Focused Impact Evaluation of the 2013-2014 Home Upgrade Program

California Public Utilities Commission

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1 EXECUTIVE SUMMARY

1.1 Background and Objectives

Home Upgrade is a statewide, single-family residential energy efficiency program implemented under the umbrella of Energy Upgrade California®. DNV GL was engaged by the California Public Utilities Commission (CPUC) to conduct an impact evaluation of the 2013-14 program. The purpose of the study was to verify the savings reported by Home Upgrade program administrators and learn as much as possible about program activity.

The Home Upgrade program includes two paths: Home Upgrade and Advanced Home Upgrade (Advanced). This impact evaluation is "focused" because it is limited to the Home Upgrade path and to estimating gross savings.

Six entities offered the Home Upgrade path in the 2013-14 program cycle: California's four Investor-Owned Utilities (IOUs), and two new program administrators, known as Regional Energy Networks (RENs), which implemented the Home Upgrade Program on an exclusive basis in their respective service areas. The six program administrators are,

- IOU:
  - Pacific Gas and Electric (PG&E)
  - Southern California Edison (SCE)
  - Southern California Gas (SoCalGas)
  - San Diego Gas and Electric (SDG&E)
- REN:
  - Bay Area Regional Energy Network (BayREN), administered by the Association of Bay Area Governments (ABAG)
  - Southern California Regional Energy Network (SoCalREN), administered by Los Angeles County

The study identifies the energy savings reported by PAs for homes that participated in Home Upgrade, measures the actual energy savings and compares these savings values by calculating a realization rate. A realization rate of 100% indicates the reported savings and the measured savings are equal. Finally, this report provides actionable recommendations to improve the effectiveness of the program.

1.2 Approach

The study approach consisted of a billing analysis to estimate electric and gas savings, and compare these to the savings[1] reported by program administrators. For this analysis, we used 60-minute interval meter data to estimate electric savings and monthly gas meter data to estimate gas savings.

[1] Gross savings with realization rates applied

1.3 Key Findings

At the program level the Home Upgrade Program produced savings, but these savings are small relative to the overall Home Upgrade program targets. For example, BayREN and SoCalREN savings for kWh are 5% and 4% of target respectively. For gas, BayREN saved 28% of target and SoCalREN saved 4%.

For the IOUs, comparing Home Upgrade Program savings to target savings is problematic because the IOU program forecasts do not separate Home Upgrade and Advanced Home Upgrade. Instead, the IOUs present one target saving value. As a result, the IOU Home Upgrade Program savings are not a direct comparison with program targets. With this caveat, we present program target savings, evaluated savings for HUP only, and percentage of savings in Table 1.

Table 1: 2013-2014 Gross First-Year Program Savings Projections and Goals

Entity	Expenditure	Target Program Savings[2]			Evaluated Program Savings			Program Savings (%)		
		MW	MWh	MTherm	MW	MWh	MTherm	MW	MWh	MTherm
BayREN[3]	$9,000,000	3.4	2,128	294	0.0	98	105	-1%	5%	28%
PG&E*	$28,665,674	19.4	15,534	1,593	0.1	82	8	0%	1%	0%
SCE*	$14,622,692	4.0	8,600	---	0.0	10	---	1%	0%	---
SoCalGas*	$6,492,411	---	---	434	---	---	17	---	---	4%
SoCalREN	$9,228,614	1.2	691	105	0.0	26	5	4%	4%	5%
SDG&E*	$11,324,594	1.9	2,372	543	0.0	47	12	2%	2%	2%

*Savings targets represent Home Upgrade and Advanced Home Upgrade combined

Table 2 presents average savings at the household level based on the results from the sample homes used in the billing analysis. Statewide we found household savings for electric demand (4.5%), electric energy (2.3%), and natural gas (24.3%). Statistics for the sample only are reported in Appendix D.

Table 2: Gross Savings Estimates per Home by Unit Value and Percent

Program Administrator	kW	kWh	Therm	kW %	kWh %	Therm %
Statewide	**0.08**	**193**	**108**	**4.5**	**2.3**	**24.3**
BayREN	-0.07	148	158	-8.1	2.3	30.7
PG&E	0.44	618	60	17.8	6.3	21.0
SCE	0.21	85	---	14.1	1.6	---
SCG	---	---	151	---	---	21.3
SoCalREN	0.37	237	48	14.9	2.4	7.8
SDG&E	0.10	137	34	3.3	1.1	15.4

1.3.1 Realization Rates

Table 3 provides mean estimates of savings for the program and realization rates[4]. Realization rates are a ratio comparing reported savings to evaluated savings. For example, a realization rate of 100% means evaluated savings is equal to savings reported by the Program Administrators. A realization rate less than 100% means evaluated savings are less than savings reported by the Program Administrators. Conversely, a

[2] California Energy Efficiency Statistics, http://eestats.cpuc.ca.gov/Views/Documents.aspx. Combines Home Upgrade and Advanced Home Upgrade savings.

[3] MOTION FOR CONSIDERATION OF THE SAN FRANCISCO BAY AREA REGIONAL ENERGY NETWORK, Appendix A, San Francisco Bay Area Regional Energy Network (BayREN) Program Implementation Plan, Revised February 24, 2014.

[4] The tracking data contains realization rates to adjust gross savings. These existing realization rates were not applied as part of the comparison.

realization rate greater than 100% means evaluated savings are greater than reported savings. With the exception of PG&E (158%), the realization rates for electric savings were relatively low. For gas, these rates were relatively higher and ranged from 49% for SDG&E to 185% for PG&E.

Table 3: Savings and Realization Rates

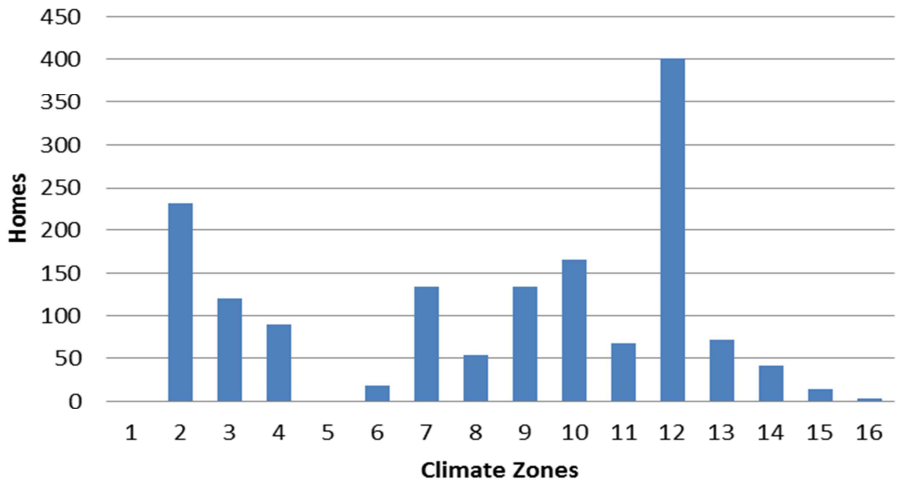
	Reported Savings*			Evaluated Savings*			Realization Rate		
Program Administrator	**kW**	**kWh**	**Therm**	**kW**	**kWh**	**Therm**	**kW**	**kWh**	**Therm**
Statewide	**0.75**	**436**	**87**	**0.08**	**193**	**108**	**11%**	**44%**	**123%**
BayREN	0.54	352	94	-0.07	148	158	-14%	42%	168%
PG&E	0.76	392	32	0.44	618	60	58%	158%	185%
SCE	1.04	499	---	0.21	85	---	21%	17%	---
SCG**	---	---	163	---	---	151	---	---	93%
SoCalREN**	1.15	692	48	0.37	237	48	32%	35%	52%
SDG&E	0.91	511	69	0.10	137	34	11%	27%	49%

* Values are rounded
** SCG and SoCalREN sample size less than ten homes for therm estimates

1.3.2 Climate Zones

The California Energy Commission partitions the state of California into 16 climate zones. These climate zones support energy efficient design criteria for residential new construction. The distribution of projects from the tracking data is shown in Figure 1.

Figure 1: Distribution of Projects



The evaluation sample contains reported projects from 13 of these 16 climate zones. Electric savings were higher in predominantly inland climate zones with hotter summer temperatures (climate zones 9-16). Gas savings were greatest in these climate zones during the winter months, but savings also occurred in the coastal climate zones with cooler year-round temperatures (climate zones 1-8). Section 3.2.8 of this report provides a more detailed discussion of Home Upgrade Project savings by climate zone.

1.4 Findings and Recommendations

Overall, the results of the evaluation indicate that the Home Upgrade Program is reducing electric and gas consumption for program participants. Program related findings and recommendations are:[5]

Finding 1: Statewide, we found annual electric energy savings averaging 3.1%. Two climate zones showed annual household savings of 5% or more. In descending order from greatest to least savings, these climate zones were 16 and 11.

Finding 2: Statewide, we found annual gas savings averaging 29.3%. Three climate zones showed annual household savings of 30% or more. In descending order from greatest to least savings, these climate zones were 3, 4, and 9. These are climate zones with more than 2,500 Heating Degree Days.

Finding 3: Statewide we estimated a reduction in demand of 7.4% between 3pm and 5pm during the hottest days of the year (August and September), except for two PAs.

Finding 4: Savings vary considerably by PA, for kW and therms. For example, statewide average demand (kW) reduction was 7.4%. The changes however ranged from an average reduction of 17.8% (PG&E) to an average kW increase of 8.1% (BayREN).

Finding 5: For therm savings, the statewide average was 29.3%. This range spanned from 30.7% (BayREN) to 7.8% (SoCalREN).

Finding 6: Sample sizes are very small in the Southern part of the state (particularly for gas). Given the quality and quantity of data available, these results are as accurate as they can be.

