Impact Evaluation of 2015 Marin Clean Energy Home Utility Report Program (Final Report)

California Public Utilities Commission

Date: 05/05/2017
CALMAC Study ID: CPU0158.01

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Table of contents

List of tables

List of figures

1 EXECUTIVE SUMMARY

This report summarizes the results of DNV GL's impact evaluation of the Marin Clean Energy (MCE) Home Utility Reports (HUR) program for 2015.

1.1 Background

MCE started the HUR program in November 2015. The HUR program provided comparative energy usage information that contains energy consumption information, consumption comparison with similar neighbors, and customized tips for saving energy. The program also encouraged customers to go to the MCE website for more customized information regarding contractors, financing, and rebates. The HUR program is similar to the Home Energy Reports (HER) programs offered by the California program administrators (PAs).

MCE structured the HUR program as a randomized controlled trial (RCT) in which the eligible population is randomly assigned to the treatment and control groups. The RCT design is widely considered the most effective way to establish causality between a treatment and its effect. The RCT design facilitates unbiased estimates of average savings that are small on a percentage basis.

This study evaluated three waves of promotion. Table 1 presents basic information about the three waves, including the number of households that received comparative energy usage reports (treatment customers), the frequency with which they received those reports, and the counts of control group customers.

Table 1. MCE HUR program waves, frequency of reports, and program start dates

Wave	Frequency of Report/Target Group	Program Start Date	Control Customers	Treatment Customers
HUR-1	Monthly/Top usage quintile	Nov 2013	2,766	3,643
HUR-2M / HUR-2Q	Monthly	Mar 2014	5,934	6,560
	Quarterly			6,587
HUR-3	Bi-monthly/Top two usage quintiles	Nov 2014	2,106	4,216

1.2 Research questions and objectives

The primary objective of this evaluation is to provide independent verification of electricity savings attributable to the HUR program. Specific research questions included the following:

- Is the experimental design employed by MCE acceptable?
- What are the energy savings for each HUR cohort (monthly, bi-monthly, and quarterly)?
- Are there downstream/upstream rebate program savings that could be jointly claimed by both the HUR program and PG&E rebate programs?
- What are the peak demand savings attributable to the program?

1.3 Study approach

To answer these research questions, DNV GL conducted an impact evaluation for the first 14 months of the 2013-2014 program cycle in 2016. This report provides an update to the previous study by including HUR program data from 2015. In this evaluation, we calculated the different components of HUR program savings including:

- *Overall unadjusted energy and demand savings*. These savings measure the impact of the HUR program on average household energy consumption and demand. We estimated the unadjusted energy savings using a fixed effects regression model that compared the treatment group's pre- and post-program consumption difference to that of the control group. For the unadjusted demand savings, we estimated savings as the difference in peak load between the treatment group and control group during the hottest heatwave in pre- and post-periods. These energy and demand savings reflect the overall program savings before applying any adjustment for joint savings achieved in conjunction with other rebate programs.
- *Joint savings*. Joint savings represent HUR-induced savings derived from the increased uptake of PG&E rebate programs. This estimate is produced for two kinds of programs:
  - *Downstream* joint savings occur due to increased participation by the HUR treatment group versus the control group in PG&E tracked energy efficiency programs.
  - *Upstream* joint savings occur due to increased purchases of PG&E-supported upstream lighting program CFL and LED bulbs by the HER treatment group versus the control group.
- *Final adjusted energy savings*. These savings represent the final program savings after deducting both the downstream and upstream joint savings. The adjustment eliminates the potential of double counting savings already accounted for in the rebated programs.

1.4 Key findings

Table 2 provides estimates of unadjusted and adjusted savings at the household level for the treatment group as compared to the control group. HUR-3 produced 1% savings that are consistent in magnitude with savings reported by other behavioral programs while electric savings per household were not statistically significant for the other waves. The lack of savings from HUR-1M, HUR-2M and HUR-2Q are consistent with the findings from the 2014 evaluation.

Table 2. Average kWh savings per household as a percent of consumption, 2015.

Wave	Unadjusted kWh Savings per Customer	Adjusted kWh Savings per Customer	Unadjusted Savings as % of Consumption	Adjusted Savings as % of Consumption	Statistically Significant with 90% confidence?
HUR-1	40.1	39.7	0.4%	0.4%	No
HUR-2M	-22.1	-22.2	-0.4%	-0.4%	No
HUR-2Q	4.3	4.3	0.1%	0.1%	No
HUR-3	84.2	83.7	1.1%	1.1%	Yes

DNV GL found statistically significant electric savings of 324 MWh for HUR-3 and found no indication of savings for the other waves. The overall 2015 program savings are positive, but not statistically significant at the 90% confidence interval. Figure 1 presents the total unadjusted and adjusted savings for the 2015 HUR program, broken out by wave.

Figure 1. Total Unadjusted and Adjusted kWh savings by HUR wave, 2015

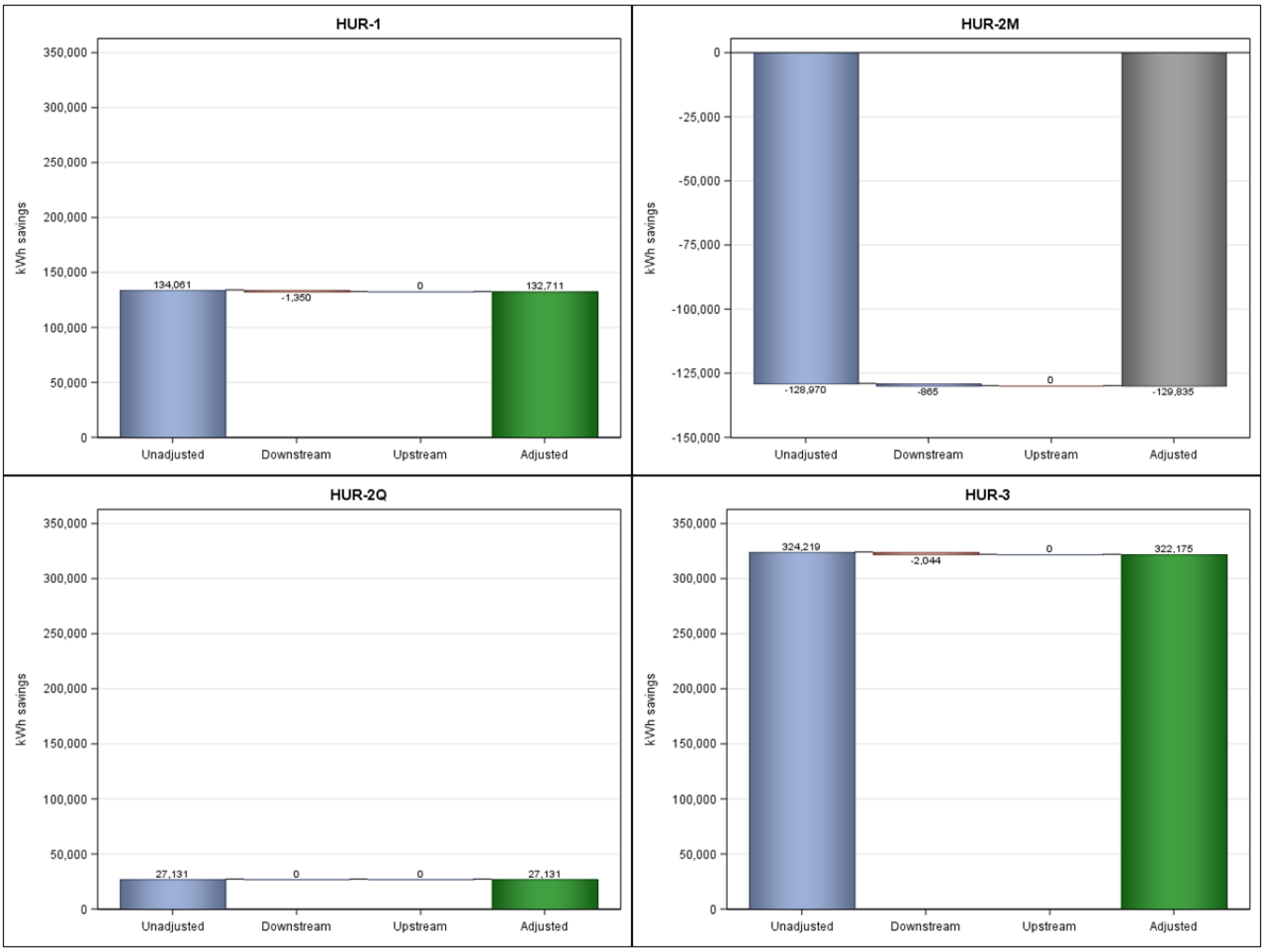


Figure 1 also shows the downstream and upstream joint savings estimates that are subtracted from the unadjusted savings to produce the final adjusted savings. Despite being non-statistically significant, joint savings adjustments are done to the extent that the treatment group produce more rebate savings than the control group. This adjustment is performed to address the potential for "double-counting" savings already claimed by PG&E programs.

Overall, the joint savings between HUR and PG&E rebate programs are very small in magnitude. DNV GL did not produce upstream joint savings estimate for HUR-1 and HUR-2 because of the limited program savings produced by these waves. For HUR-2Q, the control group had higher rebate savings than treatment group and therefore we did not apply any joint savings adjustment. For HUR-3, we did not find any evidence of upstream joint savings and only downstream joint savings are used to calculate the adjusted electric savings.

While RCTs give highly precise and unbiased estimates of savings, they do not provide any insight into what aspects of the behavioral messaging worked or not. For HUR-1, HUR-2M and HUR-2Q, a potential overlap with an MCE school program and some shortcomings of the HUR program's design (discussed in Chapter 2) possibly contribute to the lack of savings. For HUR-3, savings are in line with the 1% to 3% savings

produced by other behavioral programs. The significant savings for HUR-3 and the larger positive savings for HUR-1 compared to HUR-2M suggest that the HUR program is more effective among participants in top usage quintiles.

For this study, we also assessed the impact of the HUR program on peak load reduction. Table 4 provides the demand savings estimates for each of the HUR waves. The results are either negative and/or not statistically significant and suggest that the program did not cause households to reduce their load at the identified peak period. We did not conduct joint savings analysis at the peak due to the lack of evidence of peak load reduction in 2015.

Table 3. Overall kW savings per household

Program / Wave	Unadjusted kW Savings per household	Statistically Significant with 90% confidence?
HUR-1	-0.07	Yes
HUR-2M	-0.02	No
HUR-2Q	0.01	No
HUR-3	-0.02	No

Ultimately, the success of a behavioral program is driven by the effectiveness of the reports and the willingness and ability of the targeted populations to decrease their energy consumption. Any of these factors, individually or in combination, may explain the limited response to the HUR program.

2 INTRODUCTION

The California Public Utilities Commission (CPUC) engaged DNV GL to conduct an impact evaluation of the Marin Clean Energy (MCE) 2015 Home Utility Reports (HUR) program. This impact evaluation used HUR program tracking data provided by MCE and monthly consumption data provided to the CPUC by Pacific Gas & Electric (PG&E) to estimate electricity savings attributable to the HUR program.

2.1 HUR program description

MCE implemented the HUR program in late 2013 through 2015. Planet Ecosystem, Inc (PEI) administered the HUR program on behalf of MCE. PEI delivered normative-comparative messages via direct mail in order to motivate customers to change their energy use behavior. The messaging provided information similar to that found in other comparative feedback reports (consumption information, comparison with similar neighbors, and customized tips for saving energy). The program also encouraged customers to go to MCE's website for additional information regarding contractors, financing, and rebates. A sample of the HUR report is provided in Appendix 1.

The HUR program was offered in three waves of promotion. Table 5 presents basic information about the three waves, including the number of households that received comparative energy usage reports (treatment customers), the frequency with which they received those reports, and the number of control group customers.

Table 4. MCE HUR program waves, frequency of reports, and program start dates

Wave	Frequency of Report/Target Group	Program Start Date	Control Customers	Treatment Customers
HUR-1	Monthly/Top usage quintile	Nov 2013	2,766	3,643
HUR-2M / HUR-2Q	Monthly / full population	Mar 2014	5,934	6,560
	Quarterly / full population			6,587
HUR-3	Bi-monthly/Top two usage quintiles	Nov 2014	2,106	4,216

In addition to the HUR program, MCE also implemented a school program that offered a specially crafted curriculum and provided students with a kit of energy-saving measures (5 CFLs, 1 showerhead, 1 aerator, and 1 filter whistle). Students were required to sign a pledge stating they would install the equipment. Early in the program, MCE dropped the kit measures because they were not cost-effective and required too much time to distribute.

This evaluation did not cover MCE's school program; however, it is possible that some households with students participating in the school program also received the HUR direct mail, resulting in partial overlap between the programs. The school program was not tracked, so this overlap cannot be quantified.

DNV GL believes it is unlikely that this overlap had substantial effect on the HUR program, for the following reasons:

- The school program had relatively limited impact.
- Because the treatment and control groups are randomly distributed across the area, there was no compelling reason to expect that the school program impacts would not be approximately randomly distributed across the treatment and control groups.

- Only where the school program efforts were redundant with HUR program efforts would we expect the overlap to moderate the HUR program savings estimates.

2.2 Experimental design

MCE implemented the HUR program using a randomized controlled trial (RCT) design to facilitate estimating program savings. The RCT design randomly assigns a population of interest to control and treatment groups. This approach effectively establishes a causal relationship between treatment and its effect, in this case a possible change in consumption. This approach produces an unbiased estimate of this change with a high level of statistical precision, and is widely considered as "the gold standard" in program evaluation.

2.2.1 Population Criteria

MCE engaged PEI to develop the sample for the HUR program. Table 6 provides the criteria used to develop the sample for the HUR program. The HUR waves targeted slightly different geographical areas and consumption levels.

Table 5. Criteria for HUR waves

Criteria for all HUR waves	Wave-specific criteria		
	HUR-1	HUR-2	HUR-3
• MCE customers • Non-medical rate • Have known square footage • Name field did not appear to be a small business • Latitude and longitude values known • Had 11 or 12 months of usage data at program start • Not in the treated or control group of the PG&E HER program • Home has at least 50 neighbors	• Single-family homes in Marin County • Electric rate schedule is E1 or EL1 • Households in top usage quintile	• Single-family homes in Marin and the city of Richmond • Electric rate schedule is E1, EL1, or E6 • Not in the treated or control groups for any other MCE HUR program • All usage quintiles	• Single-family homes in Marin and the city of Richmond • Electric rate schedule is E1, EL1, or E6 • Not in the treated or control groups for any other MCE HUR program • Usage for the previous 12 months placed the home in roughly the top two quintiles (top 40%) when compared to their neighbors

2.2.2 Experimental Design Implementation

MCE and PEI created the experimental design prior to the involvement of DNV GL. This is contrary to standard best practice, as the randomization is such an important aspect of the program design. DNV GL or other third party evaluators have performed the randomization for other CA behavior programs. In cases where it was feasible, the random allocation was performed in a stratified experimental design which dramatically improves the likelihood of a well-balanced treatment and control.

DNV GL reviewed and validated MCE's randomization process after it was set. Our findings suggest that HUR-1 had substantial imbalance in pre-period consumption and household characteristics, while HUR-2 and HUR-3 waves had less imbalance. Appendix B provides the results of the randomization tests on household characteristics and electricity usage between HUR treatment and control groups.

