFY] (DO NOT READ)
        98   Don't know (DO NOT READ)
        99   Refused (DO NOT READ)

OTHER PROGRAM AWARENESS

PA1. Are you familiar with the wattsmart brand? (READ IF NECESSARY) This is a campaign and outreach effort by [UTILITY NAME] to promote energy efficiency and conservation and to educate customers on saving money on their utility bills.

        1   Yes
        2   No
        98   Don't know
        99   Refused

[IF ROCKY MOUNTAIN POWER CUSTOMERS, CONTINUE. ELSE SKIP TO PA4.]

PA2. Have you ever heard of or participated in the watts*Smart* energy efficient program offered by Rocky Mountain Power? Rocky Mountain Power offers financial incentives for energy efficient measures for residential and business customers.

1   Yes, I am familiar with watt*Smart* and have participated in a program
2   Yes, I am familiar with watt*Smart* but have not participated in a program
3   No, I am not familiar with watt*Smart*
98   Refused
99   Don't know

[IF PACIFIC POWER CUSTOMERS, CONTINUE. ELSE SKIP TO D1.]

PA4. Have you ever heard of or participated in the following energy efficient programs offered by Pacific Power? **[PROGRAM AS SEPARATE SCREENS FOR EACH PROGRAM, 1-Yes, Heard of; 2-Yes, Participated in; 3-No; 98-Don't know; 99-Refused]**

a. **Home Energy Savings Program:** offers cash incentives for home insulation, energy efficient electrical appliances, lighting and more..
b. **Low Income Weatherization Program:** provides free weatherization services to income-qualifying customers.
c. **wattsmart Business Program:** provides financial incentives for businesses.

DEMOGRAPHICS

Just a few more questions and we will be done.

D1. What is the total square footage of your home's living space, finished and unfinished? Your best estimate will be fine.

_____ Square feet
99998   Don't know
99999   Refused

D2.   In what year were you born?
         [RECORD NUMBER 1900–1996]
         Refused

         1   {SET IF D3=1995–1996} 18–19
         2   {SET IF D3=1990–1994} 20–24
         3   {SET IF D3=1980–1989} 25–34
         4   {SET IF D3=1970–1979} 35–44
         5   {SET IF D3=1960–1969} 45–54
         6   {SET IF D3=1950–1959} 55–64
         7   {SET IF D3=1900–1949} 65+
         8   {SET IF D3=Don't know, Refused} Don't know/Refused

D3. What is the last grade of school you completed?

1   Grade school or less (1-8)
2   Some high school (9-11)
3   Graduated high school (12)
4   Vocational/technical school
5   Some college (1-3 years)
6   Graduated college (4 years)
7   Post graduate education
98   Don't know
  99 Refused
  100

D4. Approximately how many people live in your household full time (at least 9 months of the year)?

Number: ____

98   Don't know
99   Refused

D5. What was your approximate annual household income in 2015 before taxes? Please stop me when I say the answer that best reflects your approximate household income.
1   Less than $15,000
2        $15,000-$29,999
3        $30,000-$49,999
4        $50,000-$74,999
5        $75,000-$99,999
6        $100,000 and over
98   Don't know
99   Refused

D6. [RECORD RESPONDENT GENDER – DO NOT READ]
1   Man
2   Woman

Those are all of the questions I have for you today. Thank you very much for your time.