Finding 7: Tracking data sets were not complete, changed during the analysis period, and were not as clearly defined as they could have been.

Recommendation 1: These evaluation results suggest the 2013-14 Home Upgrade Program is more effective at saving gas and reducing demand than saving electric energy. It may be worth reviewing the current savings goals, and redefining program design and delivery to achieve greater savings.

Recommendation 2: When higher electric energy savings and demand reductions are program goals, the Program Administrators should concentrate on the inland climate zones. These areas have nearly equal number of Heating and Cooling Degree Days. For example, climate zones in the central portion of the state (4, 11, 12, and 13) have more defined seasons with hotter temperatures in the summer and cooler temperatures in the winter.

Recommendation 3, 4 & 5: Conduct additional research on both program paths using a larger sample to refine savings estimates. This analysis should include analysis of project measures that each PA implements in their territory. In addition, we suggest surveys and interviews with participating homeowners to find out drivers for big reductions, increases, and little change to energy usage. This will include a comparison of savings and costs for Home Upgrade and Advanced Home Upgrade.

Recommendation 6: For Southern California, the results should not be considered statistically representative of the program population. Given the design and demographics of the program however, there is no evidence to suggest they are not an accurate estimate of all program participants.

[5] These findings are summarized in Appendix D

Recommendation 7: The quality of tracking data needs to be improved prior to an evaluation to ensure that all PAs are recording data that is understandable and useable. More detailed recommendations on this are presented in Section 4.2.

2 INTRODUCTION

Home Upgrade is a statewide, single-family residential energy efficiency program implemented under the umbrella of Energy Upgrade California. This program offers two paths: Home Upgrade (deemed savings) and Advanced Home Upgrade (custom savings). One major difference between the two paths is that Advanced Home Upgrade uses simulation modeling to estimate savings, while Home Upgrade does not. The purpose of Home upgrade is to offer a more straightforward and lower cost alternative to Advanced Home Upgrade. This impact evaluation is focused on the 2013-14 Home Upgrade program. It is limited to determining savings. Additional studies will explore the reasons for savings variations, determine the degree of free riders, and estimate cost-effectiveness. In addition, the next impact evaluation for 2015-16 will include Home Upgrade and Advanced Home Upgrade together to provide a direct comparison of costs and savings between both program paths.

Home Upgrade was redesigned and reintroduced by the four IOUs for the 2013-14 program cycle. At the same time, two new program administrators (known as Regional Energy Networks, or RENs) became the exclusive implementers of Home Upgrade in their respective service areas.[6]

According to the project data reported to the CPUC by the IOU and RENs[7], program administrators (PAs), completed a total of 1,366 home upgrades in 2013 and 2014. The distribution of these projects is shown in Table 4, along with the final sample sizes used to create savings estimates.

Table 4: Home Upgrades by PA

Program Administrator	Reported Home Upgrade Projects	Sample Size Electric	Sample Size Gas
BayREN	664	455	527
PG&E	132	96	56
SCE	112	21	NA
SoCalGas	112	NA	8
SoCalREN	113	17	1
SDG&E	334	30	31
Total*	1,366	619	623

* Total projects counts are unique homes. Projects may overlap between southern California PAs. Appendix A discusses the development of the sample.

2.1 Evaluation Objectives

The overarching purpose of this study was to evaluate the accuracy of the savings values used by program administrators to forecast program savings and to provide actionable recommendations to improve the effectiveness of the program. DNV GL investigated three research questions:

[6] RENs are not part of the local government partnership program run by the IOUs. These service areas overlap with IOU service territories. In 2013-2014, Home Upgrade was offered by one entity only, depending on service area.

[7] PAs report program activity to the CPUC data team on a quarterly basis. This includes account and location identifiers along with savings estimates for each project.

1. What are the actual energy savings compared to the forecasted energy savings?
2. What are the energy savings (kW, kWh, and therm only) and realization rates for homes in this program?[8]
3. What are the recommendations, if any, to improve energy savings estimates and realization rates for gross savings estimates of these upgrade packages?[9]

To answer these questions, DNV GL estimated energy usage for program participants before and after the Home Upgrade was performed, calculated the difference and compared these to savings reported by the PAs.

2.2 Report Organization

The report presents the impact analysis in Section 3. A summary of findings and recommendations are in Section 4. Details of the impact analysis are in Appendices A and B. Appendix C contains the Home Upgrade measure option. Appendix D lists a summary of findings and recommendations.

2.3 Background

The Home Upgrade program promotes long-term energy benefits in single-family dwellings through comprehensive energy efficiency retrofit measures. The program seeks to transform the single-family retrofit market from one of discrete appliances and shell upgrades to a comprehensive building system approach. This includes bundling building shell upgrades such as insulation and windows, high-efficiency HVAC units, hot water heating, and other deep energy reduction opportunities.

The structure and offerings of the Home Upgrade Program have evolved since the program's introduction in 2010. As noted earlier, two groups of entities implemented Home Upgrade for program year (PY) 2013-2014: the IOUs and the RENs.[10] For the 2013-2014 pilot program years, CPUC required the IOUs and RENs to submit a revised Program Implementation Plan (PIP) for the program.[11] For 2013-14, the program was rebranded from Energy Upgrade California to Energy Upgrade California Home Upgrade Program and Advanced Home Upgrade Program (Advanced). This Tier 2 Advice Letter proposed: (1) geographic areas to be covered by the IOUs and RENs; and (2) a re-designed Home Upgrade Program alternative to include a requirement for at least three energy-efficiency measures, and a tiered incentive structure to encourage the energy efficiency loading order. In addition, the redesigned program included appropriate Combustion Appliance Safety (CAS) testing protocols.

The IOU Home Upgrade Program is similar to the REN program. In this menu-driven approach customers are required to install a minimum of three measures total and achieve a minimum point threshold of 100 points that equates to 10% energy savings. For the IOU program, at least one of the three must be a "base" measure (to support a loading order). REN programs are not required to follow this loading order. See the measure list in Appendix C for specifics.

Both the IOU and REN program designs allocate project points with tiered incentive dollar values. To encourage customers to more fully adhere to the loading order, customers are eligible for additional bonus points for installing additional base measures; i.e., when installing one or two additional base measures

[8] IOUs report savings goals in aggregate combining Home Upgrade and Advanced. As a result, evaluated savings are compared to claimed savings and not to forecast savings.

[9] The net-to-gross ratio is deemed as part of the program forecast.

[10] Pursuant to (D.) 12.11.015, two Regional Energy Networks (RENs), collaborations of local governments, were approved. These are the San Francisco Bay Area Regional Energy Network (BayREN) and the Southern California Regional Energy Network (SoCalREN).

[11] Decision approving 2013-2014 energy efficiency programs and budgets, p. 131, CPUC 11/15/2012

beyond the required one measure, customers received bonus points (and incentives) for each additional base measure installed.[12]

Home Upgrade is offered statewide, but each entity offers it in predetermined areas. The IOUs maintain their service territories, but the RENs operate within these. For example, BayREN is the exclusive implementer of Home Upgrade to PG&E customers in the nine Bay Area counties of San Francisco, Sonoma, Marin, Napa, Solano, Contra Costa, Alameda, Santa Clara, and San Mateo. The lead agency is the Association of Bay Area Governments (ABAG). SoCalREN operates in 12 counties in southern California and parts of central California. These counties are Los Angeles, Orange, Ventura, Santa Barbara, Riverside, San Bernardino, Kern, Tulare, Inyo, Mono, and portions of Kings and Fresno. The lead agency for SoCalREN is the County of Los Angeles. The counties for the two REN organizations are highlighted in Figure 2.

Figure 2: REN Counties

[12] Joint IOU/REN advice letter April 2, 2013

Rebates for the Home Upgrade Program ranged from $2,500 to $3,150.[13] Advanced Home upgrade incentives have a tiered structure similar to Home Upgrade but can go to $6,500 depending on the level of savings achieved.

Table 5: Incentive Levels

Entity	Home Upgrade	Advanced Home Upgrade
BayREN	$3,150	NA
SoCalREN[14]	$3,000	NA
PG&E	$2,500	$4,500
SCE	$2,500	$6,500
SCG	$2,500	NA
SDG&E	$2,500	$4,500

Incentives are paid through the IOUs using IOU program dollars. BayREN does provide up to $300 to pay for home audits and safety inspections for customers in their service counties who choose the Advanced Home Upgrade path.

Program expenditures and savings forecast in the program implementation plans (PIP) are shown in Table 6. For the RENs these values represent Home Upgrade Program only. For the IOUs these values reflect totals for the Home Upgrade Program and Advanced Home Upgrade programs combined. The PIPs provide projected energy savings, but not the total number of homes expected to participate. As a result, the target program savings in Table 6 represent the PA program forecast with Home Upgrade Program and Advanced Home Upgrade program totals combined. Evaluated program savings represent only the Home Upgrade Program and exclude any savings from Advanced Home Upgrade.

Table 6: 2013-2014 Gross Program Savings Projections and Goals

Entity	Expenditure	Target Program Savings[15]			Evaluated Program Savings			Program Savings (%)		
		MW	MWh	MTherm	MW	MWh	MTherm	MW	MWh	MTherm
BayREN[16]	$9,000,000	3.4	2,128	294	0.0	98	105	-1%	5%	28%
PG&E	$28,665,674	19.4	15,534	1,593	0.1	82	8	0%	1%	0%
SCE	$14,622,692	4.0	8,600	---	0.0	10	---	1%	0%	---
SoCalGas	$6,492,411	---	---	434	---	---	17	---	---	4%
SoCalREN	$9,228,614	1.2	691	105	0.0	26	5	4%	4%	5%
SDG&E	$11,324,594	1.9	2,372	543	0.0	47	12	2%	2%	2%

A summary of measures offered under the Home Upgrade Program are in Table 7.