2.2.3 Program Delivery in the Experimental Design

MCE implemented the HUR-1 and HUR-3 waves as originally designed, with all treatment group households receiving the reports. For the HUR-2 wave, MCE changed the delivery plan after the experimental design was set. After three months of delivering the reports, MCE stopped sending the reports to lower the consumption quintiles in the HUR-2 treatment group. The best practice under such situations requires using the original design for the evaluation. Any savings that exist among those who originally received the reports should still be measured and included in the estimate of savings. Including savings from all households in the treatment group will potentially lower the magnitude of average household savings which could have an adverse effect on the precision of savings estimates. Under the circumstances, however, it is essential to accept the potential reduction in precision rather than undermine the validity of the experiment altogether.

2.3 Evaluation objectives and approach

The primary objective of this evaluation is to provide independent verification of electricity savings attributable to the HUR program. Specific research questions included the following:

- Is the experimental design employed by MCE acceptable?
- What are the energy savings for each HUR cohort (monthly, bi-monthly, and quarterly)?
- Are there downstream/upstream rebate program savings that could be jointly claimed by both the HUR program and PG&E rebate programs?
- What are the peak demand savings attributable to the program?

2.4 Evaluation objectives and approach

DNV GL reviewed the experimental design as part of the 2014 impact evaluation. Our assessment of the experimental design is discussed in Appendix A. To answer the remaining questions, DNV GL conducted an impact evaluation for the 2015 program cycle. We estimated three components of program savings:

1. **Overall (unadjusted) savings.** These savings measure the impact of the HER program on average household energy consumption and demand. We estimated the unadjusted energy savings using a fixed effects regression model that compares the treatment group's pre- and post-program consumption difference to that of the control group. For the unadjusted demand savings, we estimated savings as the difference in peak load between the treatment group and control group during the hottest heatwave in the pre- and post-periods. These energy and demand savings reflect the overall program savings before applying any adjustment for joint savings achieved in conjunction with other rebate programs.
2. **Joint savings.** Joint savings represent HUR-induced savings derived from the increased uptake of PG&E rebate programs. This estimate is produced for kinds of programs:
   - Downstream joint savings occur due to increased participation by the HUR treatment group versus the control group in PG&E's tracked energy efficiency programs.
   - Upstream joint savings occur due to the increased purchase of PG&E-supported upstream lighting program (ULP) CFL and LED bulbs by the HER treatment group versus the control group.
3. **Final adjusted energy and demand savings**. These savings represent the final program savings after deducting both the downstream and upstream joint savings. This adjustment eliminates the potential to double count savings already accounted for in the rebated programs.

3 METHODOLOGY AND DATA SOURCES

3.1 Methodology

For this evaluation, we used a fixed-effects regression model that is a standard for evaluating behavioral programs like HER. The fixed effects model specification estimates program savings by comparing consumption of the treatment group to the control group before and after program implementation. The change that occurs in the treatment group is adjusted to reflect any change that occurs in the control group, in order to isolate changes attributable to the program.

Below is the fixed-effects model specification we used in this study:

$$E_{it} = \mu_i + \lambda_t + \beta P_{it} + \varepsilon_{it}$$

where:

E_{it} = Average daily energy consumption for account i during month t
P_{it} = Binary variable: one for households in the treatment group in the post period month t, zero otherwise
λ_t = Binary variable: one for a specific month/year, zero otherwise
μ_i = Account level fixed effect
ε_{it} = Regression residual

The average monthly savings are given by:

$$\bar{S}_t = \hat{\beta}_t$$

where:

$\bar{S}_t$ = Average treatment-related consumption reduction during month t
$\hat{\beta}_t$ = Estimated parameter measuring the treatment group difference in the post period month t

The model includes site-specific and month/year fixed effects. The site-specific effects control for mean differences between the treatment and control groups that do not change over time. The month/year fixed effects control for changes over time that affect both the treatment and control groups. The monthly post-program dummy variables pick up the average monthly effects of the treatment.

Households that moved out were dropped from the model. The total savings are a sum of the monthly average savings combined with the count of households still eligible for the program in that month. Also, households that actively opted out of the program remain in the model as long as they remain in their house. In this respect, the treatment can be considered "intent to treat." This model is consistent with best practices as delineated in State and Local Energy Efficiency Action Network's Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations.[1]

[1] State and Local Energy Efficiency Action Network. 2012. *Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations*. Prepared by A. Todd, E. Stuart, S. Schiller, and C. Goldman, Lawrence Berkeley National Laboratory. http://behavioranalytics.lbl.gov.

3.2 Demand savings

Reductions in demand at peak times that result from HUR program participation can be measured through a variety of approaches. The preferred approach in California is to examine peak demand differences that occur during the pre- and post-program periods in a given peak period. We used the peak period definition provided by the Database for Energy Efficiency Resources (DEER).[2] This definition takes into account the average temperature, average afternoon temperature (12 p.m.–6 p.m.), and maximum temperature over the course of three-day heatwave candidates. Each candidate heatwave is a combination of three consecutive non-holiday weekdays occurring between June 1 and September 30.

Using this definition, the optimal heatwave (HW) for each climate zone is ultimately selected by choosing the single candidate three-day-period with the highest peak score (Score_k) among all possible candidates.

The mathematical expression is given below:

$$HW = \max_{1 \le k \le K} (\text{Score}_k)$$

$$\text{Score}_k = \max_{1 \le d \le 3} (temp_{d,k}) + \frac{1}{d} \sum_{d=1}^{3} (daily\_mean_{d,k}) + \frac{1}{d} \sum_{d=1}^{3} (afternoon\_avg_{d,k})$$

Where

HW = Zone-specific set of three consecutive non-holiday weekdays that's has the highest value of Score_k for heat wave candidate k across all possible candidates K

Score_k = The summation of maximum temp, average daily, and afternoon average temperature

$daily\_max_{d,k}$ = The maximum hourly temperature value across all hours on day d, for heat wave candidate k.

$daily\_mean_{d,k}$ = The average hourly temperature across all hours on day d, for heat wave candidate k.

$afternoon\_avg_{d,k}$ = The average hourly temperature between 12 and 6 PM on day d, for heat wave candidate k.

DNV GL collected 15-minute and 60-minute interval data during the hours of 2 p.m.–5 p.m. of the most common heat wave in the pre- and post-periods for both treatment and control households. DNV GL then applied a difference-in-differences method to calculate demand savings due to the HUR program.

The general equation for the difference-in-differences approach is given below:

$$\overline{kW}\ savings = \left(\overline{post\_kW_C} - \overline{post\_kW_T}\right) - \left(\overline{pre\_kW_C} - \overline{pre\_kW_T}\right)$$

where:

$\overline{kW}\ savings$ = Average demand reductions during the peak period

[2] http://www.cpuc.ca.gov/NR/rdonlyres/4F93F9C2-434E-4B06-8D80-B2CB7E0A4198/0/DEER2013UpdateDocumentation_792013.pdf

$\overline{pre\_kW_C}$ = Average hourly load of the control group during the peak period in the pre-period

$\overline{pre\_kW_T}$ = Average hourly load of the treatment group during the peak period in the pre-period

$\overline{post\_kW_C}$ = Average hourly load of the control group during the peak period in the post-period being evaluated or 2015

$\overline{post\_kW_T}$ = Average hourly load of the treatment group during the peak period in the post-period being evaluated or 2015

3.2.1 Downstream rebate joint savings

One possible effect of the HUR program is to increase rebate activity in other PG&E energy efficiency programs. The RCT experimental design facilitates the measurement of this effect. We compared the average savings from rebate measures installed by the treatment group with the savings from measures installed by the control group. An increase in treatment group rebate program savings represents savings caused by the HUR program jointly with the rebate programs. While these joint savings are an added benefit of the HUR program, it is essential that these joint savings are only reported once. The most common and simple approach is to remove all joint savings from the HUR program savings rather than remove program-specific joint savings from all of the associated rebate programs. This has been the approach used historically to adjust the savings from the behavioral programs.

The savings estimates from the fixed effects regressions include all differences between the treatment and control group in the post-report period. Joint savings are picked up by the regressions and included in the overall savings estimate. These joint savings are also included in PG&E rebate program tracking databases and are claimed as part of those programs' savings unless further actions were taken to remove them. Savings from the HUR program are adjusted using the joint savings estimates to avoid double counting of savings.

DNV GL used the following approach for rolling up individual rebate's savings and calculating joint savings overall:

- Use accepted deemed savings values (those being used to claim the savings for the rebate program).
- Determine accumulated savings beginning from the installation date moving forward in time.
- Assign daily savings on a load-shape-weighted basis (more savings when we expect the measure to be used more).
- Maintain the load-shape-weighted savings over the life of the measure.

This approach uses the deemed annual savings values and transforms them into realistic day-to-day savings values given the installation of that measure. We determined the daily share of annual savings using hourly 2011 DEER load shapes[3] for PG&E. [4] These load shapes indicate when a measure is used during the year and, by proxy, when efficiency savings would occur.[5]

[3] DEER load shapes are in an 8760 hourly format. DNV GL aggregated the hourly shares to daily shares in order to estimate daily savings.

[4] http://deeresources.com/DEER2011/download/DEER2011-UpdatedImpactProfiles-v2.zip

[5] This is more accurate and equitable than subtracting out the first-year savings values that are used in DEER, because most measures are not in place from the first day to the last day of the year.

Savings for each installed measure start to accrue at the time of installation (or removal for refrigerator recycling). We calculated average monthly household rebate program savings for the treatment and control groups including zeroes for the majority of households that did not take part in any rebate program. An increase in average per-household tracked program savings among the treatment group versus the control group indicates joint savings. DNV GL's recommended method for estimating joint savings analysis is consistent with the approach recommended in the SEE Action report

DNV GL only estimated joint savings from downstream programs for adjusting kWh savings. DNV GL did not produce a joint savings estimate for adjusting demand (kW) savings since the HUR program did not produce peak demand savings.

3.2.2 Upstream joint savings

Upstream joint savings are similar to downstream joint savings, except that upstream savings are not tracked at the customer level. PG&E upstream savings still represent a source of savings that MCE HUR could potentially double count. Unlike tracked programs, it is not possible to directly compare all treatment and control group member activity. This makes it more challenging to determine if the HUR program increases savings in upstream programs.

For the 2014 HUR evaluation, DNV GL did not produce an estimate for the upstream joint savings since there were no overall savings produced indicating the possibility of no savings occurring due to upstream programs. For this study, DNV GL quantified savings from HUR-3 wave that are potentially made in conjunction with the 2015 upstream programs. DNV GL did not produce joint savings estimate for HUR-1 and HUR-2 wave because of the limited program savings produced by these waves. Table 7 presents the key inputs used in 2015 MCE HUR joint savings for upstream lighting programs.

Table 6. Input assumptions used for 2015 upstream joint savings

Assumptions	Input values	Source
Excess lamps due to HUR		
2015 CFL	-0.8	2015 IOU Residential Behavioral Programs: Online Survey Results (DNV GL, 2017)
2015 LED	0.2	2015 IOU Residential Behavioral Programs: Online Survey Results (DNV GL, 2017)
Rebated sales fraction		
2015 CFL	0.9%	TRC estimate for PG&E rebated sales fraction in 2015
2015 LED	20%	TRC estimate for PG&E rebated sales fraction in 2015
Annual savings per bulb		
2015 CFL	23.50	TRC estimate for 2014 based on PG&E program tracking data (DEER 2013-14).
2015 LED	24.80	TRC estimate for 2014 based on PG&E program tracking data (DEER 2013-14).
Net-to-gross		
2015 CFL	0.31	2013-14 ULP Evaluation (DNV GL, 2016)
2015 LED	0.45	2013-14 ULP Evaluation (DNV GL, 2016)

DNV GL conducted an online survey in late December 2016 and January 2017 to collect information on the purchase and installation of CFLs and LEDs for the HUR program treatment and control groups during the last 12 months. DNV GL calculated the efficient bulb uplift due to HUR based on treatment and control responses. If joint savings are positive, DNV GL deducted the upstream joint savings from the final 2015 savings.

The estimates for the excess lamps due to HUR are based on HUR-3 participants' recall of the number of bulbs purchased and installed in 2016. DNV GL used these estimates as a proxy for the 2015 bulb uplift because the 2016 estimate from the online survey represent the HUR program better than the efficient bulb uplift due to the HER program based on the 2012 PG&E in-home study.

In general, the CFL and LED bulb uplift are small and not statistically significant. In terms of magnitude, we found a relatively higher bulb uplift for LED than CFL. The joint savings calculation also used average net-to-gross and savings per bulb estimates using studies from the 2013-2014 lighting studies. Our approach also assumed that the excess efficient lamps purchased due to HUR are purchased evenly throughout the year.

The general equations used in calculating electric joint savings from ULP are presented below:

$$\text{CFL(or LED)kWh joint savings per household} = \text{Excess CFLs(or LED)due to HUR} \times \text{Number of years CFLs(or LED)have been installed} \times \text{CFL(or LED)rebated sales fraction} \times \text{NTG} \times \text{Annual savings per CFL(or LED)}$$

$$\text{Total kWh joint savings from ULP} = \text{Number of households in the treatment group} \times (\text{CFL kWh joint savings per household} + \text{LED kWh joint savings per households})$$

Joint savings analysis was only conducted for adjusting electric savings for the HUR program. DNV GL did not produce joint savings at the peak due to the lack of evidence of peak load reduction in 2015.

3.3 Data sources and disposition

This section describes the data used in evaluating the HUR program.

3.3.1 Data sources

Program Participants

MCE provided HUR participant account numbers and the corresponding customer account numbers in PG&E's customer database. Additional information such as zip codes, house square footage, number of bedrooms/bathrooms, treatment assignment, and other household characteristics were also provided. These data served as the roster of program participants for the HUR evaluation.

Monthly Billing Data

DNV GL used the PG&E monthly billing data for HUR customer consumption from November 2012 to December 2015. The billing data included account numbers, premise numbers, billing cycle start and end dates, consumption reads, net metering flags, and the type of reading (i.e. actual meter reading/estimated reading).

Downstream Program Tracking Data

DNV GL used PG&E program tracking data to collect information on MCE HUR customers who participated in PG&E downstream rebate programs after the inception of the HUR program. PG&E tracking data included

participant information, account numbers, program name, measures installed, installation dates, and claimed savings. This dataset facilitated calculating downstream joint savings for the HUR program.

Online survey data

DNV GL conducted an online survey to assess efficient bulb uptake of the MCE HUR participants. The online survey collected information on the number of CFL and LED lamps purchased and installed by MCE HUR participants in the treatment and control groups. This survey facilitated calculating upstream joint savings for the HUR program.

Hourly Consumption Data

DNV GL used the PG&E 15-minute and 60-minute interval data for HUR customer consumption during summer from 2013 to 2015. The interval data included account numbers, service point id and 15-minute or 60-minute interval reading.

3.3.2 Data disposition

The impact evaluation relied on consumption data from the PG&E monthly billing data system. Consumption data are closely tied to the billing function and are generally considered accurate. On the other hand, missed reads, estimated reads, and corrections do occur, and may undermine the validity of some readings. In non-RCT billing analysis evaluations, it is common to apply a range of consumption data checks in an attempt to limit invalid data. This can lead to the removal of customers from the analysis because of limitations in their billing data. In an RCT analysis, one would expect anomalies to appear in the same proportion in the treatment and control groups. DNV GL assessed the frequency of potential data issues related to consumption and meter reading in the treatment and control groups. Table 8 provides an overview of the potential data issues identified in the billing data.