APPENDIX B. REGRESSION COEFFICIENT ESTIMATES

Table B-1. PPR Parameter Estimates, Legacy Wave

Variable	2014		2015		2014-2015	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
treatment	-1.153	-18.200	-1.124	-16.200	-1.144	-18.310
yrmo201401	6.137	28.900	-	-	6.127	28.820
yrmo201402	6.621	33.900	-	-	6.612	33.820
yrmo201403	7.358	39.100	-	-	7.349	39.060
yrmo201404	6.190	32.700	-	-	6.188	32.740
yrmo201405	7.773	45.600	-	-	7.767	45.580
yrmo201406	7.879	53.800	-	-	7.869	53.870
yrmo201407	7.605	43.600	-	-	7.593	43.530
yrmo201408	10.379	57.100	-	-	10.368	57.080
yrmo201409	9.387	62.300	-	-	9.373	62.320
yrmo201410	7.531	44.700	-	-	7.519	44.750
yrmo201411	9.023	45.100	-	-	9.015	45.170
yrmo201412	10.640	54.500	-	-	10.629	54.430
yrmo201501	-	-	8.040	36.300	8.075	36.740
yrmo201502	-	-	8.835	42.500	8.894	43.750
yrmo201503	-	-	8.646	42.900	8.576	40.770
yrmo201504	-	-	8.010	41.200	8.025	41.290
yrmo201505	-	-	8.122	46.200	8.137	45.630
yrmo201506	-	-	7.330	42.600	7.081	40.230
yrmo201507	-	-	15.000	76.700	14.984	77.190
yrmo201508	-	-	8.728	50.700	8.694	49.060
yrmo201509	-	-	9.090	55.200	9.067	55.550
yrmo201510	-	-	7.539	42.800	7.201	40.280
yrmo201511	-	-	9.619	47.100	9.619	47.270
yrmo201512	-	-	8.933	39.500	8.577	37.020
yrmo201401:pre.kwh	0.865	196.000	-	-	0.865	196.000
yrmo201402:pre.kwh	0.812	182.700	-	-	0.812	182.670
yrmo201403:pre.kwh	0.724	158.600	-	-	0.724	158.550
yrmo201404:pre.kwh	0.787	149.300	-	-	0.786	149.300
yrmo201405:pre.kwh	0.709	148.700	-	-	0.709	148.700
yrmo201406:pre.kwh	0.754	221.800	-	-	0.754	221.820
yrmo201407:pre.kwh	0.876	259.400	-	-	0.876	259.490
yrmo201408:pre.kwh	0.763	245.600	-	-	0.763	245.640
yrmo201409:pre.kwh	0.646	228.200	-	-	0.647	228.290
yrmo201410:pre.kwh	0.713	168.800	-	-	0.713	168.890
yrmo201411:pre.kwh	0.650	122.800	-	-	0.650	122.770

Variable	2014		2015		2014-2015	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
yrmo201412:pre.kwh	0.636	148.500	-	-	0.636	148.540
yrmo201501:pre.kwh	-	-	0.757	165.500	0.757	165.890
yrmo201502:pre.kwh	-	-	0.657	139.800	0.656	141.680
yrmo201503:pre.kwh	-	-	0.654	134.300	0.653	127.630
yrmo201504:pre.kwh	-	-	0.664	123.800	0.664	123.000
yrmo201505:pre.kwh	-	-	0.659	134.700	0.659	131.250
yrmo201506:pre.kwh	-	-	0.739	181.100	0.747	175.520
yrmo201507:pre.kwh	-	-	0.812	217.900	0.813	217.970
yrmo201508:pre.kwh	-	-	0.705	244.300	0.704	233.440
yrmo201509:pre.kwh	-	-	0.727	238.400	0.727	238.350
yrmo201510:pre.kwh	-	-	0.724	164.800	0.729	162.390
yrmo201511:pre.kwh	-	-	0.625	115.400	0.625	115.170
yrmo201512:pre.kwh	-	-	0.701	142.500	0.711	138.930

Note: t-statistics greater than 1.645 in absolute value indicate results are statistically significant at the 90% confidence level.
Source: Navigant analysis

Table B-2. LFER Parameter Estimates, Legacy Wave

Variable	2014		2015		2014-2015	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Post	-3.403	-61.250	-4.524	-73.420	-3.888	-70.870
Post * Treatment	-1.108	-17.360	-1.067	-15.090	-1.098	-17.440

Note: t-statistics greater than 1.645 in absolute value indicate results are statistically significant at the 90% confidence level.
Source: Navigant analysis

Table B-3. PPR Parameter Estimates, Expansion Wave

Variable	2014		2015		2014-2015	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
treatment	-0.134	-4.985	-0.350	-14.200	-0.297	-13.000
yrmo201409	5.042	74.371	-	-	5.174	77.300
yrmo201410	4.873	59.531	-	-	5.005	61.700
yrmo201411	5.353	57.112	-	-	5.483	58.900
yrmo201412	6.792	74.566	-	-	6.911	75.800
yrmo201501	-	-	6.797	71.530	6.764	71.700
yrmo201502	-	-	5.858	62.230	5.822	62.100
yrmo201503	-	-	5.116	48.980	5.044	50.500
yrmo201504	-	-	5.253	56.070	5.210	55.800
yrmo201505	-	-	4.678	52.440	4.635	52.100
yrmo201506	-	-	4.165	54.230	4.123	53.900
yrmo201507	-	-	9.309	123.220	9.260	123.600
yrmo201508	-	-	5.986	85.220	5.943	85.100
yrmo201509	-	-	5.324	67.600	5.281	67.300