[13] BayREN offers an additional $150-$300 rebate for combustion testing after the upgrade is complete

[14] Delivered through The Energy Network

[15] California Energy Efficiency Statistics, http://eestats.cpuc.ca.gov/Views/Documents.aspx. Combines Home Upgrade and Advanced Home Upgrade savings.

[16] MOTION FOR CONSIDERATION OF THE SAN FRANCISCO BAY AREA REGIONAL ENERGY NETWORK, Appendix A, San Francisco Bay Area Regional Energy Network (BayREN) Program Implementation Plan, Revised February 24, 2014.

Table 7: Measures Included in the Home Upgrade Program

Measures	
Duct Sealing*	Central Gas Furnace Replacement
Duct Replacement*	Air Conditioner Replacement
Whole Building Air Sealing*	Gas Storage Water Heater Replacement
Attic Insulation & Air Sealing*	Gas On-Demand Water Heater
Wall Insulation	Electric Water Heater
Floor Insulation	High Efficiency Window Replacement
Duct Insulation	Wall Heater

* = Base measure

3 BILLING ANALYSIS

DNV GL employed a billing analysis to estimate the gross demand savings (kW) and energy consumption (kWh and therms) of participants in the Home Upgrade program. As noted in section 2, the Advanced Home Upgrade pathway was not evaluated as part of this study so the Advanced program participants are not included in this analysis.

3.1 Approach

To estimate savings for a whole-building retrofit program such as Home Upgrade requires a method to comprehensively capture the combined effect of all measures installed in the home. The general method for this type of estimation is a billing analysis that incorporates both a treatment group (participants) with a comparison group (non-participants).[17]

Given the small size of the program population relative to the general population, for this evaluation we used a "pooled," fixed effects regression[18] as the primary method of analysis. Pooled refers to the fact that both participants and known future participants are used to estimate savings at any point in time. Fixed effect means the contribution of any particular variable in the model is the same for all participants. In addition to being appropriate for small sample sizes, this approach is recommended for programs such as Home Upgrade where there is no valid pre-determined independent control or comparison group.

The approach uses statistical models to incorporate weather data, various temporal variables such as year, month, day, and hour, and several household-level variables as predictors to measure energy consumption (kWh or therms). In order to take advantage of the AMI[19] hour-level kWh consumption data, independent models were fit to predict kWh consumption for each calendar day and hour of the year. The full model combined (summed) 365 individual equations to predict electric savings for each day of the year.

At any particular point in time, there are program participants who have had an upgrade, and some who are scheduled in the future; both sets are used for estimating model parameters. Future upgrades serve as a comparison group for a given point in time. [20]

One of the main advantages of using future participants as a control group when estimating model parameters is that the future participants are likely to be more similar to a current group of participants than a control group selected randomly from the population. Future participants (control) were not "matched" with treatment homes however. This comparison group compensates for any influences from outside the program that could affect savings for all participants. For example, future participants likely reside in a home that needs various program measures to increase its energy efficiency and, similar to current participants, are residents who are willing to take actions to increase the efficiency of their homes.

Details of the billing analysis used for this analysis are reported in Appendix A and B.

[17] This method is consistent with the recommended International Performance Measurement and Verification Protocol (IPMVP) option Method C, Whole Facility, and the CPUC evaluation protocols [Jayaweera, T. and Haeri, H. (2013)].

[18] For a discussion of approaches, see Chapter 8: Whole-Building Retrofit with Consumption Data Analysis Evaluation Protocol, The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures NREL/SR-7A30-53827 April 2013

[19] AMI = Advanced metering infrastructure

[20] All particpants are from 2013-2014. Past and future particpants are relative to each other in the program cycle.

3.2 Findings

3.2.1 Project Counts and Blackout Period

Table 8 summarizes the total number of program participants reported by the program administrators, the total number of participants identified in the initial tracking data, and the number of participants used in the billing analysis.

The blackout period starts when the Home Upgrade begins and ends when the Home Upgrade project is completed. For this analysis, we used project dates from the program tracking to set the duration of the project for each household. According to the Home Upgrade Program tracking data, distribution of projects across the year was relatively even, but the average number of days for the blackout period varied among PAs. A blackout period longer than 60 days can indicate a delay between contract signing and the beginning of project work or it may be an indication of an error in the tracking file's measure installation information or completion date. Additional discussion on treatment of blackout periods is provided in Appendix A, Section A.2.1.

Table 8: Participation Counts

Program Administrator	Projects From Tracking Data	Used in Electric Billing Analysis	Used in Gas Billing Analysis	Blackout Days (mean)
Statewide	**1,366**	**619**	**623**	**73**
BayREN	664	455	527	68
PG&E	132	96	56	34
SCE	112	21	NA	179
SoCalGas*	112	NA	8	186
SoCalREN*	113	17	1	30
SDG&E	345	30	31	89

* SCG and SoCalREN sample size less than ten homes for therm estimates

For this analysis, we attempted to include a census of program participants. In the end, the sample was determined by the number of accounts with at least 12 months of data for the appropriate fuel type before the blackout period and 12 months of data after the blackout period. For example, given the fixed months of available meter data, longer blackout durations reduced the number of month available for those participants, causing them to drop out of the analysis. Appendix B presents more detail on the derivation of the sample along with blackout dates and their treatment.

In addition, the population included many duel fuel homes (electric and gas) where only a single fuel was supplied by an IOU - especially around Sacramento (CZ 12) and Los Angeles (CZ 9, 10). As a result, project-billing data was available for one fuel only.

3.2.2 Participation in Other Programs

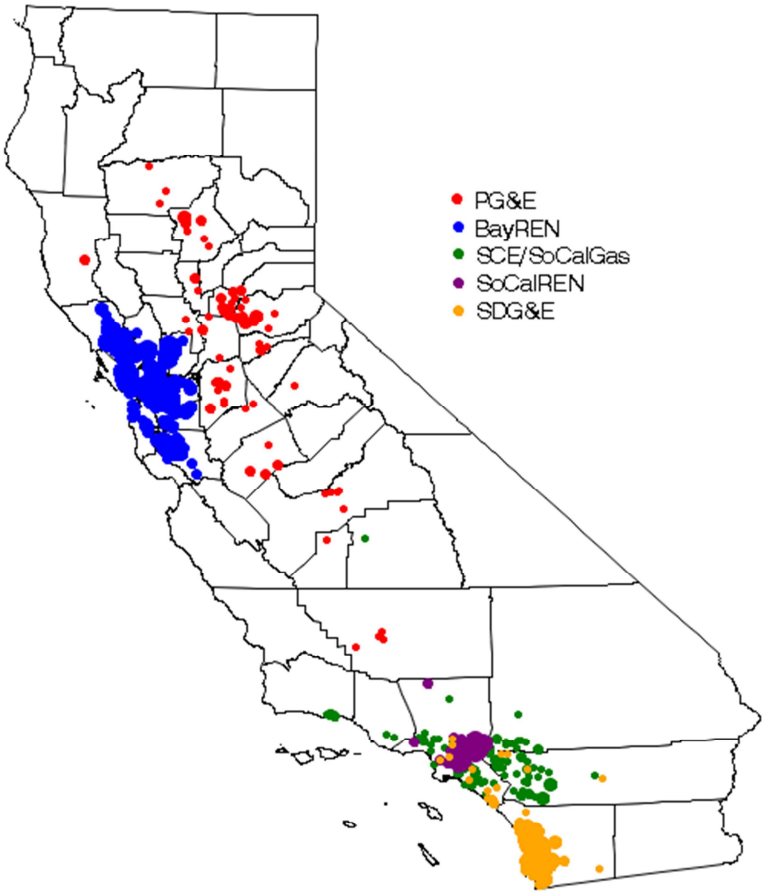
DNV GL reviewed the program tracking data to understand the degree to which Home Upgrade participants participated in other IOU programs. Among all participants identified in the tracking file, approximately 6% participated in another IOU program at some time during 2013 and 2014. These participants were not

included in the billing analysis to avoid mixing savings from multiple programs.[21] According to the tracking data, these included rebate programs for appliances, lighting, pool pumps, and HVAC.

3.2.3 Geographic Distribution

Error! Reference source not found. illustrates the regions where the 2013-14 Home Upgrades took place according to the tracking data. BayREN completed the majority of all statewide projects. These projects were located in nine Bay Area counties. PG&E projects were concentrated in the San Joaquin and Sacramento Valleys, collectively referred to as the Central Valley. As expected SCE and SoCalGas cluster around Los Angeles County. SDG&E projects are shown in the southwestern corner of the state (San Diego County).

Figure 3: Geographic Location of Home Upgrade Program Participants



3.2.4 Savings Estimates, Electricity

Table 9 summarizes the estimated gross kWh savings from the billing analysis for the total set of participants considered in the evaluation. Across the PAs, the estimated savings per household from the Home Upgrade Program was 193 kWh. This represents 2.3% of the average energy consumed per

[21] Another approach considered was to keep multi-program projects in the sample, estimate household savings, and then subtract reported savings from the other programs to isolate the home upgrade savings. Given the issues with data reporting and the small percentage of project overlap, we elected to focus on HUP only homes for this study.

participant before the upgrade occurred. The standard error on the 193 kWh estimate is 8.7 kWh. This standard error is relatively low because of the large sample size used to estimate savings for any particular point in time. For example, the day-level model used to predict savings were fitted with 444,126 data points, on average.