Table 7. Summary of billing data

Summary	Electric	
	Control	Treatment
HUR-1 Sites	2,766	3,643
Negative Reads	3%	2%
Extreme Reads	0%	0%
Net metered sites	5%	4%
No consumption in pre or post	0%	1%
No Issues	95%	95%
HUR-2M Sites	5,934	6,560
Negative Reads	1%	1%
Extreme Reads	0%	0%
Net metered sites	2%	2%
No consumption in pre or post	0%	0%
No Issues	97%	97%
HUR-2Q Sites	5,934	6,587
Negative Reads	1%	1%
Extreme Reads	0%	0%
Net metered sites	2%	2%
No consumption in pre or post	0%	0%
No Issues	97%	97%
HUR-3 Sites	2,106	4,216
Negative Reads	1%	1%
Extreme Reads	0%	0%
Net metered sites	3%	3%
No consumption in pre or post	0%	0%
No Issues	96%	96%

Overall, the incidence of issues is small across treatment and control groups and both fuel types. For large reads (>10,000 kWh per month for electric), large monthly consumption was observed in less than 0.5% of the households overall. During the 2014 evaluation, DNV GL identified a site with consumption over 10,000 kWh per month. This site was a special case of a mobile home trailer park serving more than 40 mobile home units and is excluded from the analysis.

Around 2 to 5% of the households are net metered sites. Customers who installed solar panels and switched to net metering pose a dilemma for this evaluation because of the way that net metering was addressed in the billing data. This creates challenges for either including them in the analysis or fully understanding the extent of the issue. For example, if the solar households are included in the analysis it would be necessary to incorporate household-level energy production data.[6] Otherwise, potential differences in solar energy production could be conflated with program-related savings, biasing the results up or down. For this evaluation, all net-metered customers were left out of the analysis.

[6] It is instructive to compare solar-installing households to HER opt-outs with respect to their effect on the analysis results. The removal of opt-outs from the treatment group would likely remove households with lower savings effects thus artificially increasing the savings estimate for those households remaining in the treatment group. This potential upward bias in the savings result is a clear reason for including these households despite their opting out. The solar-installing households have a less clearly defined HER program savings effect so it is more difficult to assess the effect of their removal on the HER savings of remaining households. More importantly, energy generated by solar systems would dwarf the amount of HER program savings at most households. The decision to remove these households is based on a lack of clear evidence of a biasing effect in the savings estimate and the concern that their inclusion would be practically speaking infeasible and would have the potential to introduce bias.

For most cases, potential data issues are small and proportionally balanced between the treatment and control groups. These findings indicate that data issues are infrequent and that the treatment/control difference inherent in the RCT structure controlled for the majority of the issues that existed and thus there is no need to remove such records. Consistent with the 2014 evaluation, the two primary groups removed from the analysis were net metering customers and customers with insufficient data.

Table 9 through Table 11 summarizes the count of households with respect to natural attrition due to change in occupancy for each HUR wave. Each table provides the count of active households for the treatment group that was used to calculate total program savings. The estimates of monthly savings produced by this impact evaluation reflect the consumption data of the active households remaining in the program (treatment or control group). In 2015 program year, average monthly attrition rate reached a maximum of 1.3% for treatment and control groups across the three HUR waves.

DNV GL used the end-date electric account read periods to establish the number of active households. The tables below provide the number of move-outs per month and the cumulative number of accounts used for both the treatment and control groups to determine active households.

Table 8. Number of households in HUR-1 wave

Month	Control Group	Treatment Group
Jan-15	2,593	3,350
Feb-15	2,584	3,335
Mar-15	2,575	3,324
Apr-15	2,570	3,303
May-15	2,559	3,281
Jun-15	2,546	3,259
Jul-15	2,529	3,231
Aug-15	2,516	3,198
Sep-15	2,506	3,166
Oct-15	2,500	3,151
Nov-15	2,493	3,139
Dec-15	2,482	3,127

Note: The monthly counts provided exclude sites with net metering

Table 9. Number of households in HUR-2 wave

Month	Control Group	Treatment Group (Monthly Recipients)	Treatment Group (Quarterly Recipients)
Jan-15	5,423	6,218	6,175
Feb-15	5,381	6,191	6,138
Mar-15	5,354	6,162	6,117
Apr-15	5,327	6,124	6,094
May-15	5,296	6,088	6,048
Jun-15	5,255	6,047	6,007
Jul-15	5,200	6,008	5,950
Aug-15	5,151	5,952	5,905
Sep-15	5,111	5,903	5,853
Oct-15	5,089	5,863	5,816
Nov-15	5,054	5,828	5,779
Dec-15	5,035	5,793	5,735

Note: The monthly counts provided exclude sites with net metering

Table 10. Number of households in HUR-3 wave

Month	Control Group	Treatment Group
Jan-15	2,036	4,060
Feb-15	2,019	4,032
Mar-15	2,003	4,005
Apr-15	1,990	3,974
May-15	1,979	3,946
Jun-15	1,962	3,912
Jul-15	1,937	3,872
Aug-15	1,915	3,830
Sep-15	1,895	3,793
Oct-15	1,881	3,756
Nov-15	1,867	3,733
Dec-15	1,854	3,714

Note: The monthly counts provided exclude sites with net metering

4 RESULTS: SAVINGS ESTIMATES

This chapter presents the final reported savings estimates for the 2015 MCE HUR program.

- Section 4.1 reports the *overall average savings,* which represent the unadjusted effect of the HUR program on treatment group consumption.
- Sections 4.2 and 4.3 report the *joint savings* estimates, which identify the downstream and upstream joint savings included in the overall savings estimate that are reported by other PG&E programs.
- Section 4.4 combines these estimates, removing the joint savings from the overall savings, and producing a 2015 HUR program savings estimate that does not double-count energy savings from other energy efficiency programs.

4.1 HUR program overall savings estimates

Figure 1 through Figure 4 provides graphic illustrations of the monthly electric savings from program start date through December 2015 for each HUR wave. The average monthly savings across all waves are between -8 kWh (effectively no savings) and 14 kWh per household. HUR-1 and HUR-2 did not produce statistically significant savings while HUR-3 produced an average annual savings of 84 kWh per household which is statistically significant at the 90% confidence level.

The findings for HUR-1 and HUR-2 are consistent with the 2014 evaluation results. As discussed in Appendix A, the HUR-1 treatment group had substantially higher usage than the control group in general. The model specification we used to estimate savings corrected for pre-existing differences in average consumption between treatment and control groups thereby correcting the bias. That means the annual savings estimates produced are unbiased.

For HUR-2, the results can be attributed to the discontinuation of the reports for a subset of the program participants. The HUR program stopped sending reports to participants in the lower quintile a few months after HUR-2 was launched. Consistent with last year's approach, we included all participants in the original randomization to produce an unbiased estimate of savings.

Figure 2. Average monthly kWh savings per household in HUR-1

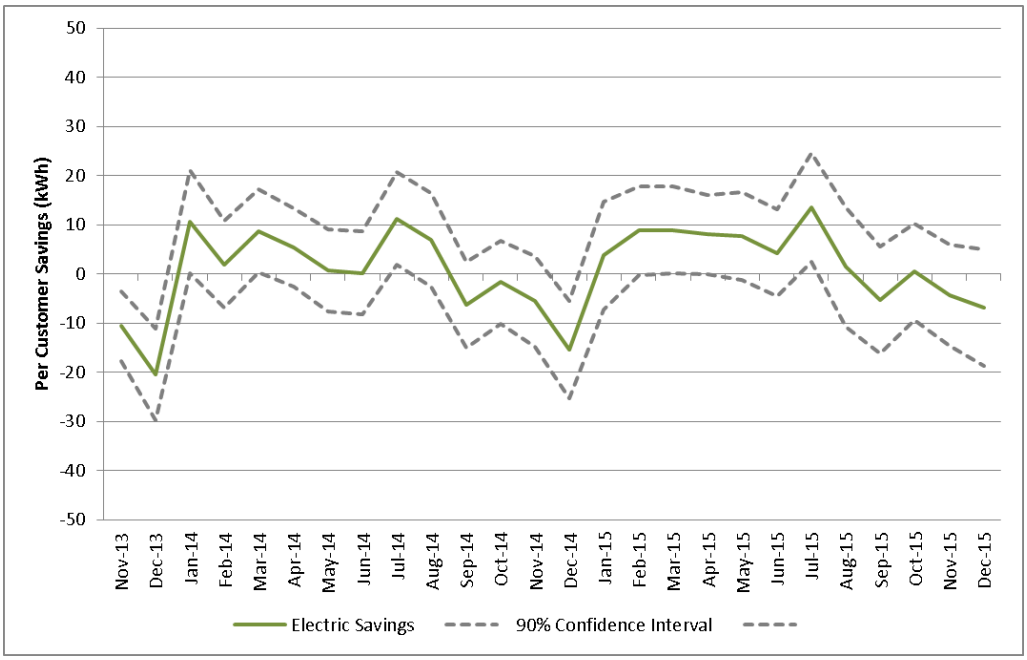


Figure 3. Average monthly kWh savings per household in HUR-2M

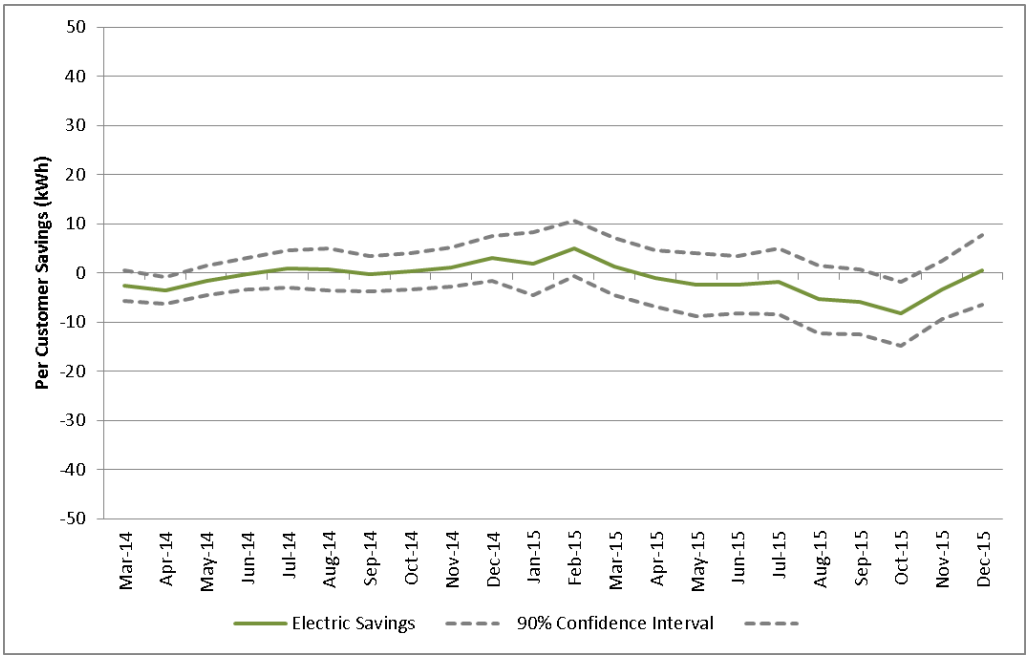


Figure 4. Average monthly kWh savings per household in HUR-2Q

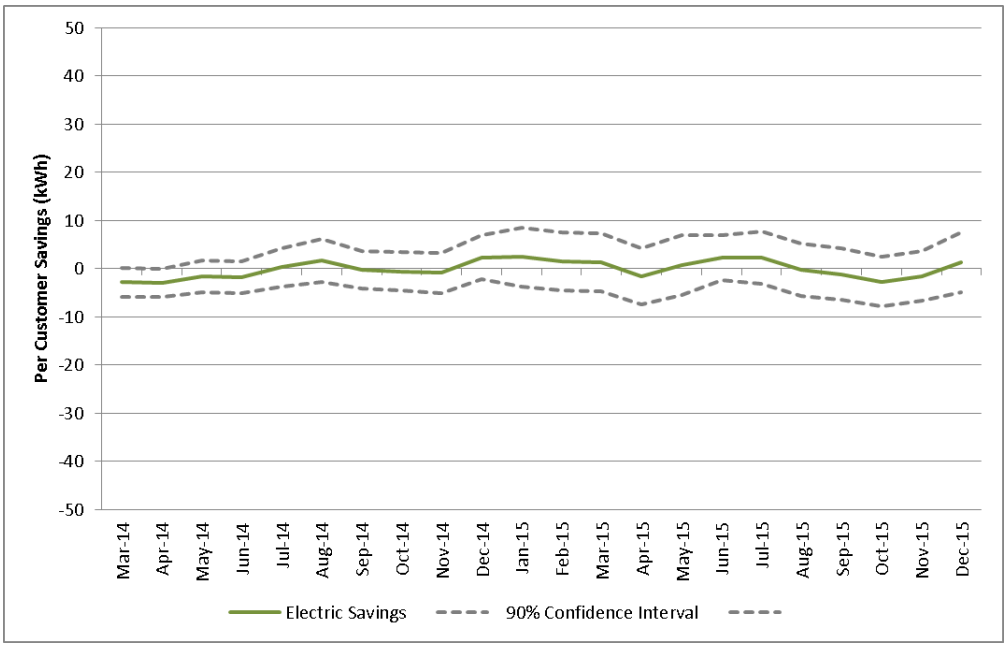


Figure 5. Average monthly kWh savings per household in HUR-3

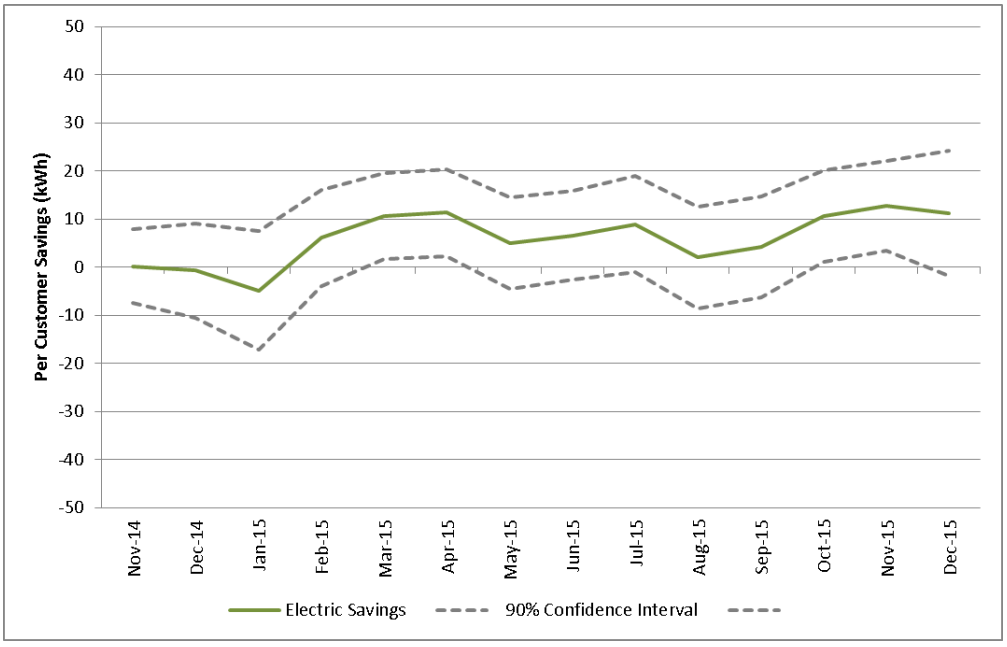


Table 12 and Table 13 provide the monthly electric savings in tabular form, along with the count of treatment group households for each month. In combination, these numbers generate the total program savings for the HUR program. The bottom rows of the tables provide the annual savings per household and total program savings along with indication of statistical significance for the aggregate numbers.