Variable	2014		2015		2014-2015	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
yrmo201510	-	-	6.184	63.720	6.141	63.500
yrmo201511	-	-	6.608	61.690	6.565	61.400
yrmo201512	-	-	6.640	61.050	6.597	60.800
yrmo201409:pre.kwh	0.708	331.824	-	-	0.708	331.800
yrmo201410:pre.kwh	0.819	211.758	-	-	0.819	211.700
yrmo201411:pre.kwh	0.728	160.794	-	-	0.728	160.800
yrmo201412:pre.kwh	0.669	181.006	-	-	0.670	179.700
yrmo201501:pre.kwh	-	-	0.709	199.660	0.709	200.300
yrmo201502:pre.kwh	-	-	0.677	172.910	0.677	173.000
yrmo201503:pre.kwh	-	-	0.741	153.100	0.743	159.700
yrmo201504:pre.kwh	-	-	0.693	149.740	0.693	149.800
yrmo201505:pre.kwh	-	-	0.745	161.980	0.745	162.000
yrmo201506:pre.kwh	-	-	0.815	251.070	0.815	251.100
yrmo201507:pre.kwh	-	-	0.830	366.130	0.830	367.600
yrmo201508:pre.kwh	-	-	0.740	377.180	0.740	377.200
yrmo201509:pre.kwh	-	-	0.803	319.090	0.803	319.100
yrmo201510:pre.kwh	-	-	0.778	167.780	0.778	167.800
yrmo201511:pre.kwh	-	-	0.675	129.530	0.675	129.500
yrmo201512:pre.kwh	-	-	0.718	161.920	0.718	161.900

Note: t-statistics greater than 1.645 in absolute value indicate results are statistically significant at the 90% confidence level.
Source: Navigant analysis

Table B-4. LFER Parameter Estimates, Expansion Wave

Variable	2014		2015		2014-2015	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Post	-1.242	-47.824	-0.684	-30.410	-1.066	-53.100
Post * Treatment	-0.133	-4.595	-0.363	-14.530	-0.302	-13.540

Note: t-statistics greater than 1.645 in absolute value indicate results are statistically significant at the 90% confidence level.
Source: Navigant analysis

APPENDIX C. DETAILED UPLIFT TABLES

Table C-1. Estimated Double-Counted Savings from Uplift in Other Energy Efficiency Programs, Legacy Wave: 2014-2015

|	Program	
	Appliance Recycling	**HES**
Median Program Savings (Annual kWh per Treatment Customer)	1230	199
No. of HER Treatment Households	94,004	94,004
Annualized Rate of Participation (%)	0.98%	2.21%
Change in Annualized Rate of Participation from Pre-Program Year (%)	0.08%	-8.69%
No. of HER Control Households	29,830	29,830
Annualized Rate of Participation	0.90%	2.21%
Change in Annualized Rate of Participation from Pre-Program Year (%)	0.08%	-8.58%
DID Statistic for 24 Months	-0.21%	-0.22%
Annualized DID Statistic	-0.11%	-0.11%
Change in Program Participation due to HER Program	-197	-211
Statistically Significant at the 90% Confidence Level?	Yes	No
Double-Counted Savings (kWh)	-242,812	-41,993
Percentage Change in Energy Efficiency Program Participation Rate for HER Treatment Customers	0%	-5%

Note: Median program savings are equal to the median kWh impact for HER treatment customers during the post-program period.
Source: Navigant analysis

Table C-2. Estimated Double-Counted Savings from Uplift in Other Energy Efficiency Programs, Expansion Wave: Sept. 2014-2015

	Program	
	Appliance Recycling	HES
Median Program Savings (Annual kWh per Treatment Customer)	1230	170
No. of HER Treatment Households	216,772	216,772
Annualized Rate of Participation (%)	1.00%	5.80%
Change in Annualized Rate of Participation from Pre-Program Year (%)	0.89%	-0.78%
No. of HER Control Households	51,712	51,712
Annualized Rate of Participation (%)	0.98%	5.61%
Change in Annualized Rate of Participation from Pre-Program Year (%)	0.87%	-0.93%
DID Statistic for 24 Months	0.03%	0.14%
Annualized DID Statistic	0.02%	0.07%
Change in Program Participation due to HER Program	68	298
Statistically Significant at the 90% Confidence Level?	No	Yes
Double-Counted Savings (kWh)	83,550	50,708
Percentage Change in Energy Efficiency Program Participation Rate for HER Treatment Customers	3%	3%