The model predictions yielded estimated savings by PA that ranged from 1.1% for SDG&E to 6.3% for PG&E.[22]

Table 9: Estimated kWh Usage and Savings

Program Administrator	Participant Sample Size	Normalized Energy Use Pre Upgrade	Normalized Energy Use Post Upgrade	Estimated Savings	Standard Error of Savings	kWh Savings (%)
Statewide	**621**	**8,473**	**8,280**	**193**	**9**	**2.3%**
BayREN	456	6,333	6,184	148	8	2.3%
PG&E	96	9,792	9,174	618	6	6.3%
SCE	21	5,274	5,189	85	9	1.6%
SoCalGas	NA	NA	NA	NA	NA	NA
SoCalREN	17	9,728	9,491	237	10	2.4%
SDG&E	31	12,726	12,589	137	17	1.1%

Note: Values are rounded. The savings estimates were computed using weather data associated with a typical meteorological year (TMY). The day-level predictions were summed to obtain the estimates presented in this table.

The kWh billing analysis model was based on hour-level AMI metered data. One of the advantages of modeling data at the hour-level is that reasonable time-specific predictions can be generated from the model. Appendix B displays estimates by weekday, hour, and month. Results suggested higher savings from the Home Upgrade Program at specific times:

- During the colder months of November and December, and during the hotter months of July and August
- Around the 7:00 am hour (when people generally begin their day)
- Around 5:00 pm (when people generally return from school/work)

Figure 4 displays the estimated kWh savings from the Home Upgrade Program by hour for an average weekend and weekday. There are greater kWh savings during the morning and evening hours. This pattern is consistent between weekend days and weekday days.

[22] Low savings estimates from billing analysis sometimes are discountde"as noise" in the estimates. We do not consider this an issue fro HUP due to the low standard errors associated with the model's savings estimates.

Figure 4: Estimated Savings by Weekend / Weekday, and Hour

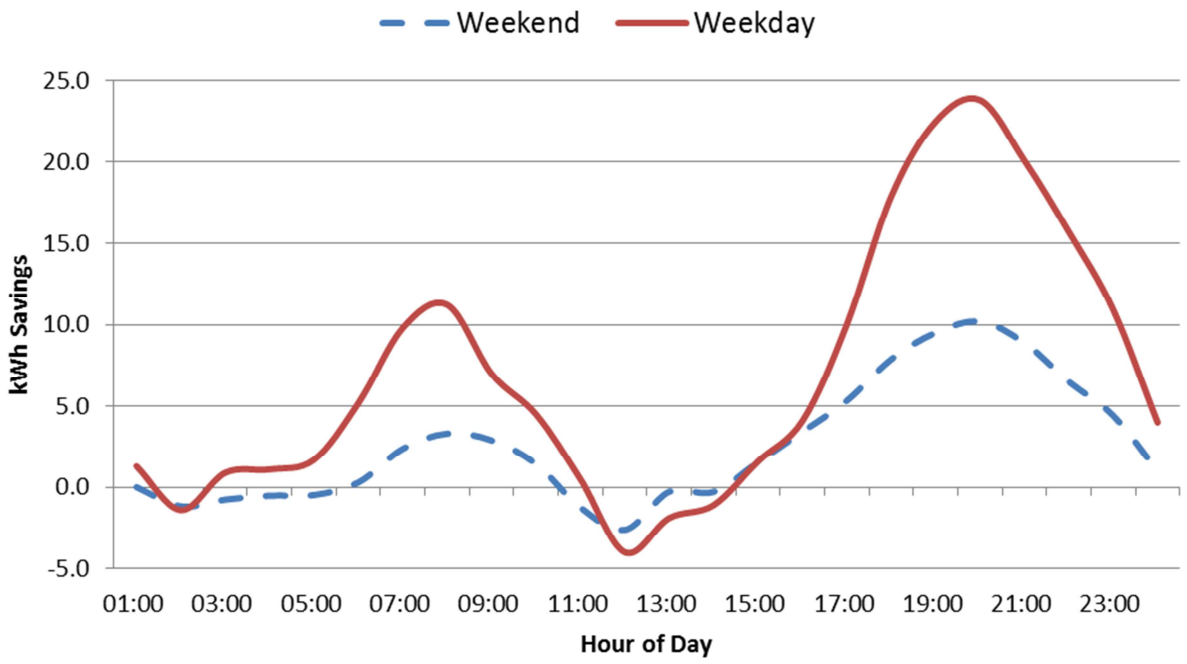
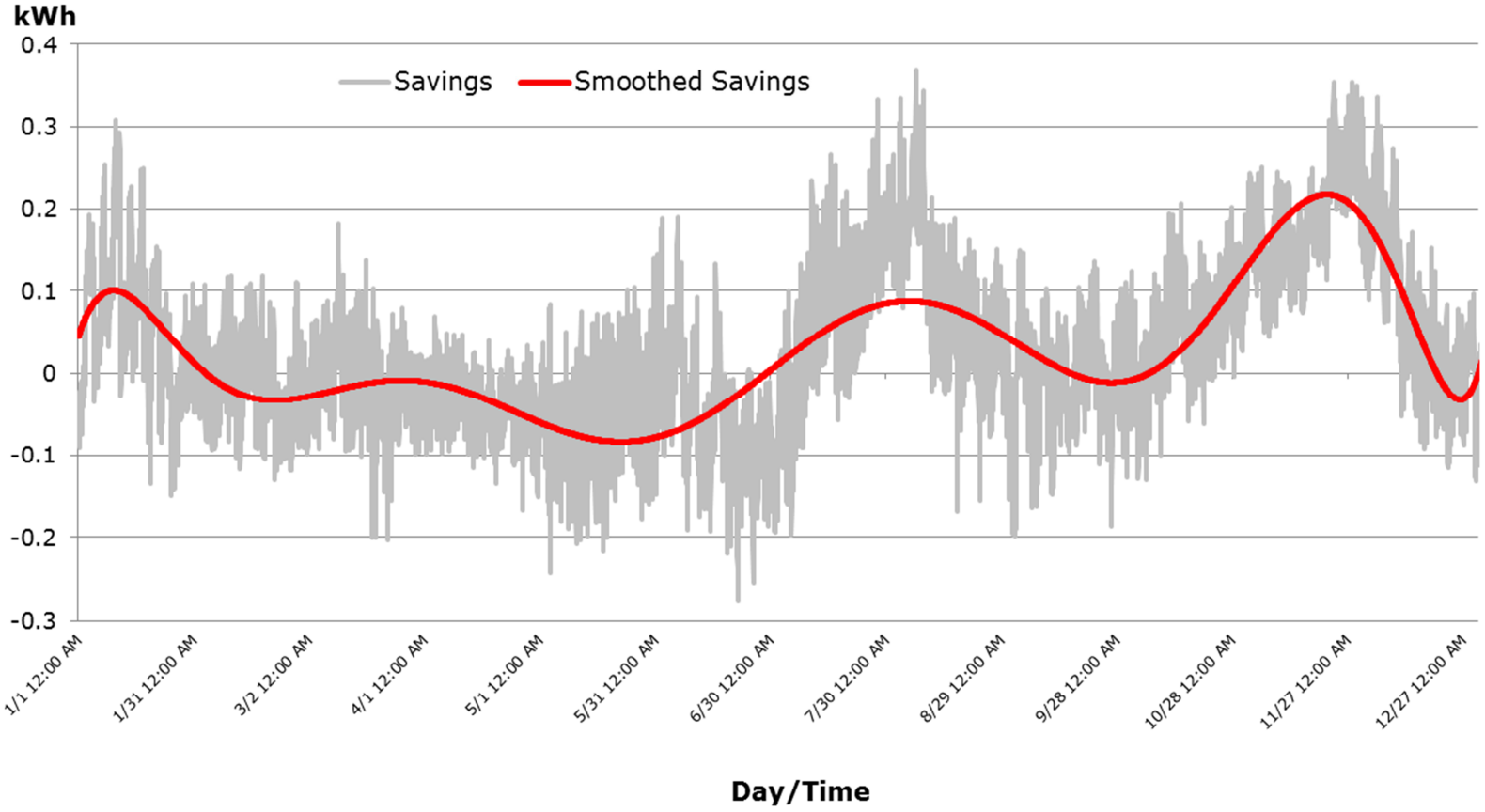


Figure 5 displays the estimated energy savings from the upgrade by day and hour.[23] This figure shows the variability in the estimated savings during each day. The period from June to September shows more savings, but also a much higher amount of variability.

The red line in Figure 5 represents a "smoothed" representation of the daily and hourly savings to highlight the seasonal pattern of savings. According to the graph, estimated savings from the Home Upgrade Program are greatest during the colder months of November and December, and during the hotter months of July and August. As discussed later in this section, statewide peak demand was identified as August 10, between 3pm and 5pm.

[23] This is often referred to as an 8,760 graph (365 days x 24 hours = 8,760 hours).

Figure 5: Model-Predicted kWh savings Before (Pre) and After (Post) the upgrade period, By Day and Hour, for a Typical Meteorological Year



3.2.5 Savings Estimates, Gas

Table 10 summarizes the estimated gross therm savings from the billing analysis for participants considered in the evaluation. Across all PAs, we estimated a 24.3% average reduction.[24] This translates to estimated savings per household from the Home Upgrade Program of 107.6 therms. The standard error of the estimate is 11.0 therms. This indicates actual savings should be in the range of 96.6 and 118.6 therms.