Table 11. Household counts and average monthly unadjusted kWh savings per household

Month	Count of treatment households				Savings per household			
	HUR-1	HUR-2		HUR-3	HUR-1	HUR-2		HUR-3
		M	Q			M	Q	
Jan-15	3,350	6,218	6,175	4,060	3.8	1.9	2.4	(4.9)
Feb-15	3,335	6,191	6,138	4,032	8.8	5.0	1.5	6.1
Mar-15	3,324	6,162	6,117	4,005	8.9	1.2	1.3	10.5
Apr-15	3,303	6,124	6,094	3,974	8.0	(1.1)	(1.6)	11.3
May-15	3,281	6,088	6,048	3,946	7.6	(2.4)	0.7	5.0
Jun-15	3,259	6,047	6,007	3,912	4.3	(2.3)	2.3	6.6
Jul-15	3,231	6,008	5,950	3,872	13.5	(1.8)	2.2	8.9
Aug-15	3,198	5,952	5,905	3,830	1.4	(5.4)	(0.2)	2.0
Sep-15	3,166	5,903	5,853	3,793	(5.3)	(5.9)	(1.2)	4.1
Oct-15	3,151	5,863	5,816	3,756	0.5	(8.3)	(2.7)	10.6
Nov-15	3,139	5,828	5,779	3,733	(4.4)	(3.5)	(1.5)	12.8
Dec-15	3,127	5,793	5,735	3,714	(6.9)	0.6	1.3	11.2
				Total	40.1[ns]	(22.1) [ns]	4.3 [ns]	84.2

[ns] *Not statistically significant at 90% confidence level. The statistical significance is based on the combined standard errors of the monthly parameter estimates weighted by the monthly counts.*

Table 12. Total unadjusted kWh savings

Month	Unadjusted Program Savings (kWh)			
	HUR-1	HUR-2		HUR-3
		M	Q	
Jan-15	12,630	11,687	14,809	(19,795)
Feb-15	29,222	30,890	9,090	24,480
Mar-15	29,627	7,547	7,875	42,252
Apr-15	26,363	(6,980)	(9,824)	45,028
May-15	25,014	(14,900)	4,241	19,643
Jun-15	13,958	(14,125)	13,586	25,851
Jul-15	43,568	(10,670)	12,858	34,499
Aug-15	4,523	(32,167)	(1,231)	7,543
Sep-15	(16,841)	(34,665)	(6,797)	15,570
Oct-15	1,449	(48,617)	(15,866)	39,946
Nov-15	(13,905)	(20,169)	(8,953)	47,710
Dec-15	(21,548)	3,198	7,342	41,491
Total	134,061	(128,970)	27,131	324,219
Upper Bound at the 90% CI	418,942	247,265	340,615	629,193
Lower Bound at the 90% CI	(150,821)	(505,204)	(286,353)	19,244

4.2 HUR program joint savings: downstream rebates

Table 14 shows some of the broad categories in which HUR may have influenced uptake in PG&E rebate programs. HUR-3 did not have as much rebate activity, likely because the program started later than the other waves. Otherwise, the most common type of program rebates was related to lighting, while participation in refrigerator and clothes-washer-related rebate activities were similar.

Table 13. Types of rebates

Wave	Group	Count of Participation in PG&E Rebate Programs			
		Refrigerator	Lighting	Clothes Washer	Other
HUR-1	Treatment	58	114	56	51
	Control	54	152	56	27
HUR-2M	Treatment	89	151	98	51
	Control	82	129	85	46
HUR-2Q	Treatment	102	171	72	41
HUR-3	Treatment	23	69	26	26
	Control	35	54	14	13

Figure 5 through Figure 8 show the monthly downstream savings per HUR group. These results show that the monthly savings are not statistically different from zero for all experimental waves. However, despite being non-statistically significant, positive joint savings are removed as they provided some evidence of possible double counting.

Figure 6. Monthly kWh joint savings per household in HUR-1

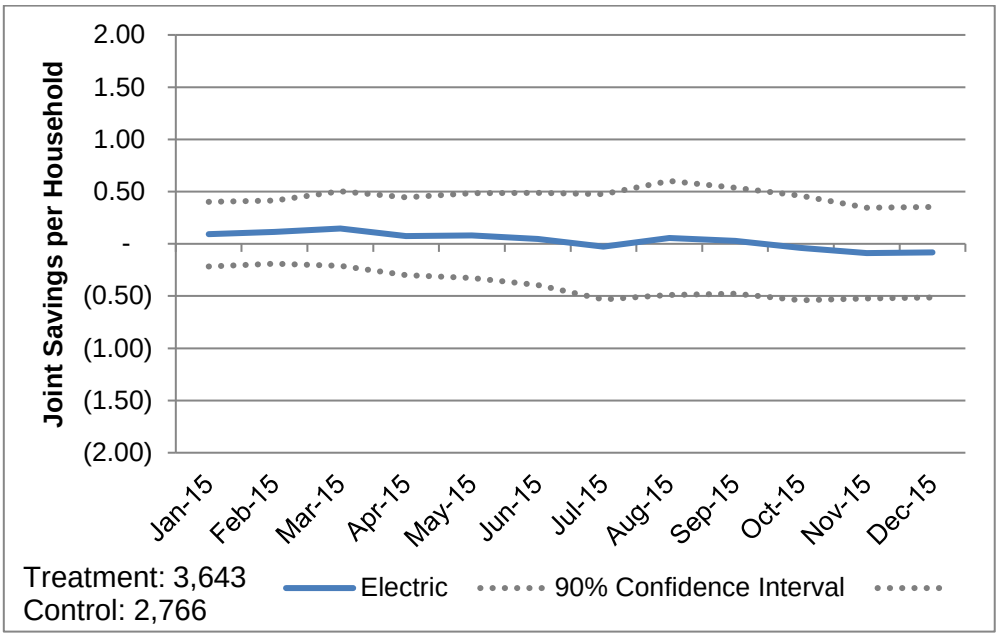


Figure 7. Monthly kWh joint savings per household in HUR-2M

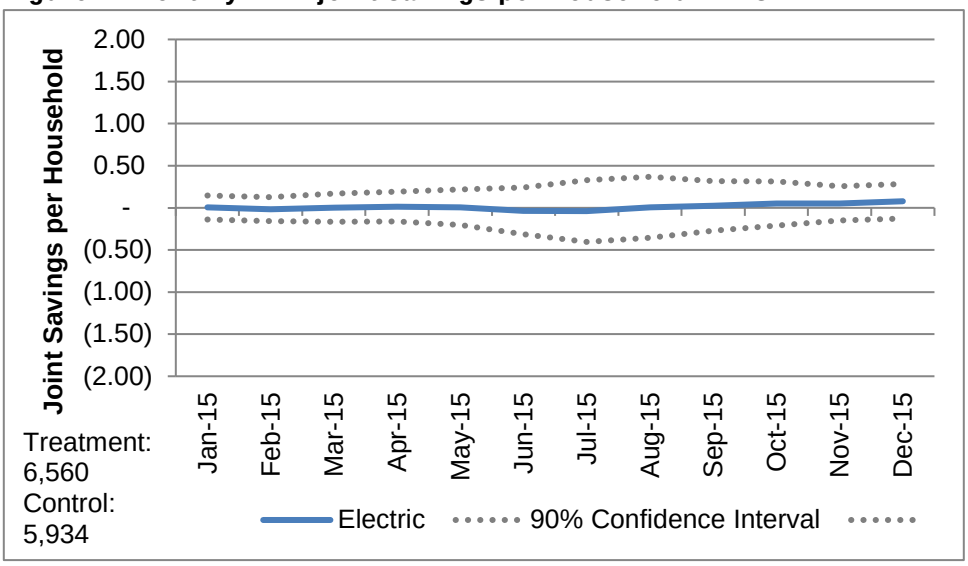


Figure 8. Monthly kWh joint savings per household in HUR-2Q

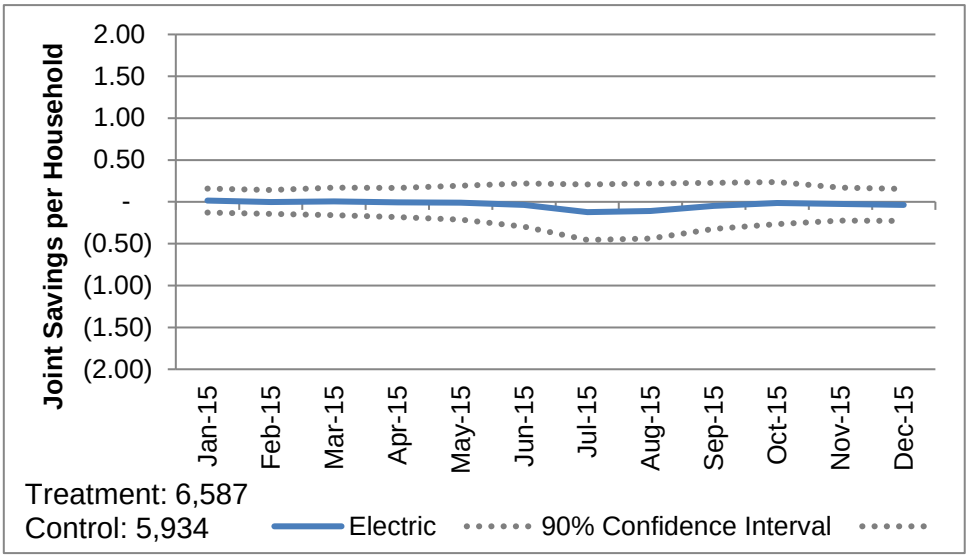
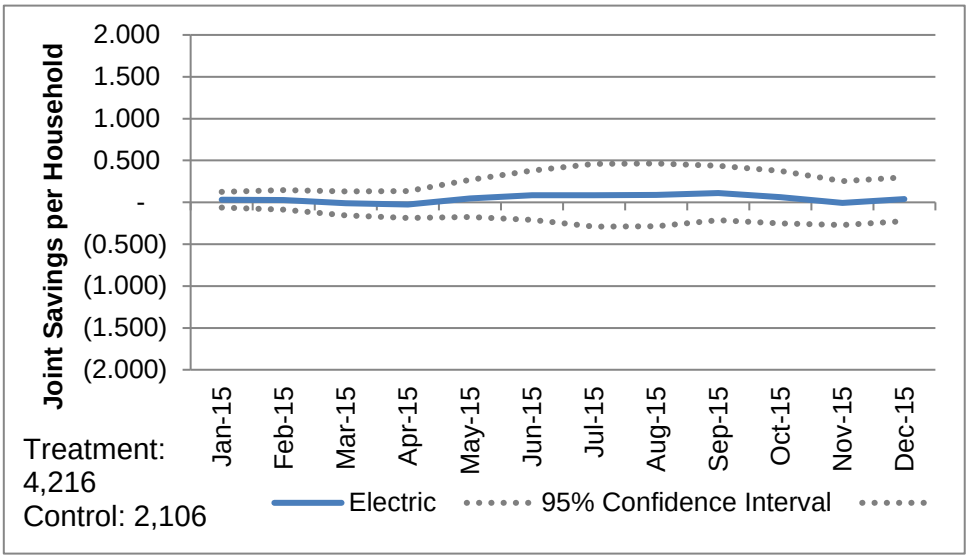


Figure 9. Monthly kWh joint savings per household in HUR-3



4.3 HUR program joint savings: upstream rebates

DNV GL quantified savings from HUR-3 wave that are potentially made in conjunction with the 2015 upstream programs. Table 15 provides the upstream joint savings calculation for CFLs and LEDs. DNV GL did not produce joint savings estimated for HUR-1 and HUR-2 waves because of the limited program savings produced by these waves.

Table 14. Upstream kWh joint savings inputs for CFL and LED

Inputs	HUR-3	
	CFL	LED
No. of excess bulb per year	-0.8	0.2
Year bulbs have been installed in 2015	0.5	0.5
Deemed kWh savings per bulb	23.5	24.8
CFL/LED rebated sales fraction	0.1	0.2
Net-to-gross	0.3	0.5
Average annual kWh joint savings per household by lamp type	-0.3	0.3
Average annual kWh joint savings per household	-0.02	

The results from joint savings analysis is very small and negative. This indicates that there is no evidence of double counting between HUR and PG&E upstream lighting programs. DNV GL did not apply upstream joint savings adjustment to the HUR program savings.

4.4 Per-household savings and total program savings

Table 16 provides the final per-household kWh savings for the MCE HUR program. The unadjusted electric savings for HUR-3 are statistically significantly different from zero while the unadjusted results for the rest of the waves are not. The overall 2015 program savings are positive, but not statistically significant at the 90% confidence interval.