Note: Median program savings are equal to the median kWh impact for HER treatment customers during the post-program period.
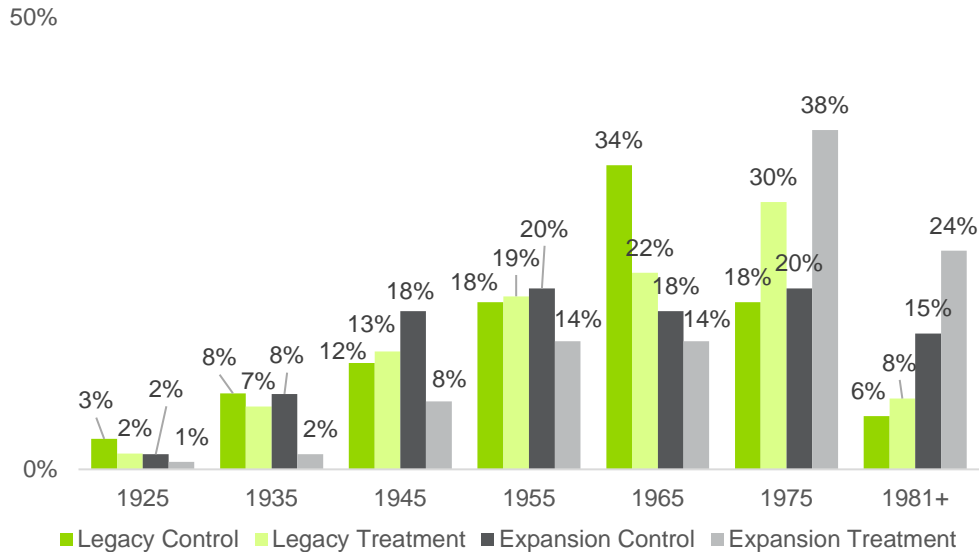*Source: Navigant analysis*

APPENDIX D. DEMOGRAPHICS

The following graphics represent self-reported demographic characteristics of survey respondents.