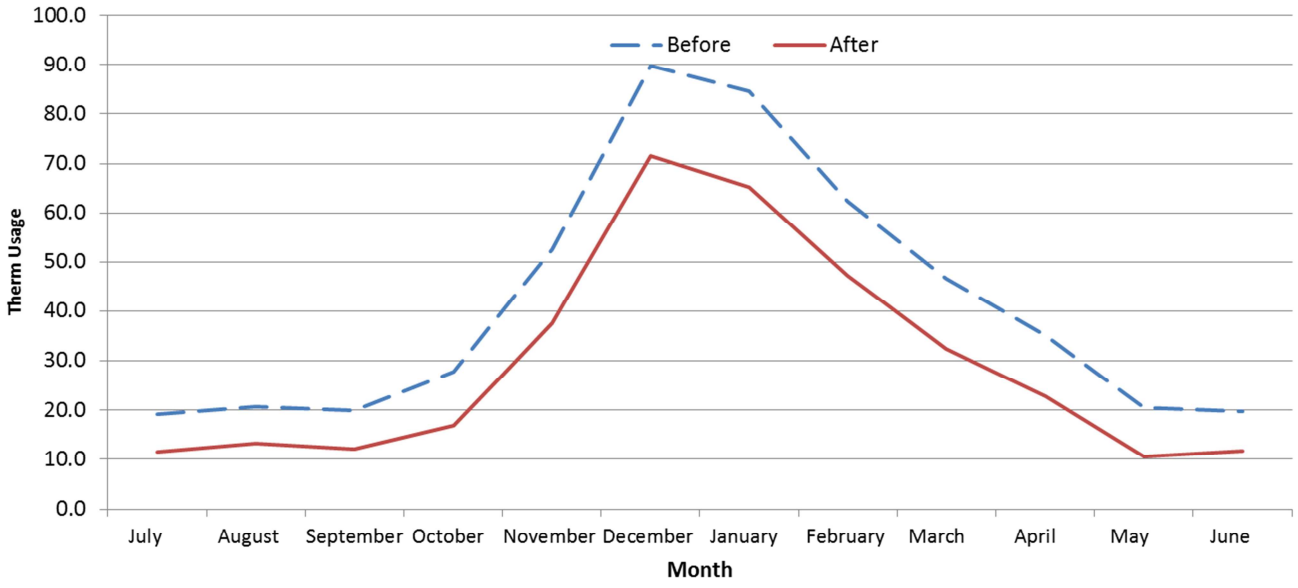
The estimated savings by PA varied considerably. The estimated percentage savings ranged from 7.8% for SoCalREN to 30.7% for PG&E.

Table 10: Estimated Therm Usage and Savings for a Typical Meteorological Year

Program Administrator	Participant Sample Size	Therm Pre Upgrade	Therm Post Upgrade	Therm Savings	Standard Error of Savings	Energy Savings (%)
Statewide	**623**	**443**	**335**	**108**	**11**	**24.3%**
BayREN	527	515	356	158	13	30.7%
PG&E	56	284	225	60	10	21.0%
SCE	NA	NA	NA	NA	NA	NA
SoCalGas	8	711	560	151	23	21.3%
SoCalREN	1	618	570	48	31	7.8%
SDG&E	31	219	185	34	10	15.4%

Figure 6 illustrates gas usage during colder months. Looking at the cold months only, as expected, usage for this fuel type is greatest in the coldest months of the year and decreases as the weather warms. Savings follows a similar pattern. However, savings as a percentage of usage before the upgrade is greatest in March and April.

Figure 6: Therm Usage Pre/Post during a Typical Meteorological Year



[24] Gas estimates based on 12-months and may include estimated values.

3.2.6 Savings Estimates, Demand

To calculate the kW reduction attributed to the Home Upgrade Program, DNV GL used the kWh billing model results along with the definition of kW savings suggested by the PG&E Avoided Cost Calculator[25]. Peak kW savings is defined as:

> "…the average grid impact for the measure from 2 pm to 5 pm during the three consecutive weekday period containing the weekday with the hottest temperature of the year. This definition is consistent with the definition used in the 2005 Database for Energy Efficiency Resources (DEER)." Details for this analysis are provided in Appendix A.

This evaluation found an overall reduction in household demand of 0.12 kW (7.4%) during the hottest day of the year statewide. On initial glance this overall reduction varies substantially across PAs. When considering climate zone, it looks like the savings are lower for PA's with predominantly cooler climates. BayREN and SDG&E have project concentrated in milder coastal regions, while the remaining PAs have project mostly in warmer inland regions. For example, the largest demand reduction estimate as a percentage change was for PG&E (17.8%), SoCalREN (14.9%), and SCE (14.4%). Conversely the SDG&E showed little change with a 3.3% reduction. Interestingly we estimated an increase in demand for projects in BayREN's region (kW savings of -8.1).

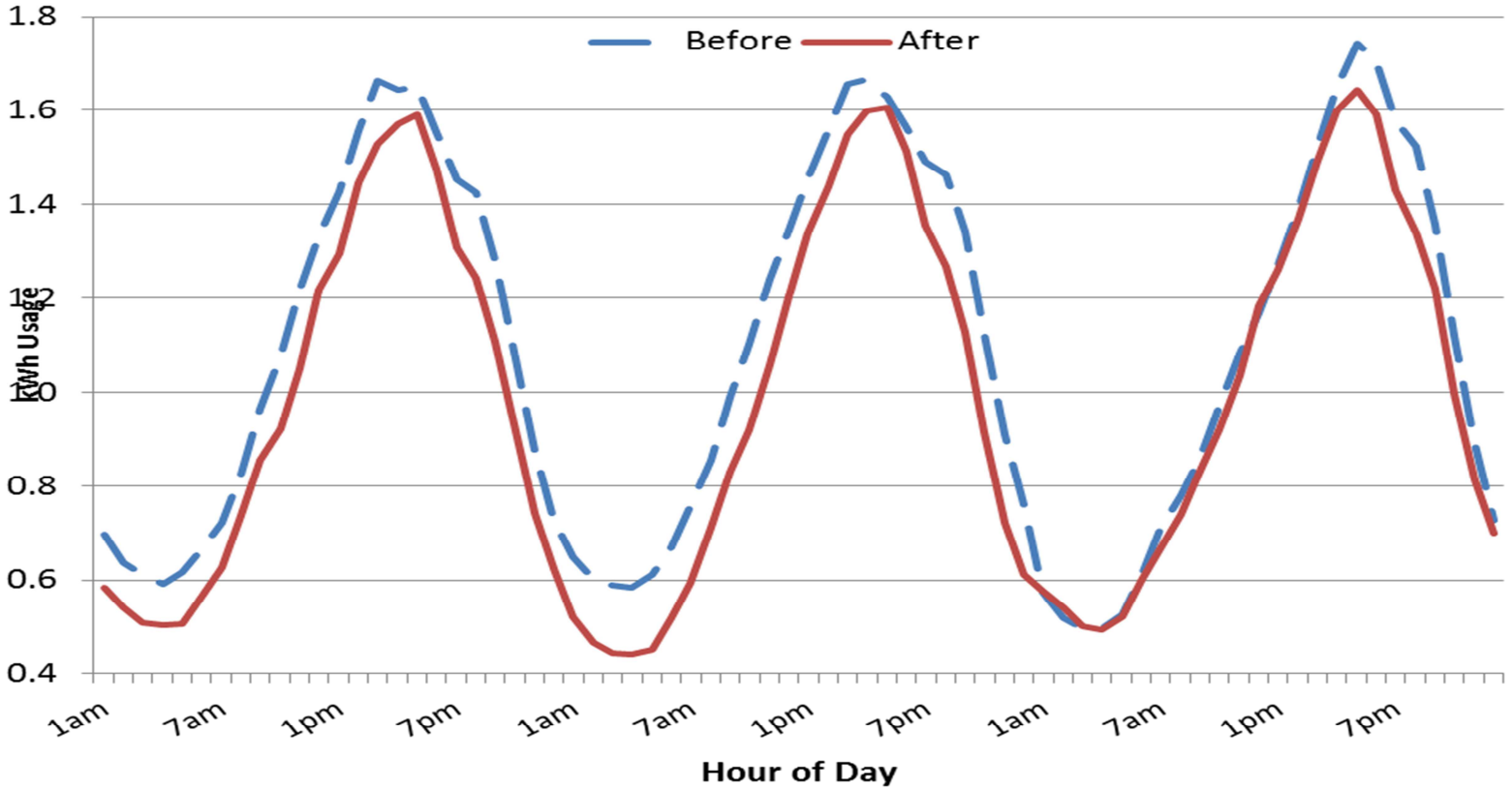
Table 11: Estimated Demand and Reduction in a Typical Meteorological Year

PA	Mean Hourly Temp (°F)	Demand Using Date, Hours	kW Pre upgrade	kW Post upgrade	kW Savings	Standard Error of Savings	Demand Reduction (%)
Statewide	**86.1**	**8/10, 3pm-5pm**	**1.61**	**1.49**	**0.12**	**0.01**	**7.4%**
BayREN	87.4	9/28, 3-5pm	0.99	1.07	-0.08	0.01	-8.1%
PG&E	98.6	8/26, 3-5pm	2.40	1.98	0.43	0.01	17.8%
SCE	93.2	9/4, 3-5pm	2.24	1.92	0.32	0.01	14.4%
SoCalGas	NA	NA	NA	NA	NA	0.01	NA
SoCalREN	94.6	9/4, 3-5pm	2.28	1.94	0.34	0.01	14.9%
SDG&E	84.0	9/5, 3-5pm	1.36	1.31	0.04	0.02	3.3%

Figure 7 illustrates the estimated usage before and after the upgrade during the three-day peak period of August 9 to August 11. As illustrated in Figure 7, during the summer, usage and savings tend to peak once each day around approximately 5:00 pm even though temperatures reach their maximum levels a few hours earlier. Temperatures tend to be cooler in the mornings during the summer months, so this pattern is not surprising.

[25] "INSTRUCTIONS for PG&E Avoided Cost Calculator (E-3 Calculator, Version 2d3)" (PGE, 2015).