Table 15. kWh savings per household and percent savings

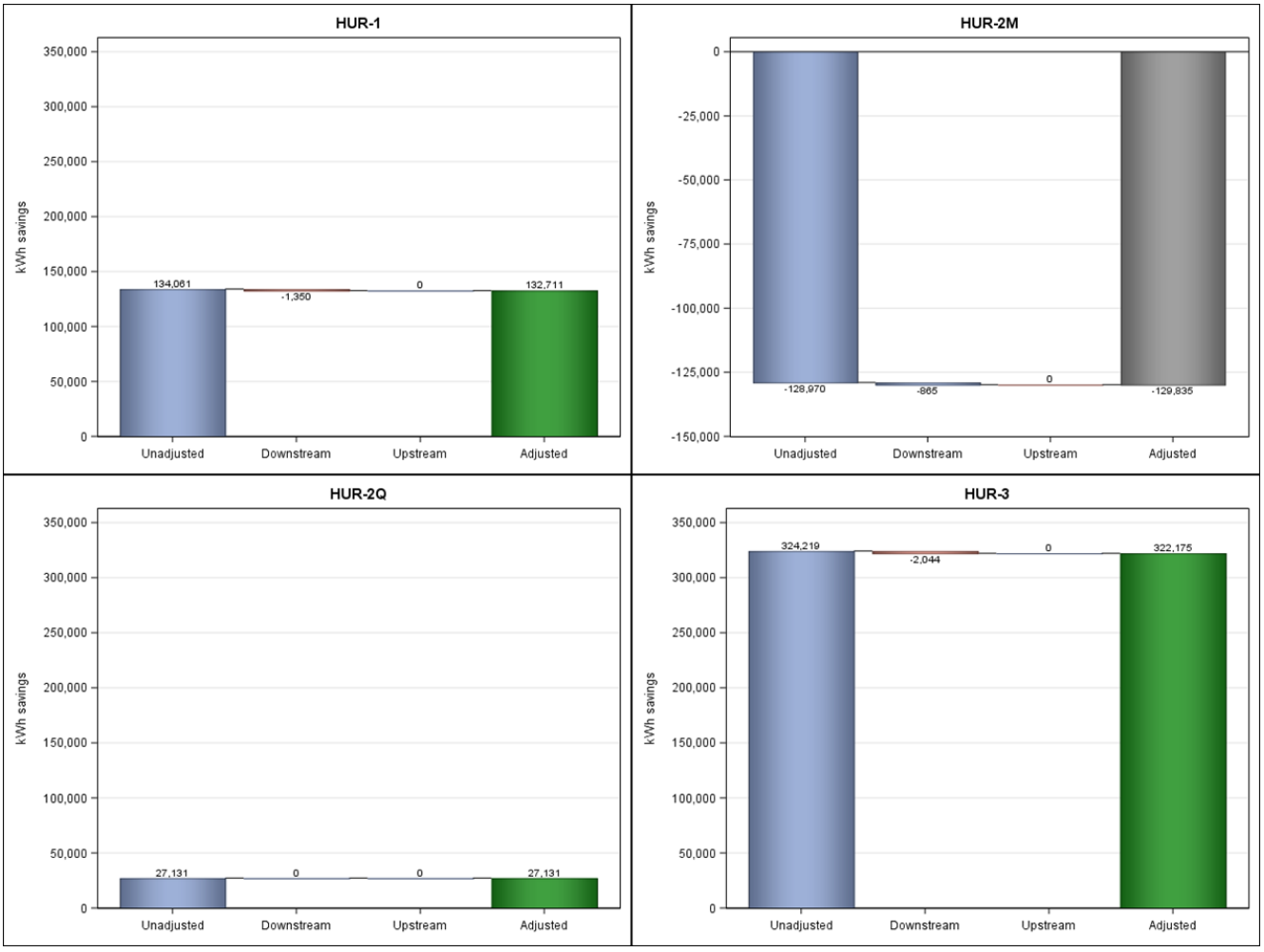
Wave	Unadjusted kWh per Customer Savings	Adjusted kWh per Customer Savings	Unadjusted Savings as % of Consumption	Adjusted Savings as % of Consumption	Statistically Significant with 90% confidence?
HUR-1	40.1	35.2	0.4%	0.4%	No
HUR-2M	-22.1	-25.1	-0.4%	-0.5%	No
HUR-2Q	4.3	4.3	0.1%	0.1%	No
HUR-3	84.2	83.7	1.1%	1.1%	Yes

Appendix C provides the unadjusted program savings, joint savings from downstream and upstream program and adjusted program savings at the monthly level for each of the wave. The total adjusted savings are calculated by multiplying the monthly savings estimates per household with the no. of households in the treatment group in each month.

Figure 10 presents the total unadjusted savings, joint savings and adjusted savings estimates for the different HUR waves. The electric savings are adjusted with joint savings despite lack of statistical

significance to provide the most conservative savings estimates that are free of potentially double counted savings.

Figure 10. Total unadjusted and adjusted kWh savings by wave

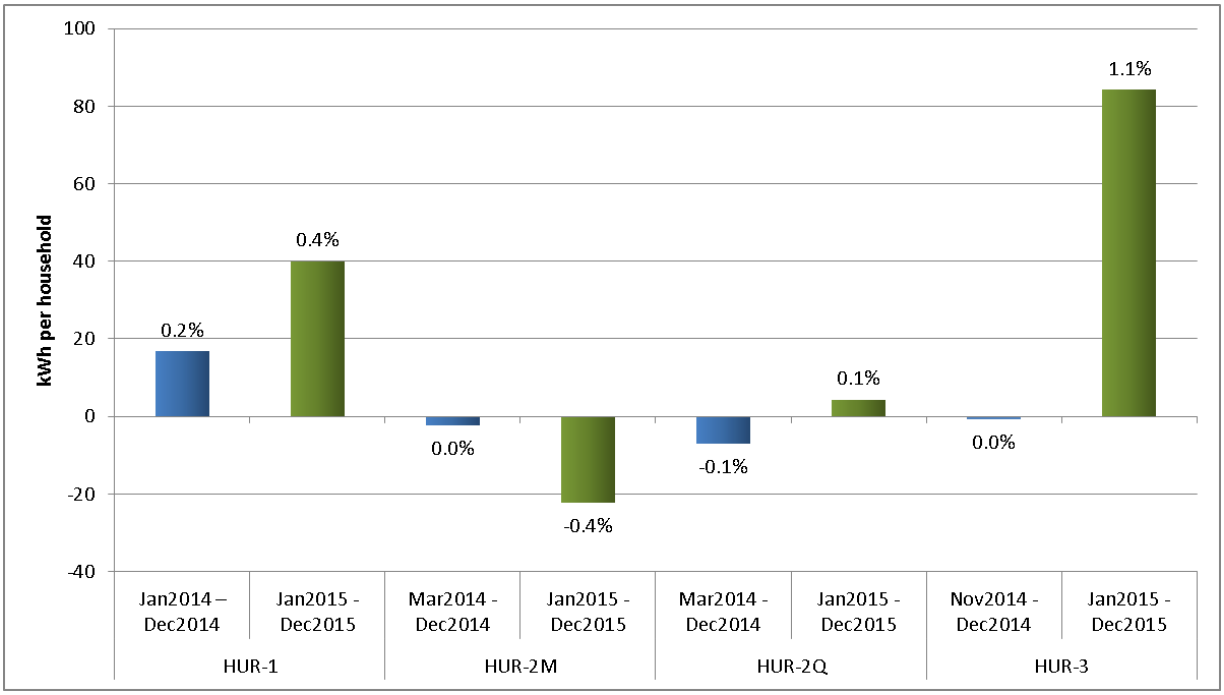


The treatment groups for HUR-1, HUR-2M and HUR-3 produced more rebate savings than their corresponding control groups and savings from these waves are adjusted with downstream joint savings to avoid potential double counting of savings. For HUR-2Q, the control group's rebate savings are larger than the treatment group and therefore we did not apply any joint savings adjustment.

For upstream joint savings, DNV GL did not produce upstream joint savings estimate for HUR-1 and HUR-2 because of the limited program savings produced by these waves. For HUR-3, we did not find any evidence of upstream joint savings and only downstream joint savings are used to calculate the adjusted electric savings.

Figure 11 presents a comparison of the kWh savings in 2014 and 2015 for the HUR program. HUR-1 savings increased to 0.4% from 0.2% in 2014 while savings from HUR-2 are effectively zero in both years. HUR-3 produced the highest savings amounting to 1% electric savings.

Figure 11. Unadjusted kWh savings and percent kWh savings, 2014-2015



*denotes statistically significant at the 90% confidence level.

4.5 Demand savings

DNV GL estimated peak demand savings attributable to the HUR program using a difference-in-differences. Hourly demand data and weather data were used in this analysis.

4.5.1 Heat waves by climate zone

DNV GL established pre- and post-period heat waves using PG&E hourly temperature data from weather stations across the PG&E service territory from January 1, 2013 to December 31, 2015. DNV GL identified peak periods using the DEER peak definition as defined in the methodology section. Heatwaves were assessed for each of the climate zones and the heatwave from the climate zone that had the highest number of control and treatment households was selected.

The HUR participants were more or less split between climate zones 2 and 3. The 2015 heat waves identified for these two climate zones fell on September 8-10, 2015. For the pre-period, we identified July 1-3, 2013 and July 23-25, 2014 as the peak period in 2013 and 2014 respectively. Table 18 provides the final set of peak heat waves identified for the HUR program.

Table 16. DEER defined heatwaves for HUR program

Program / Wave	Period	DEER Heatwave
HUR-1	Pre	7/01/2013 - 7/03/2013
	Post	9/08/2015 - 9/10/2015
HUR-2	Pre	7/01/2013 - 7/03/2013
	Post	9/08/2015 - 9/10/2015
HUR-3	Pre	7/23/2014 - 7/25/2014
	Post	9/08/2015 - 9/10/2015

4.5.2 Peak demand reductions

DNV GL calculated per household demand reductions across each hour of the most common three-day heat wave. The household-level estimate of kW reduction was calculated as the difference between the change in the demand of the treatment and the control groups from pre- to post-periods.

Table 19 provides the average demand based on the most common heat wave and Table 20 presents the average demand savings due to the HUR program. Based on the results, the waves that targeted the top usage quintiles has the highest level of demand changes. However, demand savings estimates are either negative and/or not statistically significant. These results suggest that the program did not cause households to reduce their load at the identified peak period.

Table 17. Average kW savings in the pre- and post-periods

Program / Wave	Group	Average kW per household in pre-period	Average kW per household in post-period
HUR-1	Treatment	1.84	1.83
	Control	1.77	1.70
HUR-2M	Treatment	0.68	0.71
	Control	0.69	0.73
HUR-2Q	Treatment	0.69	0.72
	Control	0.69	0.73
HUR-3	Treatment	0.95	1.06
	Control	0.96	1.04

Table 18. Overall kW savings

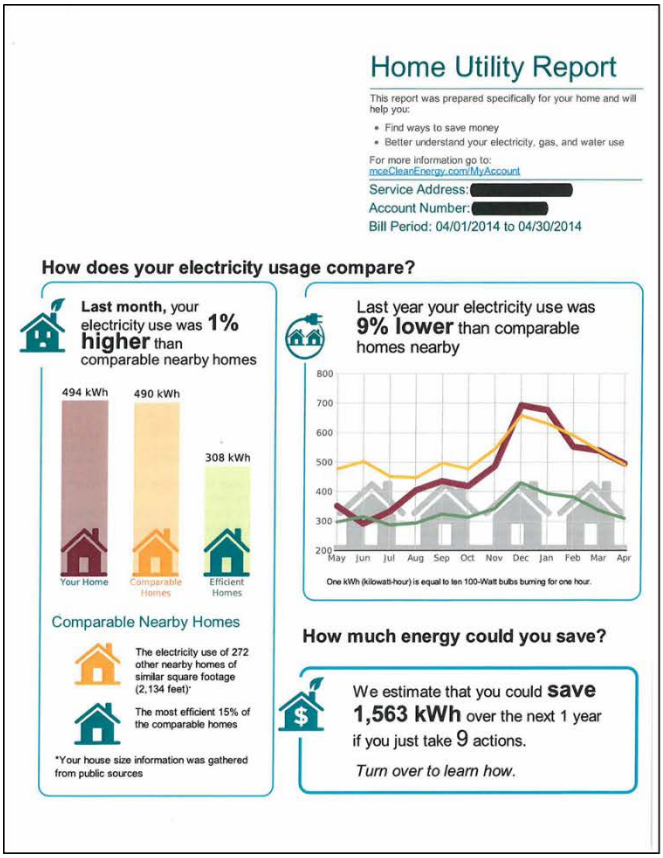
Program / Wave	kW Savings (Difference-in-differences)	+/- kW Savings at the 90% confidence level
HUR-1	-0.07*	0.05
HUR-2M	-0.02	0.04
HUR-2Q	0.01	0.02
HUR-3	-0.02	0.04

*denotes statistically significant at 90% confidence interval

5 CONCLUSIONS

This evaluation finds electric savings of about 1% for HUR-3, but not for the first two waves. While there are savings in HUR-3, the total program savings from all the experimental waves are positive, but not statistically significantly different from zero for program year 2015. Furthermore, this evaluation did not find statistically significant peak load reductions. These findings are definitive given the experimental design within which the program was organized, and the standards set by the CPUC for the evaluation of these programs.

APPENDIX A. SAMPLE HOME UTILITY REPORT



Home Utility Report

This report was prepared specifically for your home and will help you:

- Find ways to save money
- Better understand your electricity, gas, and water use

For more information go to:
mceCleanEnergy.com/MyAccount

Service Address: [redacted]
Account Number: [redacted]
Bill Period: 04/01/2014 to 04/30/2014

How does your electricity usage compare?

Last month, your electricity use was **1% higher** than comparable nearby homes

494 kWh | 490 kWh | 308 kWh

Your Home | Comparable Homes | Efficient Homes

Comparable Nearby Homes

The electricity use of 272 other nearby homes of similar square footage (2,134 feet)*

The most efficient 15% of the comparable homes

*Your house size information was gathered from public sources

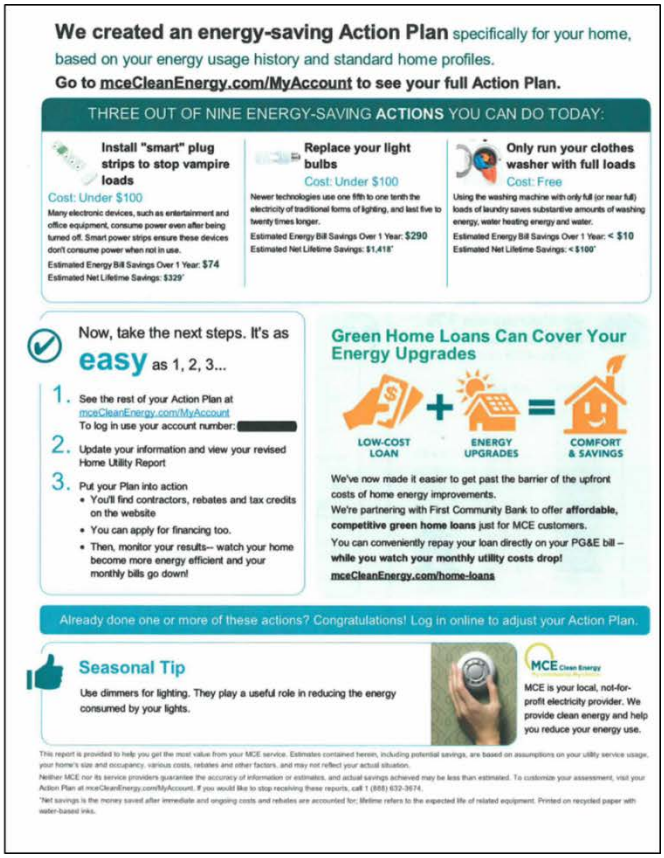
Last year your electricity use was **9% lower** than comparable homes nearby

One kWh (kilowatt-hour) is equal to ten 100-Watt bulbs burning for one hour.

How much energy could you save?

We estimate that you could **save 1,563 kWh** over the next 1 year if you just take 9 actions.

Turn over to learn how.



We created an energy-saving Action Plan specifically for your home, based on your energy usage history and standard home profiles.

Go to mceCleanEnergy.com/MyAccount to see your full Action Plan.

THREE OUT OF NINE ENERGY-SAVING **ACTIONS** YOU CAN DO TODAY:

Install "smart" plug strips to stop vampire loads
Cost: Under $100
Many electronic devices, such as entertainment and office equipment, consume power even after being turned off. Smart power strips ensure these devices don't consume power when not in use.
Estimated Energy Bill Savings Over 1 Year: $74
Estimated Net Lifetime Savings: $329*

Replace your light bulbs
Cost: Under $100
Newer technologies use one fifth to one tenth the electricity of traditional forms of lighting, and last five to twenty times longer.
Estimated Energy Bill Savings Over 1 Year: $290
Estimated Net Lifetime Savings: $1,418*

Only run your clothes washer with full loads
Cost: Free
Using the washing machine with only full (or near full) loads of laundry saves substantive amounts of washing energy, water heating energy and water.
Estimated Energy Bill Savings Over 1 Year: < $10
Estimated Net Lifetime Savings: < $100*

Now, take the next steps. It's as **easy** as 1, 2, 3...