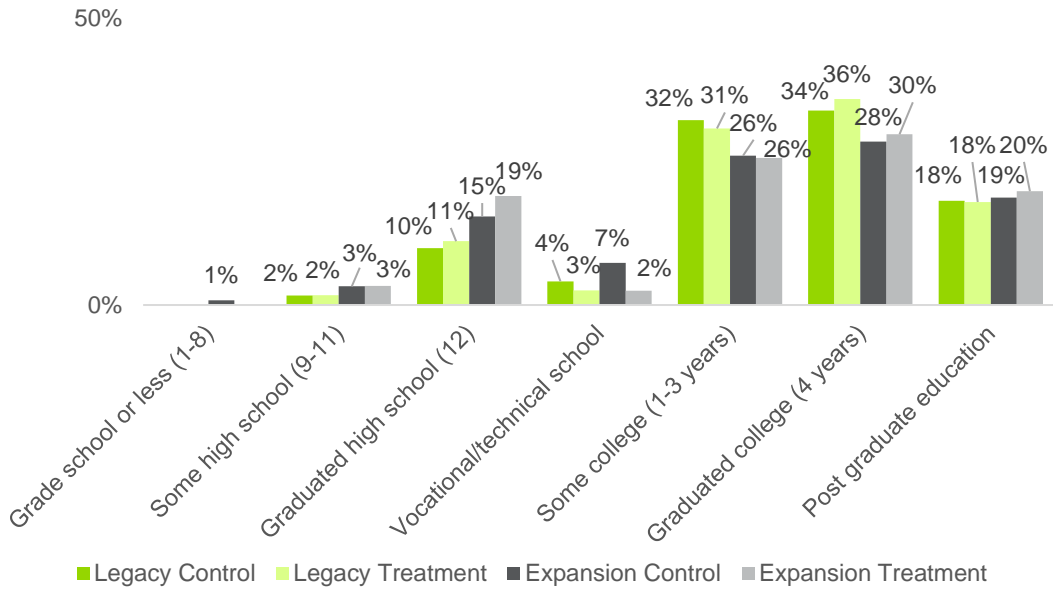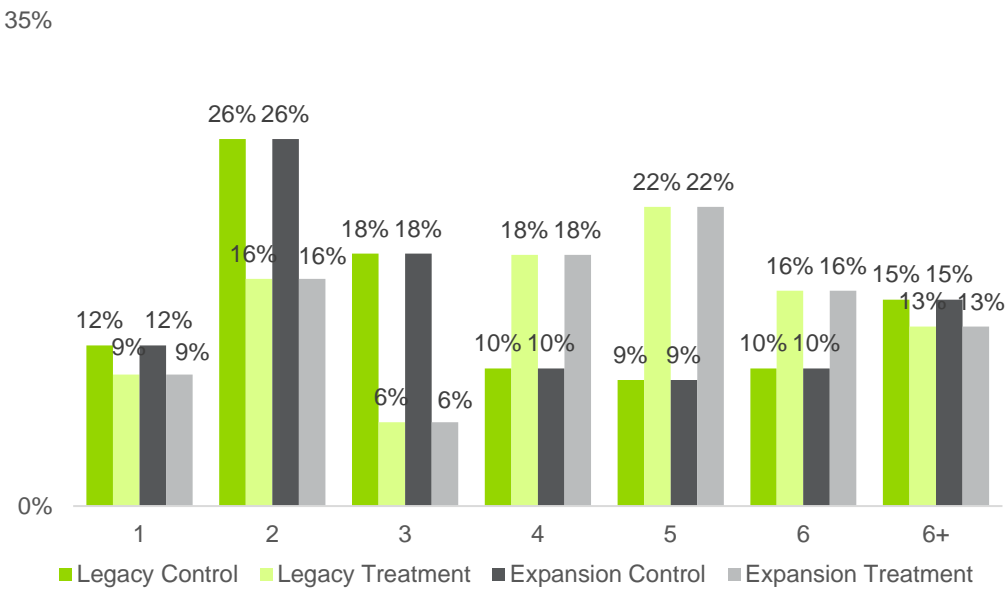**Figure D-1. Household Square Footage**
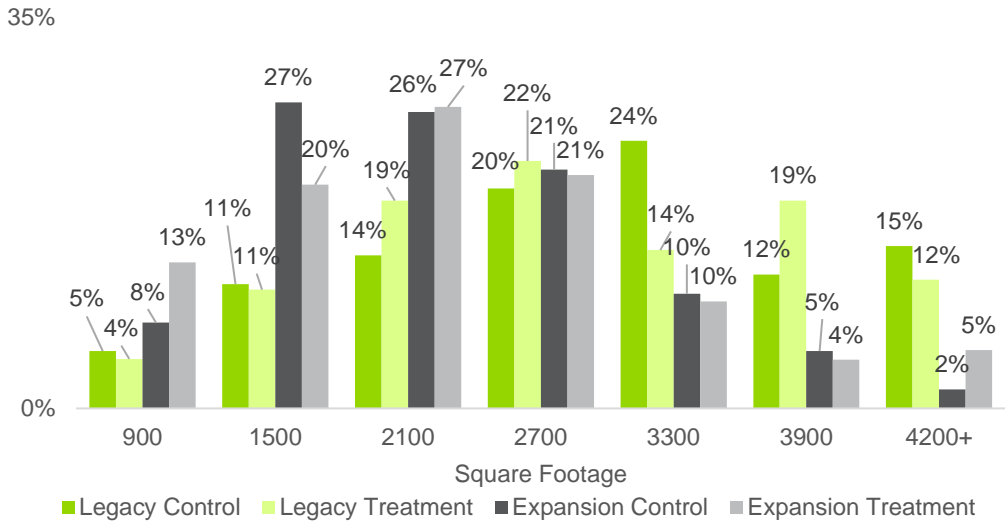
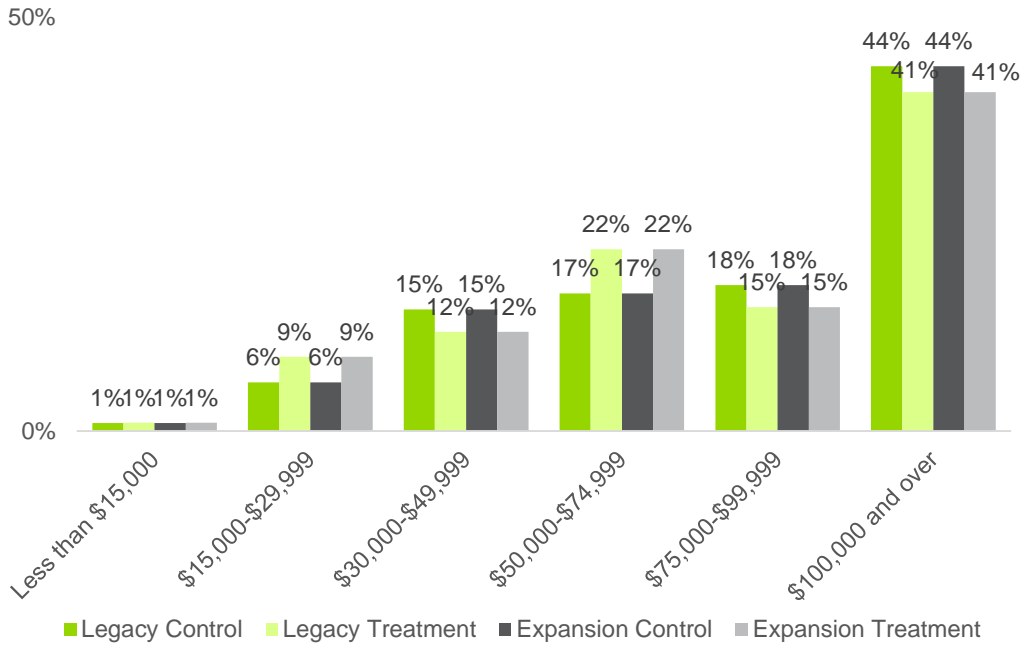
Legacy Control n=118; Legacy Treatment n=118; Expansion Control n=121; Expansion Treatment n=119
Source: Navigant analysis of customer survey; D1