Figure 7: Usage during Hot Days



The savings values in the tracking data had some anomalies. Specifically the average reported kW reduction was 0.64. Considering a typical residential household draws approximately 2.0kW at peak[26] on average, the reported value implies a reduction of over 32%. We suspect the low realization rate for the Home Upgrade Program kW has more to do with savings assumptions and data quality, rather than the savings from the program.

[26] This varies by A/C unit size, with higher tonnage units drawing more kW.

3.2.7 Realization Rates

Expected (or deemed) savings associated with demand (kW), electricity (kWh), and gas (therms) from the program tracking file compiled by the CPUC are gross and do not include any adjustments (i.e. Realization rate, Net to Gross). To generate realization rates for Home Upgrade, we compared the gross savings reported in the tracking data to our modeled estimates of savings. At the statewide level, our modeled savings were 11% of reported kW savings, 44% of reported kWh, and 123% of reported therms. A summary of these findings at the PA level are in Table 12.

Table 12: Realization Rates

	First Year Gross Savings Reported (per Participant)*			Billing Analysis Savings Estimate (per Participant)*			Realization Rate		
Program Administrator	kW	kWh	Therm	kW	kWh	Therm	kW	kWh	Therm
Statewide	**0.75**	**436**	**87**	**0.08**	**193**	**108**	**11%**	**44%**	**123%**
BayREN	0.54	352	94	-0.07	148	158	-14%	42%	168%
PG&E	0.76	392	32	0.44	618	60	58%	158%	185%
SCE**	1.04	499	---	0.21	85	---	21%	17%	---
SCG**	---	---	163	---	---	151	---	---	93%
SoCalREN	1.15	692	48	0.37	237	48	32%	35%	52%
SDG&E	0.91	511	69	0.10	137	34	11%	27%	49%

*kW values are rounded to nearest hundredth. kWh and Therms rounded to nearest whole number. "First-year gross" is the variable name in the Energy Division Tracking Database for values typically associated with annual savings.
** SCG and SoCalREN sample size less than ten homes for therm estimates

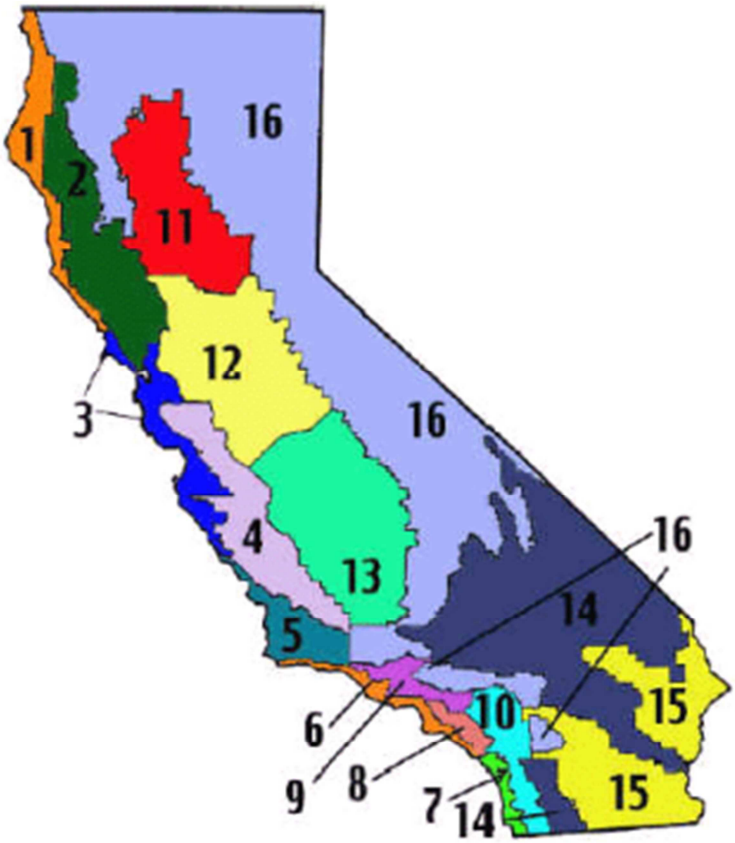
Interestingly the average kWh savings estimate across PAs ranged from 1% to 6%. Realization rates ranged from 17% to 157%. This can indicate that while savings were relatively consistent, forecasted savings were not. This view is supported by an earlier HUP work paper review that found differences between IOU and REN ex-ante savings. [27]

3.2.8 Climate Zones

The California Energy Commission partitions the state of California into 16 climate zones. Climate zones with the lower numbers 1-8 tend to be the coastal regions and represent cooler climates. Climate zones 9-16 tend to be inland and represent areas with a wide range of temperatures over the course of the year. A map of these climate zones is provided in Figure 8.

[27] CALMAC ID: CPU0113.01, "2013-14 Regional Energy Networks and Community Choice Aggregator Programs Impact Assessment Final Report", Iton, Inc, January 2016

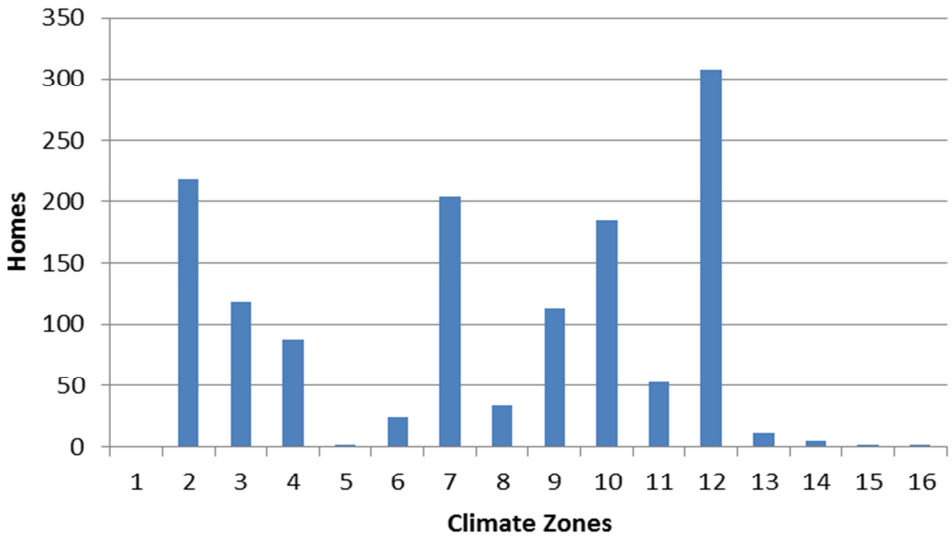
Figure 8: Building Climate Zones



Source: California Energy Commission

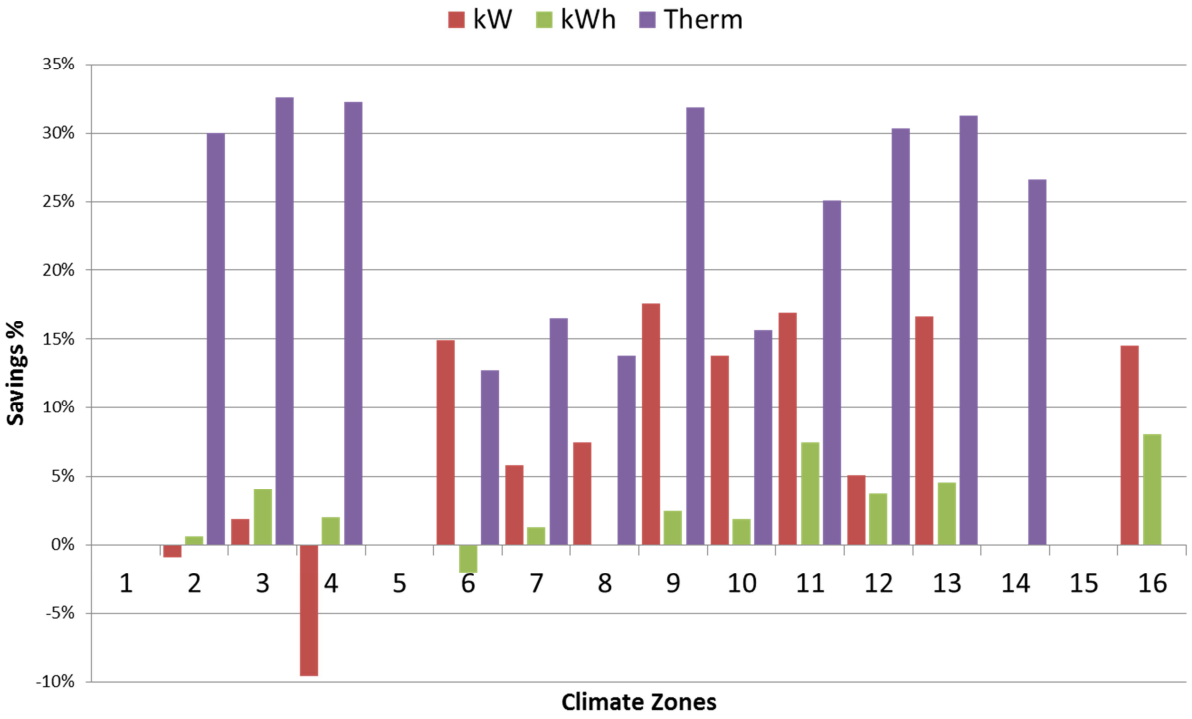
The Home Upgrade Program completed at least one project for at least one fuel type in all 16 climate zones. Statewide, 58% of projects were in warmer climate zones 9-16. The remaining 42% were in the cooler climate zones 1-8. The highest concentration of projects across all climate zones was in climate zone 12 (26%). Climate zone 12 contains mostly PG&E and some BayREN projects. Climate zone 2 (15%) was the next highest concentration. This climate zone contains mainly BayREN projects with some PG&E projects. The reported distribution of projects from the tracking data is shown in Figure 9.