1. See the rest of your Action Plan at mceCleanEnergy.com/MyAccount
   To log in use your account number: [redacted]
2. Update your information and view your revised Home Utility Report
3. Put your Plan into action
   - You'll find contractors, rebates and tax credits on the website
   - You can apply for financing too.
   - Then, monitor your results-- watch your home become more energy efficient and your monthly bills go down!

Green Home Loans Can Cover Your Energy Upgrades

LOW-COST LOAN + ENERGY UPGRADES = COMFORT & SAVINGS

We've now made it easier to get past the barrier of the upfront costs of home energy improvements.
We're partnering with First Community Bank to offer **affordable, competitive green home loans** just for MCE customers.
You can conveniently repay your loan directly on your PG&E bill – **while you watch your monthly utility costs drop!**
mceCleanEnergy.com/home-loans

Already done one or more of these actions? Congratulations! Log in online to adjust your Action Plan.

Seasonal Tip

Use dimmers for lighting. They play a useful role in reducing the energy consumed by your lights.

MCE Clean Energy

MCE is your local, not-for-profit electricity provider. We provide clean energy and help you reduce your energy use.

This report is provided to help you get the most value from your MCE service. Estimates contained herein, including potential savings, are based on assumptions on your utility service usage, your home's size and occupancy, various costs, rebates and other factors, and may not reflect your actual situation.
Neither MCE nor its service providers guarantee the accuracy of information or estimates, and actual savings achieved may be less than estimated. To customize your assessment, visit your Action Plan at mceCleanEnergy.com/MyAccount. If you would like to stop receiving these reports, call 1 (888) 632-3674.
*Net savings is the money saved after immediate and ongoing costs and rebates are accounted for; lifetime refers to the expected life of related equipment. Printed on recycled paper with water-based inks.

APPENDIX B. RANDOMIZATION TESTS

This section presents DNV GL's review of the randomization process followed for the HUR program.

5.1 Random allocation process

MCE randomly assigned all three HUR waves to treatment and control groups with no additional stratification. After finalizing the HUR-1 selection, the treatment and control groups were substantially unbalanced. As a result, for HUR-2 and HUR-3 waves, MCE repeated the random selection process several times until the treatment and control groups for both waves demonstrated balance among available parameters.

This situation reflects an ongoing experience in the area of behavioral programs, and represents a cautionary tale. While the savings estimation techniques will control for mean differences across the treatment and control samples (as with HUR-1), a balanced set of treatment and control groups is desirable. The solution to this problem, however, is not multiple random allocations to find a suitable balance.[7] The preferred approach is to use the available data to stratify the population and perform the random allocation within those strata. Taking this approach greatly increases the likelihood that the overall allocation will be balanced with respect to all or most characteristics, and makes it more likely that the samples will be amenable to analysis by subsets defined by those characteristics.

As part of this evaluation, DNV GL reviewed the experimental design of the HUR program to ensure validity of this impact evaluation. Statistical t-tests were applied by testing pre-existing differences in energy consumption and household characteristics between the treatment and control groups. Results from the t-tests are presented for each wave.

5.2 HUR-1 wave

Figure 10 shows the monthly difference in electric consumption between the treatment and control groups, along with the upper and lower limits at a 90% confidence interval. Differences greater than zero indicate higher consumption by the treatment group. Results show that electric consumption of the treatment group is significantly higher relative to the control group. These results confirm that the treatment and control groups are unbalanced. The fact that the two samples are substantially more different during the winter months is important. The savings estimation approach used for this evaluation corrects for mean differences across the whole pre-report period, not individual monthly differences. On an annual basis, the model used in savings estimation produce unbiased savings.

[7] The SEEAction Report does put this method forward as an option, though in subsequent protocols the authors have responded to feedback and changed this recommendation. Citation in subsequent footnote.

Figure 12. Electric consumption differences between treatment and control, HUR-1

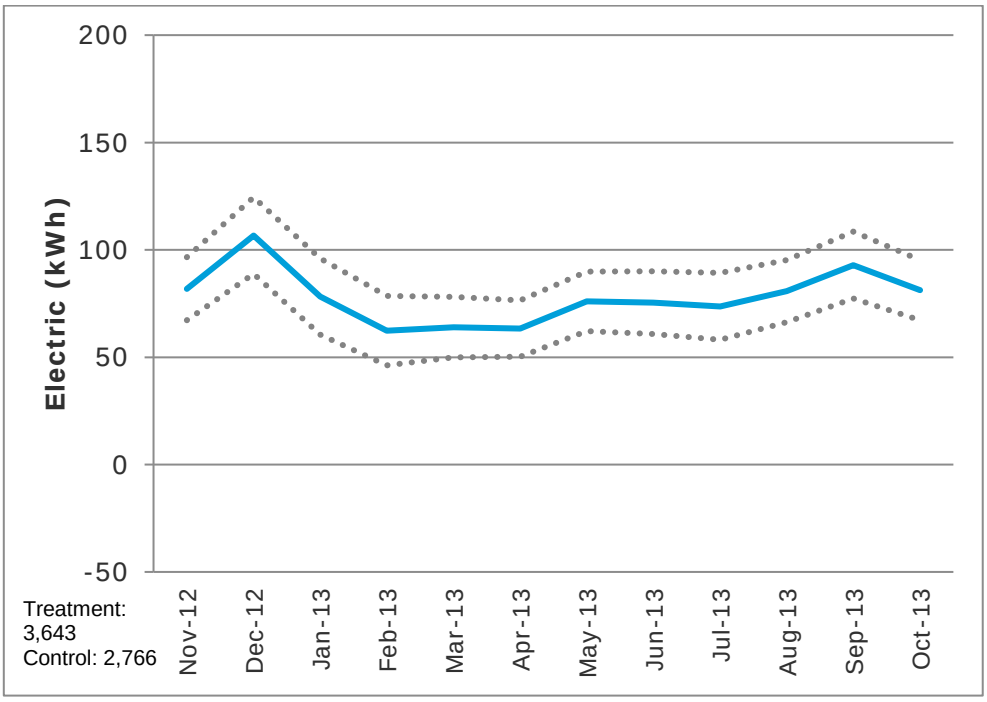


Table 22 provides a comparison of different household characteristics between the treatment and control groups. The test of differences also showed statistically significant differences in several household characteristics between the treatment and control groups, such as number of bedrooms/bathrooms, number of adults, construction year, and house size.

Table 19. Differences in household characteristics between treatment and control, HUR-1

Characteristics	Treatment			Control			Treatment - Control		
	Count	Mean	Std Error	Count	Mean	Std Error	Difference	Std Error	Pr > |t|
No. of adults	3,442	2.43	0.02	2,609	2.54	0.02	0.1*	0.03	0.00
No. of bathrooms	3,447	2.61	0.01	2,610	2.47	0.01	-0.1*	0.01	0.00
No. of bedrooms	3,447	2.97	0.02	2,610	3.21	0.02	0.2*	0.03	0.00
No. of children	3,442	0.61	0.01	2,609	0.58	0.02	-0.03	0.02	0.21
House construction year	3,447	1965	0.35	2,610	1962	0.41	-2.9*	0.53	0.00
No. of occupants	3,447	1.72	0.01	2,610	1.74	0.01	0.02	0.02	0.22
House square footage	3,447	2,307	12.87	2,610	2,062	12.68	-245.6*	18.45	0.00

**Statistically significant at 90% confidence level*

Results from the randomization tests for the HUR-1 wave suggest that, on the average, households in the treatment group use 9% more electricity and 13% more gas relative to the control group. Also, households in the treatment group have relatively larger and newer homes. On the other hand, the treatment group also has fewer adults and a house with fewer bedrooms. While it is unfortunate that the sample is not balanced in many aspects, using the pooled fixed effects model with a difference-in-differences structure to

estimate savings should control for pre-existing differences between the treatment and control groups with respect to consumption and any unobserved heterogeneity across households that are fixed over time.

5.3 HUR-2 wave

Figure 11 and Figure 12 show the results from the randomization test on consumption for the HUR-2M and the HUR-2Q waves. Consumption differences in all months are not statistically significantly different than zero. HUR-2M and HUR-2Q pre-period energy consumptions are balanced between the treatment and control groups.

Figure 13. Electric consumption differences between treatment and control, HUR-2M

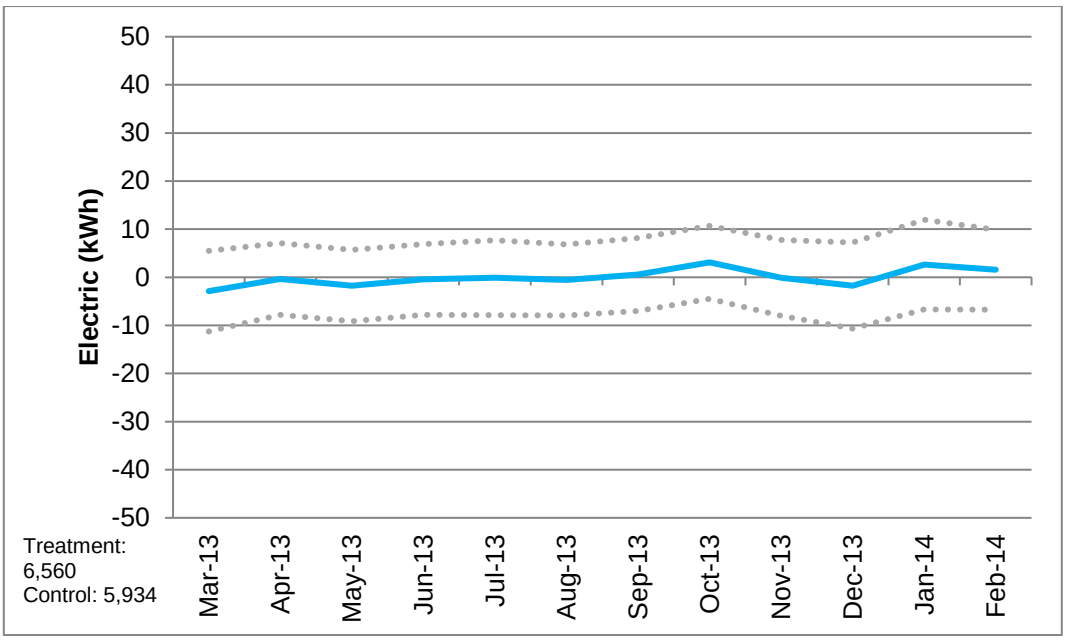


Figure 14. Electric consumption differences between treatment and control, HUR-2Q

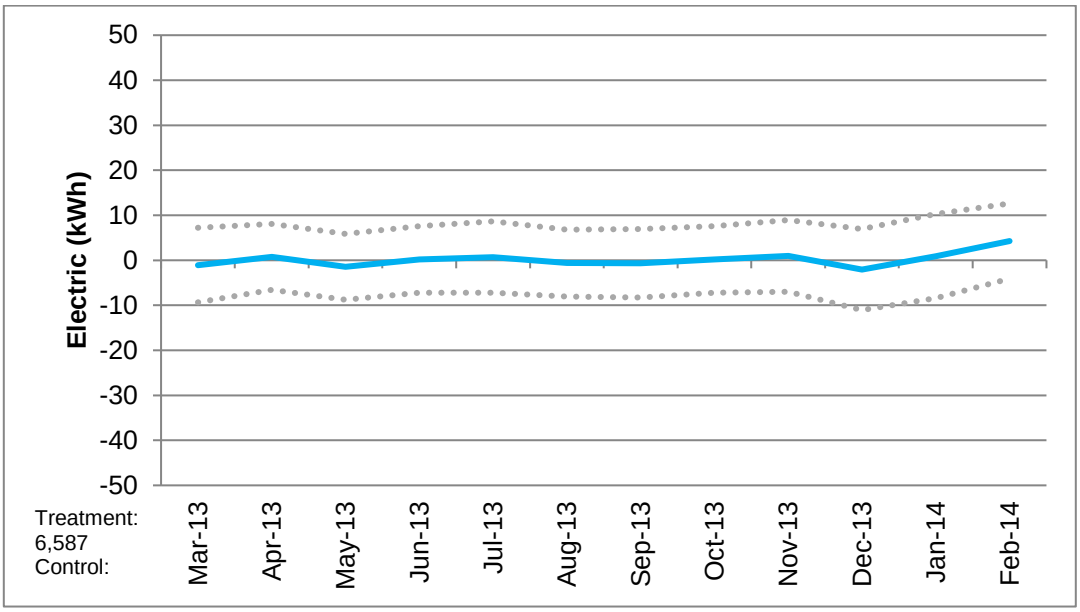


Table 23 and Table 24 provide the comparisons of household characteristics for HUR-2 standard (HUR-2M) and HUR-2 reduced (HUR-2Q) frequencies. Despite the fact that samples were chosen using multiple "random" assignments, the results show small but statistically significant differences in some household characteristics between the treatment and control groups for HUR-2M and HUR-2Q. The observed imbalance in household characteristics for the HUR-2 wave is not expected to bias results produced in this evaluation for the same reasons stated above.

Table 20. Differences in household characteristics between treatment and control, HUR-2M

Characteristics	Treatment			Control			Treatment – Control		
	Count	Mean	Std Error	Count	Mean	Std Error	Difference	Std Error	Pr > |t|
No. of adults	6,340	2.10	0.01	5,736	2.09	0.01	-0.01	0.02	0.78
No. of bathrooms	6,347	2.26	0.01	5,746	2.24	0.01	-0.02*	0.01	0.02
No. of bedrooms	6,347	2.07	0.02	5,746	2.07	0.02	0.00	0.02	0.86
No. of children	6,340	0.44	0.01	5,736	0.45	0.01	0.02	0.01	0.25
House construction year	6,347	1959	0.53	5,746	1958	0.58	-0.7	0.79	0.40
No. of occupants	6,347	1.71	0.01	5,746	1.70	0.01	-0.02	0.01	0.12
House square footage	6,347	1,688	8.97	5,746	1,664	9.20	-24.6*	12.86	0.05

**Statistically significant at 90% confidence level*

Table 21. Differences in household characteristics between treatment and control, HUR-2Q

Characteristics	Treatment			Control			Treatment - Control		
	Count	Mean	Std Error	Count	Mean	Std Error	Difference	Std Error	Pr > |t|
No. of adults	6,362	2.09	0.01	5,736	2.09	0.01	0.00	0.02	0.96
No. of bathrooms	6,372	2.26	0.01	5,746	2.24	0.01	-0.02*	0.01	0.01
No. of bedrooms	6,372	2.14	0.02	5,746	2.07	0.02	-0.06*	0.02	0.01
No. of children	6,362	0.42	0.01	5,736	0.45	0.01	0.03*	0.01	0.03
House construction year	6,372	1960	0.30	5,746	1958	0.58	-1.4*	0.63	0.03
No. of occupants	6,372	1.70	0.01	5,746	1.70	0.01	0.00	0.01	0.97
House square footage	6,372	1,705	9.04	5,746	1,664	9.20	-41.1*	12.92	0.00

**Statistically significant at 90% confidence level*

5.4 HUR-3 wave

Figure 13 shows the results from the randomization test on energy consumption for the HUR-3 wave, and Table 25 provides a comparison of household characteristics between the treatment and control groups. Results show that electric consumption for each month in the pre-period are similar, and only one out of the seven household characteristics had significant differences between treatment and control groups.