Figure D-2. Birth Year

Legacy Control n=118; Legacy Treatment n=118; Expansion Control n=121; Expansion Treatment n=119
Source: Navigant analysis of customer survey; D2

Figure D-3. Educational Background

Legacy Control n=118; Legacy Treatment n=118; Expansion Control n=121; Expansion Treatment n=119
Source: Navigant analysis of customer survey; D3
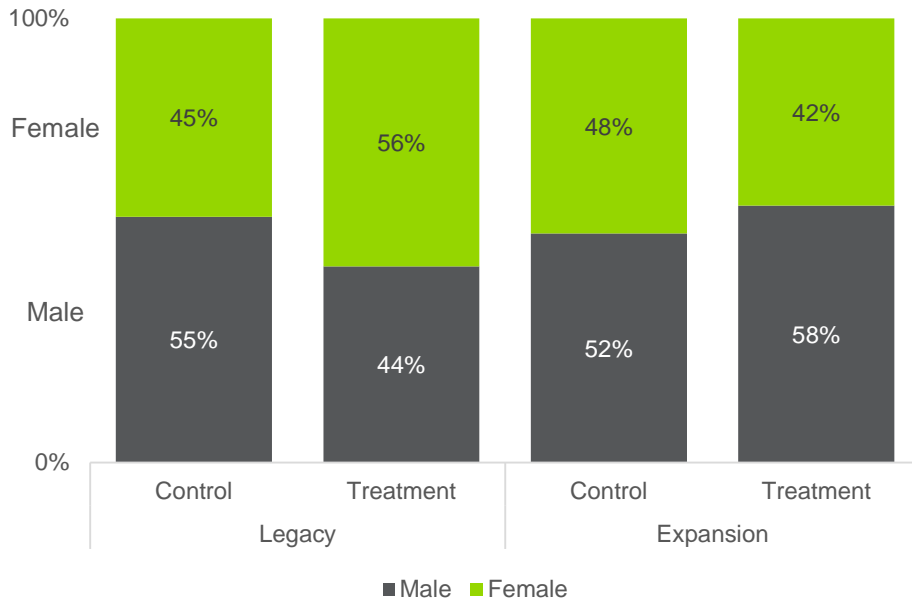
Figure D-4. Number of People in Household

Legacy Control n=118; Legacy Treatment n=118; Expansion Control n=121; Expansion Treatment n=119
Source: Navigant analysis of customer survey; D4

Figure D-5. Household Income

Legacy Control n=118; Legacy Treatment n=118; Expansion Control n=121; Expansion Treatment n=119
Source: Navigant analysis of customer survey; D5

Figure D-6. Gender

Legacy Control n=118; Legacy Treatment n=118; Expansion Control n=121; Expansion Treatment n=119
Source: Navigant analysis of customer survey; D6