Figure 9: Distribution of All Projects



The evaluation sample contains reported projects from 13 of these 16 climate zones. The average saving percentage by fuel type for each sample climate zone is illustrated in Figure 10.

Figure 10: Percentage savings by climate zone



Electric energy (kWh) savings averaged 3.1% across all climate zones.

The average reduction for kW was 5.6%, but in contrast to kWh, kW exhibited a wide variation of savings from -9.6% in climate zone 4, to 17.6% in climate zone 9. With the exception of climate zone 6, the

greatest kW percent reductions were concentrated in the climate zones with hotter temperatures. Climate zone 12, the inland area surrounding Sacramento is of particular interest. Both PG&E and BayREN reported projects in this climate zone, but with very different outcomes. The PG&E climate zone 12 projects averaged a 19.8% kW reduction. The BayREN projects in the same climate zone averaged a 1.9% kW increase. We cannot explain this outcome from the tracking data alone.[28]

Gas savings averaged 30% statewide. These saving were in climate zones that experience lower temperatures. Savings were highest in the cooler climate zones (2, 3 and 4) and in the climate zone with more extreme high and low temperatures (9 through 14).

These finding suggest that the program may be more effective at delivering savings in climate zones with wider annual temperature ranges. The program also may be more effective at reducing peak demand (kW) and gas (therm) savings than overall energy usage (kWh).

[28] Differences may be due to the way savings are reported, new vs replaced A/C units in the sample, or that CZ 12 temperatures vary from the east side to the central and west side. These types of questions will be included of next HUP follow-up study.

4 FINDINGS AND RECOMMENDATIONS

This section has two sub-sections. The first section provides findings and recommendations based on the analysis of the program savings. The second section focuses on issues underlying, but outside, the analysis.

4.1 Program Savings

Finding 1: Statewide, we found annual electric energy savings averaging 3.1%. Two climate zones showed annual household savings of 5% or more. In descending order from greatest to least savings, these climate zones were 16 and 11.

Finding 2: Statewide, we found annual gas savings averaging 29.3%. Three climate zones showed annual household savings of 30% or more. In descending order from greatest to least savings, these climate zones were 3, 4, and 9. These are climate zones with more than 2,500 Heating Degree Days.

Finding 3: Statewide we estimated a reduction in demand of 7.4% between 3pm and 5pm during the hottest days of the year (August and September), except for two PAs.

Finding 4: Savings vary considerably by PA, for kW and therms. For example, statewide average demand (kW) reduction was 7.4%. The changes however ranged from an average reduction of 17.8% (PG&E) to an average kW increase of 8.1% (BayREN).

- We can not determine the reason for this range with billing data alone. This difference may be due to the types of measures installed, or the fact that PG&E projects were in predominantly hotter climate zones while BayREN projects were predominantly in cooler climate zones.

Finding 5: For therms, the statewide average savings was 29.3%. This range spanned from 30.7% (BayREN) to 7.8% (SoCalREN).

Finding 6: Sample sizes are very small in the Southern part of the state (particularly for gas). Given the quality and quantity of the data, these results are as accurate as they can be.

Recommendation 1: These evaluation results suggest the 2013-14 Home Upgrade Program is more effective at saving gas and reducing demand than saving electric energy. It may be worth reviewing the current savings goals, and redefining program design and delivery to achieve greater savings.

Recommendation 2: When higher electric energy savings and demand reductions are program goals, the Program Administrators should concentrate on the inland climate zones. For example, climate zones in the central portion of the state (4, 11, 12, and 13) have more defined seasons with hotter temperatures in the summer and cooler temperatures in the winter.

Recommendation 3, 4 & 5: Conduct additional research on both program paths using a larger sample to refine savings estimates.This study should include analyzing the differences in the measures that are implemented by each PA. In addition, we suggest surveys and interviews with participating homeowners to find out drivers for big reductions, increases, and little change to energy usage. This will included a comparison of savings and costs for Home Upgrade and Advanced Home Upgrade.

Recommendation 6: For Southern California, the results should not be considered statistically representative of the program population. Given the design and demographics of the program however, there is no evidence to suggest they are not an accurate estimate of all program participants.

4.2 Program Evaluation

Finding 7: Tracking data sets were not complete and changed during the analysis period. For example,

- The Home Upgrade and Advanced home Upgrade projects were not clearly labeled or flagged among all project administrators.
- For some projects, multiple records separated each measure. Unfortunately, the total savings for the entire project were associated with each record. Simply adding all measure savings together resulted in savings that were greater than the total usage for the home.
- The reported duration of most Home Upgrade projects (66%) was cataloged as only 1 day. These projects were set to a 30-day blackout period.
- Reporting of account numbers was for only one fuel type only and matching accounts via premise ID was not consistent across program administrators.
- Deemed savings reported in the tracking data had some anomalies. Specifically, the average reported kW savings was 0.64. Considering a typical residential household draws an approximate maximum 2.0kW at peak, this implies savings of 32%.

Recommendation 7: The quality of tracking data needs to be improved prior to an evaluation to ensure that all PAs are recording data that is understandable and useable.

- Energy Division ex-ante program tracking data should be coded consistently across all PAs.
- The CPUC and IOUs should identify a mechanism to check data prior to the start of an evaluation, to ensure it proper coding.
- Tracking data should be checked thoroughly by PAs prior to submission. Specifically,
    - Home Upgrade and Advanced Home Upgrade projects should be clearly differentiated,
    - projects that receive financing should be clearly differentiated,
    - projects from other programs should be coded differently, so that if they are included in the data, they can immediately be identified and removed, such as multi-family and energy savings assistance program projects,
    - projects should include well-defined and verified project start and end dates,
    - tracking data should identify and verify valid electric and gas account numbers when possible,
    - where account numbers are not available, due to service territory overlap for example, service provider should be identified for each fuel type,
    - data should be checked for accuracy with project files and reasonableness in terms of magnitude.

APPENDIX A. BILLING ANALYSIS METHODOLOGY

This appendix provides a detailed discussion of the billing analysis methodology used in this study. It may be used as a reference for the study results or as a standalone document on the technical aspects of this evaluation. As such, some of the language and exhibits from the main report are repeated in the appendix.

The purpose of this impact evaluation was to estimate the change in electric demand (kW), and electric and gas energy savings (kWh, therms) for Home Upgrade Program participants who completed their upgrade in program year 2013-2014.

To quantify the energy savings estimates for this study, DNV GL used "pooled billing analysis," a method that involves comparing energy consumption among participants before and after program participation. The billing analysis for this study is considered pooled because the models used to estimate the impact of the program were estimated using all participants.[29]

With this type of a model, for any particular time under consideration, those participants who enrolled after the time period are considered a control group when estimating model parameters and those participants who enrolled before the time period are considered the treatment group. The use of later participants as a control group allows the billing analysis—at least to some extent—to control for the effects of participant self-selection bias and various exogenous factors that are unrelated to the program and might otherwise affect a participant's energy consumption in the pre-program and post-program periods.

In a pooled billing analysis, energy consumption is modeled using regression techniques in order to account for year-specific anomalies that might affect consumption, such as outside temperature extremes and various additional fixed effects. An average normalized annual consumption (NAC) is computed among program participants using the fitted models for both the pre- and post-program periods. The difference between the two is the gross savings estimate that might be attributed to the program. Note the estimate is largely considered a "gross" savings estimate because it does not account for effects of factors such as free ridership and spillover.[30]

For this evaluation we modeled, energy usage for two fuels - electricity (kWh) and gas (therms) - using a pooled billing analysis..[31] The kWh fitted model was subsequently used to estimate the effect of the program on electricity demand (kW). Details of the modeling and estimation process are presented in this Appendix. Additional final results from this billing analysis can be found in Appendix B.

A.1 Basic Model

The billing analysis used to evaluate the effect of the Home Upgrade Program on electricity and gas consumption used a two-phase, fixed effects pooled billing model methodology. The analysis is considered two-phased because models were estimated at two different steps in the process[32] (this is discussed below).

[29] BayREN and SoCalREN values are not reported due to the small sample sizes available, but the results in this appendix include 10 BayREN and 42 SoCalREN home upgrade projects.

[30] See Jayaweera and Haeri (2013) for more details on pooled analysis

[31] The "pool" is statewide, however HDD and CDD are taken into account for each participating home since two homes in the the same climate zone can experience different temperatures during the the same hour. See Appendix A section 3 for details on weather data.

[32] A set of models were estimated to obtain an appropriate heating, cooling, and dew-point degree day base value for each participant. This is considered phase 1. The estimation of the final billing models is considered phase 2. These are discussed in Steps #2 and #4 later in this section.

The various models estimated during the billing analysis used linear regression techniques, and were a variation of the well-documented and widely used PRISM®[33]

An important feature of the PRISM model is its use of weather data as predictors. This makes it both unique and applicable for measuring energy savings. Weather predictors were included in the models by constructing heating, cooling, and dew-point degree day values for each participant and each time period.[34] The computation of the heating, cooling, and dew-point degree day values for this billing analysis is discussed in Section A.3.

The following equation shows the basic PRISM linear model that was considered in this billing analysis:

$$E_{ki} = \mathbf{z}_{ki}\boldsymbol{\gamma} + \mathbf{x}_{ki}\boldsymbol{\beta} + \varepsilon_{ki} \quad (1)$$

Where the subscript i denotes participant, k is time period (time period can be month, day, or hour in this evaluation, depending on the specific model under consideration), and

E_{ki} is the energy consumption for participant i and time period k. This equals kWh for the electric billing models and therms for the gas billing models. This data item came from billing data and metered interval data from the six PAs noted in the previous section.

$\mathbf{z}_{ki}$ is a vector of model explanatory variables that are not a function of any program-related variables. For this evaluation, this vector included an assortment of variables, including weather data (degree-days), year/month indicators, and house-level (or participant-level) indicators.