Figure 15. Electric consumption differences between treatment and control, HUR-3

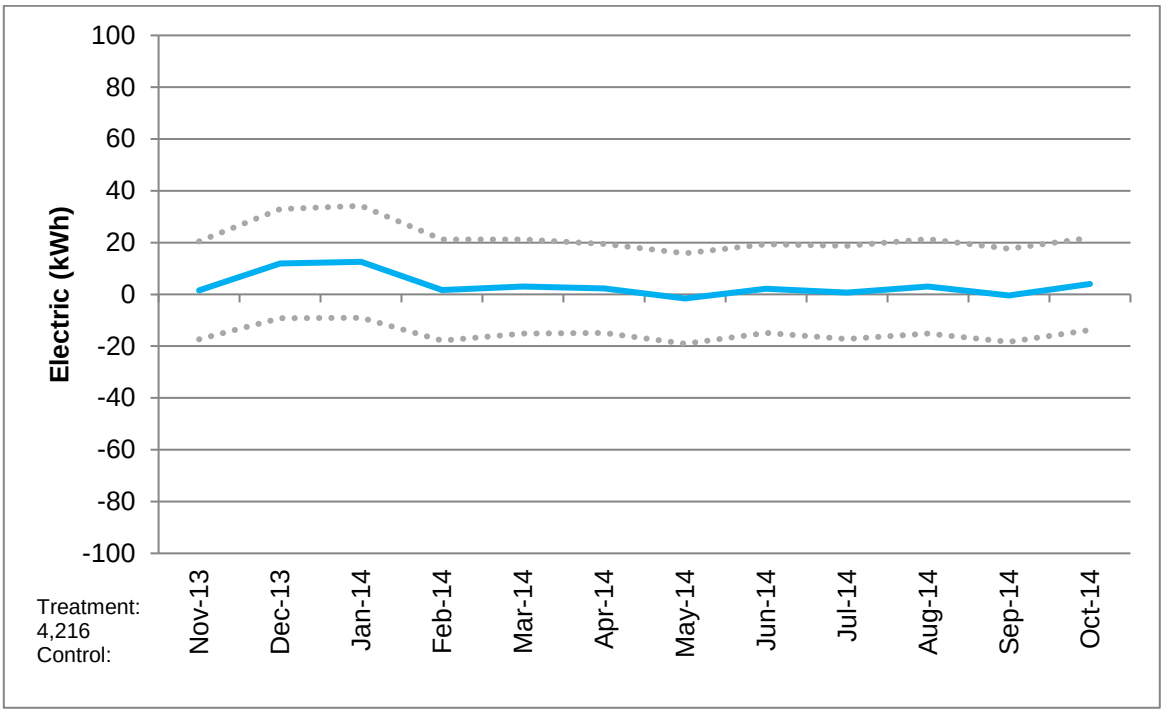


Table 22. Differences in household characteristics between treatment and control, HUR-3

Characteristics	Treatment			Control			Treatment - Control		
	Count	Mean	Std Error	Count	Mean	Std Error	Difference	Std Error	Pr > |t|
No. of adults	3,929	2.11	0.02	1,968	2.07	0.02	-0.04	0.03	0.15
No. of bathrooms	4,044	2.19	0.01	2,016	2.16	0.01	-0.02	0.02	0.16
No. of bedrooms	4,044	2.40	0.02	2,016	2.35	0.03	-0.05	0.03	0.14
No. of children	3,929	0.41	0.01	1,968	0.38	0.02	-0.03	0.02	0.18
House construction year	4,044	1957	0.78	2,016	1958	0.53	1.01	1.17	0.39
No. of occupants	4,044	1.70	0.01	2,016	1.70	0.01	-0.01	0.02	0.65
House square footage	4,044	1,669	11.59	2,016	1,622	15.85	-46.97	19.87	0.02

**Statistically significant at 90% confidence level*

APPENDIX C. COMBINED RESULTS

The tables in this appendix provide the monthly unadjusted, downstream, and adjusted savings for each wave of the 2015 HUR programs.

Table 23. Combined results for HUR-1 kWh savings

Month	kWh per Household				Count of Treatment Group Participants	Adjusted Program Savings (MWh)
	Unadjusted Savings	Joint Savings - Downstream	Joint Savings - Upstream	Adjusted Savings		
Jan-15	3.8	0.1	-	3.7	3,350	12
Feb-15	8.8	0.1	-	8.6	3,335	29
Mar-15	8.9	0.1	-	8.8	3,324	29
Apr-15	8.0	0.1	-	7.9	3,303	26
May-15	7.6	0.1	-	7.5	3,281	25
Jun-15	4.3	0.0	-	4.2	3,259	14
Jul-15	13.5	(0.0)	-	13.5	3,231	44
Aug-15	1.4	0.1	-	1.4	3,198	4
Sep-15	(5.3)	0.0	-	(5.3)	3,166	(17)
Oct-15	0.5	(0.0)	-	0.5	3,151	2
Nov-15	(4.4)	(0.1)	-	(4.3)	3,139	(14)
Dec-15	(6.9)	(0.1)	-	(6.8)	3,127	(21)
Total	**40.1**	**0.4**	**-**	**39.7**		**132.7**

Table 24. Combined results for HUR-2M kWh savings

Month	kWh per Household				Count of Treatment Group Participants	Adjusted Program Savings (MWh)
	Unadjusted Savings	Joint Savings - Downstream	Joint Savings - Upstream	Adjusted Savings		
Jan-15	1.9	0.0	-	1.9	6,218	12
Feb-15	5.0	(0.0)	-	5.0	6,191	31
Mar-15	1.2	0.0	-	1.2	6,162	8
Apr-15	(1.1)	0.0	-	(1.2)	6,124	(7)
May-15	(2.4)	0.0	-	(2.5)	6,088	(15)
Jun-15	(2.3)	(0.0)	-	(2.3)	6,047	(14)
Jul-15	(1.8)	(0.0)	-	(1.7)	6,008	(10)
Aug-15	(5.4)	0.0	-	(5.4)	5,952	(32)
Sep-15	(5.9)	0.0	-	(5.9)	5,903	(35)
Oct-15	(8.3)	0.1	-	(8.3)	5,863	(49)
Nov-15	(3.5)	0.1	-	(3.5)	5,828	(20)
Dec-15	0.6	0.1	-	0.5	5,793	3
Total	**(22.1)**	**0.2**	**-**	**(22.2)**		**(129.8)**

Table 25. Combined results for HUR-2Q kWh savings

Month	kWh per Household				Count of Treatment Group Participants	Adjusted Program Savings (MWh)
	Unadjusted Savings	Joint Savings - Downstream	Joint Savings - Upstream	Adjusted Savings		
Jan-15	2.4	0.02	-	2.4	6,175	15
Feb-15	1.5	(0.00)	-	1.5	6,138	9
Mar-15	1.3	0.01	-	1.3	6,117	8
Apr-15	(1.6)	(0.01)	-	(1.6)	6,094	(10)
May-15	0.7	(0.01)	-	0.7	6,048	4
Jun-15	2.3	(0.04)	-	2.3	6,007	14
Jul-15	2.2	(0.12)	-	2.2	5,950	13
Aug-15	(0.2)	(0.11)	-	(0.2)	5,905	(1)
Sep-15	(1.2)	(0.05)	-	(1.2)	5,853	(7)
Oct-15	(2.7)	(0.01)	-	(2.7)	5,816	(16)
Nov-15	(1.5)	(0.03)	-	(1.5)	5,779	(9)
Dec-15	1.3	(0.04)	-	1.3	5,735	7
Total	**4.3**	**(0.4)**	**-**	**4.3**		**27.1**

Table 26. Combined results for HUR-3 kWh savings

Month	kWh per Household				Count of Treatment Group Participants	Adjusted Program Savings (MWh)
	Unadjusted Savings	Joint Savings - Downstream	Joint Savings - Upstream	Adjusted Savings		
Jan-15	(4.9)	0.0	(0.0)	(4.9)	4,060	(20)
Feb-15	6.1	0.0	(0.0)	6.0	4,032	24
Mar-15	10.5	(0.0)	(0.0)	10.6	4,005	42
Apr-15	11.3	(0.0)	(0.0)	11.4	3,974	45
May-15	5.0	0.0	(0.0)	4.9	3,946	19
Jun-15	6.6	0.1	(0.0)	6.5	3,912	26
Jul-15	8.9	0.1	(0.0)	8.8	3,872	34
Aug-15	2.0	0.1	(0.0)	1.9	3,830	7
Sep-15	4.1	0.1	(0.0)	4.0	3,793	15
Oct-15	10.6	0.1	(0.0)	10.6	3,756	40
Nov-15	12.8	(0.0)	(0.0)	12.8	3,733	48
Dec-15	11.2	0.0	(0.0)	11.1	3,714	41
Total	**84.2**	**0.5**	**(0.2)**	**83.7**		**322.2**

Appendix AA. Standardized High Level Savings

The tables in Appendix AA summarizing natural gas savings make use of the unit MTherms – 1,000 Therms – rather than MMTherms – 1,000,000 Therms – for formatting purposes.

Gross Lifecycle Savings (MWh)

Report Name	PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
RES_3_1_2015_PGE_HER	PGE	Home Energy Reports	116,439[a]	138,588	1.19	0.0%	1.19
RES_3_1_2015_PGE_HER	**PGE**	**Total**	**116,439**	**138,588**	**1.19**	**0.0%**	**1.19**
RES_3_1_2015_PGE_HER		***Statewide***	***116,439***	***138,588***	***1.19***	***0.0%***	***1.19***
RES_3_2_2015_SCE_HER	SCE	Home Energy Reports	4,565	4,796	1.05	0.0%	1.05
RES_3_2_2015_SCE_HER	**SCE**	**Total**	**4,565**	**4,796**	**1.05**	**0.0%**	**1.05**
RES_3_2_2015_SCE_HER		***Statewide***	***4,565***	***4,796***	***1.05***	***0.0%***	***1.05***
RES_3_3_2015_SDGE_HER	SDGE	Home Energy Reports	0	5,658			
RES_3_3_2015_SDGE_HER	SDGE	Manage Act Save	0	5,531			
RES_3_3_2015_SDGE_HER	**SDGE**	**Total**	**0**	**11,189**			
RES_3_3_2015_SDGE_HER		***Statewide***	***0***	***11,189***			
RES_3_4_2015_MCE_HUR	MCE	Home Utility Reports	0	0			
RES_3_4_2015_MCE_HUR	**MCE**	**Total**	**0**	**0**			
RES_3_4_2015_MCE_HUR		***Statewide***	***0***	***0***			

[a] *The ExAnte savings represent savings claimed by PG&E.*

Net Lifecycle Savings (MWh)

Report Name	PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
RES_3_1_2015_PGE_HER	PGE	Home Energy Reports	116,439[a]	138,588	1.19	0.0%	1.00	1.00	1.00	1.00
RES_3_1_2015_PGE_HER	**PGE**	**Total**	**116,439**	**138,588**	**1.19**	**0.0%**	**1.00**	**1.00**	**1.00**	**1.00**
RES_3_1_2015_PGE_HER		***Statewide***	***116,439***	***138,588***	***1.19***	***0.0%***	***1.00***	***1.00***	***1.00***	***1.00***
RES_3_2_2015_SCE_HER	SCE	Home Energy Reports	4,565	4,796	1.05	0.0%	1.00	1.00	1.00	1.00
RES_3_2_2015_SCE_HER	**SCE**	**Total**	**4,565**	**4,796**	**1.05**	**0.0%**	**1.00**	**1.00**	**1.00**	**1.00**
RES_3_2_2015_SCE_HER		***Statewide***	***4,565***	***4,796***	***1.05***	***0.0%***	***1.00***	***1.00***	***1.00***	***1.00***
RES_3_3_2015_SDGE_HER	SDGE	Home Energy Reports	0	5,658				1.00		1.00
RES_3_3_2015_SDGE_HER	SDGE	Manage Act Save	0	5,531				1.00		1.00
RES_3_3_2015_SDGE_HER	**SDGE**	**Total**	**0**	**11,189**				**1.00**		**1.00**
RES_3_3_2015_SDGE_HER		***Statewide***	***0***	***11,189***				***1.00***		***1.00***
RES_3_4_2015_MCE_HUR	MCE	Home Utility Reports	0	0						
RES_3_4_2015_MCE_HUR	**MCE**	**Total**	**0**	**0**						
RES_3_4_2015_MCE_HUR		***Statewide***	***0***	***0***						

[a]*The ExAnte savings represent savings claimed by PG&E.*

Gross Lifecycle Savings (MW)

Report Name	PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
RES_3_1_2015_PGE_HER	PGE	Home Energy Reports	20.0[a]	27.3	1.36	0.0%	1.36
RES_3_1_2015_PGE_HER	**PGE**	**Total**	**20.0**	**27.3**	**1.36**	**0.0%**	**1.36**
RES_3_1_2015_PGE_HER		***Statewide***	***20.0***	***27.3***	***1.36***	***0.0%***	***1.36***
RES_3_2_2015_SCE_HER	SCE	Home Energy Reports	0.7	0.7	1.02	0.0%	1.02
RES_3_2_2015_SCE_HER	**SCE**	**Total**	**0.7**	**0.7**	**1.02**	**0.0%**	**1.02**
RES_3_2_2015_SCE_HER		***Statewide***	***0.7***	***0.7***	***1.02***	***0.0%***	***1.02***
RES_3_3_2015_SDGE_HER	SDGE	Home Energy Reports	0.0	1.4			
RES_3_3_2015_SDGE_HER	SDGE	Manage Act Save	0.0	0.0			
RES_3_3_2015_SDGE_HER	**SDGE**	**Total**	**0.0**	**1.4**			
RES_3_3_2015_SDGE_HER		***Statewide***	***0.0***	***1.4***			
RES_3_4_2015_MCE_HUR	MCE	Home Utility Reports	0.0	0.0			
RES_3_4_2015_MCE_HUR	**MCE**	**Total**	**0.0**	**0.0**			
RES_3_4_2015_MCE_HUR		***Statewide***	***0.0***	***0.0***			

[a]The ExAnte savings represent savings claimed by PG&E.

Net Lifecycle Savings (MW)

Report Name	PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
RES_3_1_2015_PGE_HER	PGE	Home Energy Reports	20.0[a]	27.3	1.36	0.0%	1.00	1.00	1.00	1.00
RES_3_1_2015_PGE_HER	**PGE**	**Total**	**20.0**	**27.3**	**1.36**	**0.0%**	**1.00**	**1.00**	**1.00**	**1.00**
RES_3_1_2015_PGE_HER		***Statewide***	***20.0***	***27.3***	***1.36***	***0.0%***	***1.00***	***1.00***	***1.00***	***1.00***
RES_3_2_2015_SCE_HER	SCE	Home Energy Reports	0.7	0.7	1.02	0.0%	1.00	1.00	1.00	1.00
RES_3_2_2015_SCE_HER	**SCE**	**Total**	**0.7**	**0.7**	**1.02**	**0.0%**	**1.00**	**1.00**	**1.00**	**1.00**
RES_3_2_2015_SCE_HER		***Statewide***	***0.7***	***0.7***	***1.02***	***0.0%***	***1.00***	***1.00***	***1.00***	***1.00***
RES_3_3_2015_SDGE_HER	SDGE	Home Energy Reports	0.0	1.4				1.00		1.00
RES_3_3_2015_SDGE_HER	SDGE	Manage Act Save	0.0	0.0						
RES_3_3_2015_SDGE_HER	**SDGE**	**Total**	**0.0**	**1.4**				**1.00**		**1.00**
RES_3_3_2015_SDGE_HER		***Statewide***	***0.0***	***1.4***				***1.00***		***1.00***
RES_3_4_2015_MCE_HUR	MCE	Home Utility Reports	0.0	0.0						
RES_3_4_2015_MCE_HUR	**MCE**	**Total**	**0.0**	**0.0**						
RES_3_4_2015_MCE_HUR		***Statewide***	***0.0***	***0.0***						

[a]The ExAnte savings represent savings claimed by PG&E.

Gross Lifecycle Savings (MTherms)

Report Name	PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
RES_3_1_2015_PGE_HER	PGE	Home Energy Reports	4,148[a]	4,691	1.13	0.0%	1.13
RES_3_1_2015_PGE_HER	**PGE**	**Total**	**4,148**	**4,691**	**1.13**	**0.0%**	**1.13**
RES_3_1_2015_PGE_HER		***Statewide***	***4,148***	***4,691***	***1.13***	***0.0%***	***1.13***
RES_3_2_2015_SCE_HER	SCE	Home Energy Reports	0	0			
RES_3_2_2015_SCE_HER	**SCE**	**Total**	**0**	**0**			
RES_3_2_2015_SCE_HER		***Statewide***	***0***	***0***			
RES_3_3_2015_SDGE_HER	SDGE	Home Energy Reports	0	130			
RES_3_3_2015_SDGE_HER	SDGE	Manage Act Save	0	271			
RES_3_3_2015_SDGE_HER	**SDGE**	**Total**	**0**	**401**			
RES_3_3_2015_SDGE_HER		***Statewide***	***0***	***401***			
RES_3_4_2015_MCE_HUR	MCE	Home Utility Reports	0	0			
RES_3_4_2015_MCE_HUR	**MCE**	**Total**	**0**	**0**			
RES_3_4_2015_MCE_HUR		***Statewide***	***0***	***0***			

[a]*The ExAnte savings represent savings claimed by PG&E.*

Net Lifecycle Savings (MTherms)

Report Name	PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
RES_3_1_2015_PGE_HER	PGE	Home Energy Reports	4,148[a]	4,691	1.13	0.0%	1.00	1.00	1.00	1.00
RES_3_1_2015_PGE_HER	**PGE**	**Total**	**4,148**	**4,691**	**1.13**	**0.0%**	**1.00**	**1.00**	**1.00**	**1.00**
RES_3_1_2015_PGE_HER		***Statewide***	***4,148***	***4,691***	***1.13***	***0.0%***	***1.00***	***1.00***	***1.00***	***1.00***
RES_3_2_2015_SCE_HER	SCE	Home Energy Reports	0	0						
RES_3_2_2015_SCE_HER	**SCE**	**Total**	**0**	**0**						
RES_3_2_2015_SCE_HER		***Statewide***	***0***	***0***						
RES_3_3_2015_SDGE_HER	SDGE	Home Energy Reports	0	130				1.00		1.00
RES_3_3_2015_SDGE_HER	SDGE	Manage Act Save	0	271				1.00		1.00
RES_3_3_2015_SDGE_HER	**SDGE**	**Total**	**0**	**401**				**1.00**		**1.00**
RES_3_3_2015_SDGE_HER		***Statewide***	***0***	***401***				***1.00***		***1.00***
RES_3_4_2015_MCE_HUR	MCE	Home Utility Reports	0	0						
RES_3_4_2015_MCE_HUR	**MCE**	**Total**	**0**	**0**						
RES_3_4_2015_MCE_HUR		***Statewide***	***0***	***0***						

[a]*The ExAnte savings represent savings claimed by PG&E.*

Gross First Year Savings (MWh)

Report Name	PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
RES_3_1_2015_PGE_HER	PGE	Home Energy Reports	116,439[a]	138,588	1.19	0.0%	1.19
RES_3_1_2015_PGE_HER	**PGE**	**Total**	**116,439**	**138,588**	**1.19**	**0.0%**	**1.19**
RES_3_1_2015_PGE_HER		***Statewide***	***116,439***	***138,588***	***1.19***	***0.0%***	***1.19***
RES_3_2_2015_SCE_HER	SCE	Home Energy Reports	4,565	4,796	1.05	0.0%	1.05
RES_3_2_2015_SCE_HER	**SCE**	**Total**	**4,565**	**4,796**	**1.05**	**0.0%**	**1.05**
RES_3_2_2015_SCE_HER		***Statewide***	***4,565***	***4,796***	***1.05***	***0.0%***	***1.05***
RES_3_3_2015_SDGE_HER	SDGE	Home Energy Reports	0	5,658			
RES_3_3_2015_SDGE_HER	SDGE	Manage Act Save	0	5,531			
RES_3_3_2015_SDGE_HER	**SDGE**	**Total**	**0**	**11,189**			
RES_3_3_2015_SDGE_HER		***Statewide***	***0***	***11,189***			
RES_3_4_2015_MCE_HUR	MCE	Home Utility Reports	0	0			
RES_3_4_2015_MCE_HUR	**MCE**	**Total**	**0**	**0**			
RES_3_4_2015_MCE_HUR		***Statewide***	***0***	***0***			

[a]*The ExAnte savings represent savings claimed by PG&E.*

Net First Year Savings (MWh)

Report Name	PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
RES_3_1_2015_PGE_HER	PGE	Home Energy Reports	116,439[a]	138,588	1.19	0.0%	1.00	1.00	1.00	1.00
RES_3_1_2015_PGE_HER	**PGE**	**Total**	**116,439**	**138,588**	**1.19**	**0.0%**	**1.00**	**1.00**	**1.00**	**1.00**
RES_3_1_2015_PGE_HER		***Statewide***	***116,439***	***138,588***	***1.19***	***0.0%***	***1.00***	***1.00***	***1.00***	***1.00***
RES_3_2_2015_SCE_HER	SCE	Home Energy Reports	4,565	4,796	1.05	0.0%	1.00	1.00	1.00	1.00
RES_3_2_2015_SCE_HER	**SCE**	**Total**	**4,565**	**4,796**	**1.05**	**0.0%**	**1.00**	**1.00**	**1.00**	**1.00**
RES_3_2_2015_SCE_HER		***Statewide***	***4,565***	***4,796***	***1.05***	***0.0%***	***1.00***	***1.00***	***1.00***	***1.00***
RES_3_3_2015_SDGE_HER	SDGE	Home Energy Reports	0	5,658				1.00		1.00
RES_3_3_2015_SDGE_HER	SDGE	Manage Act Save	0	5,531				1.00		1.00
RES_3_3_2015_SDGE_HER	**SDGE**	**Total**	**0**	**11,189**				**1.00**		**1.00**
RES_3_3_2015_SDGE_HER		***Statewide***	***0***	***11,189***				***1.00***		***1.00***
RES_3_4_2015_MCE_HUR	MCE	Home Utility Reports	0	0						
RES_3_4_2015_MCE_HUR	**MCE**	**Total**	**0**	**0**						
RES_3_4_2015_MCE_HUR		***Statewide***	***0***	***0***						

[a]*The ExAnte savings represent savings claimed by PG&E.*

Gross First Year Savings (MW)

Report Name	PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
RES_3_1_2015_PGE_HER	PGE	Home Energy Reports	20.0[a]	27.3	1.36	0.0%	1.36
RES_3_1_2015_PGE_HER	**PGE**	**Total**	**20.0**	**27.3**	**1.36**	**0.0%**	**1.36**
RES_3_1_2015_PGE_HER		***Statewide***	***20.0***	***27.3***	***1.36***	***0.0%***	***1.36***
RES_3_2_2015_SCE_HER	SCE	Home Energy Reports	0.7	0.7	1.02	0.0%	1.02
RES_3_2_2015_SCE_HER	**SCE**	**Total**	**0.7**	**0.7**	**1.02**	**0.0%**	**1.02**
RES_3_2_2015_SCE_HER		***Statewide***	***0.7***	***0.7***	***1.02***	***0.0%***	***1.02***
RES_3_3_2015_SDGE_HER	SDGE	Home Energy Reports	0.0	1.4			
RES_3_3_2015_SDGE_HER	SDGE	Manage Act Save	0.0	0.0			
RES_3_3_2015_SDGE_HER	**SDGE**	**Total**	**0.0**	**1.4**			
RES_3_3_2015_SDGE_HER		***Statewide***	***0.0***	***1.4***			
RES_3_4_2015_MCE_HUR	MCE	Home Utility Reports	0.0	0.0			
RES_3_4_2015_MCE_HUR	**MCE**	**Total**	**0.0**	**0.0**			
RES_3_4_2015_MCE_HUR		***Statewide***	***0.0***	***0.0***			

[a]The ExAnte savings represent savings claimed by PG&E.

Net First Year Savings (MW)

Report Name	PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
RES_3_1_2015_PGE_HER	PGE	Home Energy Reports	20.0[a]	27.3	1.36	0.0%	1.00	1.00	1.00	1.00
RES_3_1_2015_PGE_HER	**PGE**	**Total**	**20.0**	**27.3**	**1.36**	**0.0%**	**1.00**	**1.00**	**1.00**	**1.00**
RES_3_1_2015_PGE_HER		***Statewide***	***20.0***	***27.3***	***1.36***	***0.0%***	***1.00***	***1.00***	***1.00***	***1.00***
RES_3_2_2015_SCE_HER	SCE	Home Energy Reports	0.7	0.7	1.02	0.0%	1.00	1.00	1.00	1.00
RES_3_2_2015_SCE_HER	**SCE**	**Total**	**0.7**	**0.7**	**1.02**	**0.0%**	**1.00**	**1.00**	**1.00**	**1.00**
RES_3_2_2015_SCE_HER		***Statewide***	***0.7***	***0.7***	***1.02***	***0.0%***	***1.00***	***1.00***	***1.00***	***1.00***
RES_3_3_2015_SDGE_HER	SDGE	Home Energy Reports	0.0	1.4				1.00		1.00
RES_3_3_2015_SDGE_HER	SDGE	Manage Act Save	0.0	0.0						
RES_3_3_2015_SDGE_HER	**SDGE**	**Total**	**0.0**	**1.4**				**1.00**		**1.00**
RES_3_3_2015_SDGE_HER		***Statewide***	***0.0***	***1.4***				***1.00***		***1.00***
RES_3_4_2015_MCE_HUR	MCE	Home Utility Reports	0.0	0.0						
RES_3_4_2015_MCE_HUR	**MCE**	**Total**	**0.0**	**0.0**						
RES_3_4_2015_MCE_HUR		***Statewide***	***0.0***	***0.0***						

[a]*The ExAnte savings represent savings claimed by PG&E.*

Gross First Year Savings (MTherms)

Report Name	PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
RES_3_1_2015_PGE_HER	PGE	Home Energy Reports	4,148[a]	4,691	1.13	0.0%	1.13
RES_3_1_2015_PGE_HER	**PGE**	**Total**	**4,148**	**4,691**	**1.13**	**0.0%**	**1.13**
RES_3_1_2015_PGE_HER		***Statewide***	***4,148***	***4,691***	***1.13***	***0.0%***	***1.13***
RES_3_2_2015_SCE_HER	SCE	Home Energy Reports	0	0			
RES_3_2_2015_SCE_HER	**SCE**	**Total**	**0**	**0**			
RES_3_2_2015_SCE_HER		***Statewide***	***0***	***0***			
RES_3_3_2015_SDGE_HER	SDGE	Home Energy Reports	0	130			
RES_3_3_2015_SDGE_HER	SDGE	Manage Act Save	0	271			
RES_3_3_2015_SDGE_HER	**SDGE**	**Total**	**0**	**401**			
RES_3_3_2015_SDGE_HER		***Statewide***	***0***	***401***			
RES_3_4_2015_MCE_HUR	MCE	Home Utility Reports	0	0			
RES_3_4_2015_MCE_HUR	**MCE**	**Total**	**0**	**0**			
RES_3_4_2015_MCE_HUR		***Statewide***	***0***	***0***			

[a]The ExAnte savings represent savings claimed by PG&E.

Net First Year Savings (MTherms)

Report Name	PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
RES_3_1_2015_PGE_HER	PGE	Home Energy Reports	4,148[a]	4,691	1.13	0.0%	1.00	1.00	1.00	1.00
RES_3_1_2015_PGE_HER	**PGE**	**Total**	**4,148**	**4,691**	**1.13**	**0.0%**	**1.00**	**1.00**	**1.00**	**1.00**
RES_3_1_2015_PGE_HER		***Statewide***	***4,148***	***4,691***	***1.13***	***0.0%***	***1.00***	***1.00***	***1.00***	***1.00***
RES_3_2_2015_SCE_HER	SCE	Home Energy Reports	0	0						
RES_3_2_2015_SCE_HER	**SCE**	**Total**	**0**	**0**						
RES_3_2_2015_SCE_HER		***Statewide***	***0***	***0***						
RES_3_3_2015_SDGE_HER	SDGE	Home Energy Reports	0	130				1.00		1.00
RES_3_3_2015_SDGE_HER	SDGE	Manage Act Save	0	271				1.00		1.00
RES_3_3_2015_SDGE_HER	**SDGE**	**Total**	**0**	**401**				**1.00**		**1.00**
RES_3_3_2015_SDGE_HER		***Statewide***	***0***	***401***				***1.00***		***1.00***
RES_3_4_2015_MCE_HUR	MCE	Home Utility Reports	0	0						
RES_3_4_2015_MCE_HUR	**MCE**	**Total**	**0**	**0**						
RES_3_4_2015_MCE_HUR		***Statewide***	***0***	***0***						

[a]The ExAnte savings represent savings claimed by PG&E.

Appendix AB. Standardized Per Unit Savings

NOT REPORTED

Appendix AC. Recommendations

Appendix AC: Recommendations

Study ID	Study Type	Study Title	Study Manager			
Res 3.4	Impact Evaluation	Impact Evaluation of 2015 Marin Clean Energy Home Utility Report Program	CPUC			
Recommendation	**Program or Database**	**Summary of Findings**	**Additional Supporting Information**	**Best Practice / Recommendations**	**Recommendation Recipient**	**Affected Workpaper or DEER**
1	HUR	MCE used simple random sampling to allocate customers in the treatment and control groups for HUR-1. HUR-1 showed substantial imbalance in baseline consumption and home characteristics between the treatment and control groups.	N/A	DNV GL recommends using stratified random sampling when implementing randomized control trials. This approach greatly increases the likelihood that the overall allocation will be balanced with respect to all or most characteristics	MCE	N/A
2	HUR	For HUR-2 and HUR-3, MCE repeated the random selection process several times until the treatment and control groups for both waves demonstrated balance among available parameters.	N/A	Random assignment requires letting the allocation process to be truly random. To increase the chances of balanced treatment and control, the solution is not multiple random allocations to find a suitable balance but stratifying based on the characteristics that one would like to be balanced between the treatment and control.	MCE	N/A
3	HUR	After three months of delivering the reports, MCE stopped sending the reports to lower the consumption quintiles in the HUR-2 treatment group.	N/A	The best practice when evaluating savings under such situations requires using the original design for the evaluation. Any savings that exist among those who originally received the reports should still be measured and included in the estimate of savings.	MCE	N/A

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