$\mathbf{x}_{ki}$ is a set of model explanatory variables that are a function of program-related variable(s). Elements in this vector were equal to zero for time period k in the pre-blackout period (blackout period is defined below) for each participant and were generally something other than zero for periods in the post-blackout period. Often some or all of the components of $\mathbf{x}_{ki}$ are interaction terms between a 0/1 program indicator for (k,i) and the variables in $\mathbf{z}_{ki}$

$\boldsymbol{\gamma}$, $\boldsymbol{\beta}$ are the model coefficients that are estimated in a least squares, regression estimation process.

ε_{ki} is the model random error term.

The blackout period for a participant refers to the total time period in which program measures were installed. This is defined uniquely and independently for each participant as the time period between the participant's earliest installation date among all Home Upgrade measures and the latest completion date among all Home Upgrade measures. If the blackout period was less than 30 days, it was assumed to equal the time period between the installation date and installation date + 30 days.

Returning to Equation (1), assume the estimated $\boldsymbol{\gamma}$ and $\boldsymbol{\beta}$ are $\hat{\boldsymbol{\gamma}}$ and $\hat{\boldsymbol{\beta}}$ respectively, and note that for any particular $\mathbf{z}_{ki} = \tilde{\mathbf{z}}_i$ and $\mathbf{x}_{ki} = \tilde{\mathbf{x}}_i$, the model-predicted amount of energy use before program participation for participant i is the following:

[33] PRISM® (PRInceton Scorekeeping Method) is copyright protected. Copyright 1995, Princeton University. All rights reserved.

[34] One of the earliest references to the PRISM model can be found in Fels (1986).

$$\hat{E}_{i,before} = \tilde{\mathbf{z}}_i \hat{\boldsymbol{\gamma}} \quad (2)$$

And the predicted amount of energy use after program participation is the following:

$$\hat{E}_{i,after} = \tilde{\mathbf{z}}_i \hat{\boldsymbol{\gamma}} + \tilde{\mathbf{x}}_i \hat{\boldsymbol{\beta}} \quad (3)$$

So the difference in energy use that can be attributed to the program is found by subtracting Equation (2) from Equation (3), which results in the following:

$$\Delta\hat{E}_i = \hat{E}_{i,after} - \hat{E}_{i,before} = \left(\tilde{\mathbf{z}}_i \hat{\boldsymbol{\gamma}} + \tilde{\mathbf{x}}_i \hat{\boldsymbol{\beta}}\right) - \left(\tilde{\mathbf{z}}_i \hat{\boldsymbol{\gamma}}\right) = \tilde{\mathbf{x}}_i \hat{\boldsymbol{\beta}} \quad (4)$$

When $\Delta\hat{E}_i$ is negative, this indicates some energy *savings* can be attributed to the program. Energy savings are reported in tabulations as $-\tilde{\mathbf{x}}_i \hat{\boldsymbol{\beta}}$.

Also, when needed, an estimate of annual energy savings is logically found by multiplying the change $\Delta\hat{E}_i$ from Equation (4) by an appropriate scale factor that depends on the time period associated with *k*. For example, for the gas billing model, Equation (1) was estimated using monthly billing data, *k* represented day, and $\Delta\hat{E}_i$ was multiplied by 365 to arrive at an annual estimate.

This pooled billing analysis conducted for this evaluation was a six-step process:

- **Step 1:** First, we aggregated consumption data into one analysis file, defined the blackout period for each participant, and identified the participants who were eligible for the billing analysis. Ultimately there were 619 participants used in the electric billing analysis, 623 participants used in the gas billing analysis, and the two sets overlapped for 41 participants. In other words, 41 participants were used in both the electric and gas billing analyses. This step is discussed further in Section A.2.
- **Step 2:** We obtained weather data for the weather station(s) closest to each participant and defined heating, cooling, and dew-point degree days. A variation of Equation (1) was used to determine an optimal, individual heating, cooling, and de- point degree day base value for each participant. The base values were used in the computation of degree days. This step is discussed further in Section A.3.
- **Step 3:** We obtained additional explanatory variables that were considered for inclusion in the vectors $\mathbf{x}_{ki}$ and $\mathbf{z}_{ki}$. For this evaluation, additional zip-code level variables were obtained from the 2009-2013 5-Year American Community Survey (ACS) available from the U.S. Census Bureau. This step is discussed further in Section A.4.
- **Step 4:** The final, full billing models were fitted using the data from Steps #1 through #3. Four pooled billing model sets were fit for this evaluation. Two of these were fit for quality control and comparative purposes only.

    1. The first set involved fitting 365 pooled billing models to predict kWh savings for each day of the calendar year. These models contained hour-specific indicators so that both a day and hour effect could be estimated.
    2. A more classical, monthly billing model was estimated to predict kWh savings.
    3. A monthly billing model was fit to estimate therm savings over an entire calendar year.
    4. A monthly billing model was fit to estimate therm savings for the winter monthly only in a calendar year.

The winter months are defined as the six-month period between November and April. Model sets #1 and #4 were used to produce the final estimate of savings attributed to the program for kWh and therms, respectably. Models #2 and #3 were estimated for comparative and quality control purposes only. This step is discussed further in Section A.5.

- **Step 5:** The estimated model parameters from Step #4 were used to derive an estimate of kWh and therm savings attributed to the program by various characteristics such as region, day, and hour. This is discussed further in Section A.6.
- **Step 6:** The fitted 365 kWh models were used to estimate the average peak demand (kW) for each program participant. This is discussed further in Section A.7.

Section A.8 presents a discussion of the computation of realization rates associated with this program. Realization rates for electricity savings, gas savings, and demand are discussed. The last section of this Appendix, Section A.9, presents some suggestions for any subsequent billing analysis that might be conducted with this population.

A.2 Gathering Data from Billing Files

The analysis file that used during the model estimation process is a critical component of the billing analysis.

Goals when Creating an Analysis File for the Billing Analysis

For a billing analysis, the goals are:

- To identify and account for all evaluation-eligible participants during the reference period of interest
- To define exactly when each participant enrolled in the program and received all their program measures (i.e., to define each participant's blackout period)
- To gather at least 12 full months of data before and after each participant's blackout period so that seasonal fluctuations can be accounted for in the pre/post comparisons

For a variety of reasons, virtually no billing analyses attain this goal for *all* participants, so the challenge is to come as close as possible given the time, data, and budget constraints for the analysis.

For Home Upgrade, statewide many projects were completed in the latter half of 2014 rather than throughout 2013 and 2014. Due to timing of billing data requests, many projects lacked sufficient post upgrade data. In addition, for PG&E the Home Upgrade population was overstated in the initial tracking data due to coding errors. The subsequent Home Upgrade population was much smaller. Also, there were issues with reported projects that were either not included in the 2013-2014 tracking data or being reported in the 2015 program year tracking data. These issues reduced the PG&E population to 132 homes. Of these, 96 had sufficient data before and after the upgrade and made up the sample (73% of the identified population).

Data Inputs

For this evaluation, the analysis began with several files obtained from the six regions. These included:

- A list of account numbers corresponding to 2013-2014 program participants. Depending on the region, sometimes these referred to electric accounts, sometimes gas accounts, and sometimes both.
- Master account-level files for all 2014 customers. DNV GL has these files for all regions, all customers, and for both gas and electric accounts.
- Hourly, and for some regions 15-minute, kWh interval data and daily therm interval data for program participants. The 15-minute interval data was aggregated to the hour level to be consistent with other regions. Because therm interval data was only available for some regions and for a small

number of customers, monthly billing data was used for the therm-level evaluation instead. Electric (kWh) interval data was available from 12/31/2011 until 7/20/2015, depending on the region and participant.

- Monthly gas billing data for all customers in the six regions. This was available for 2011-2014. Monthly gas billing data was not available for 2015 at the time this evaluation was conducted.
- A program tracking file that provided measure-level installation and completion dates for participants in all IOU and REN efficiency programs initiated within each service territory.

For quality control purposes, the hourly kWh interval data was compared to the monthly kWh billing data that were available for all customers in the six regions. The billing data was used to fit both models. The agreement rate between the two sources was quite high (greater than 94%).

The Day-level models predict usage and savings at the day and hour level, and thus contain various day and hour-level variables. The monthly model predicts usage and savings at the monthly level only and does not contain day or hour-level predictors.

The results suggest the monthly model yields savings estimates that are larger than the day-level models but this does not necessarily mean the monthly model predictions are more accurate. In fact, the standard errors on the monthly model estimates are much larger than the day-level model estimates - and this was expected because the number of sample points used to fit the monthly model is quite a bit less than the day-level models.

In addition to yielding smaller standard errors, the day-level models are more likely to yield prediction estimates that have less bias since the model accounts for variation in usage between hours of the day and days of the year - something the more classical monthly billing model does not account for very well.

The important finding from a quality control perspective was the pattern in the estimates. We found, for example, that the results from both models suggested the BayREN estimate was less than the overall "Total" estimate; the PG&E estimates was greater than the Total estimate and the SDG&E estimate was quite a bit less than the Total estimate.

Data Editing Steps

Given the input files above and the goals for creating the analysis file, the editing and file creation process proceeded as follows:

1. The process began with the list of accounts associated with all participants (File #1). Since data quality varied by region, the initial step was to identify any missing gas accounts associated with electric accounts—and any missing electric accounts associated with gas accounts—in this file. We assumed that this file contained at least one of the two accounts (gas or electric) for all participants that should be considered for this billing analysis.
2. For some PAs, a participant's gas and electric account number and/or premise number were the same; identifying missing gas or electric records in the file was relatively straightforward for these PAs. For others, the master account file was used (File #2) to link gas and electric accounts for all participants considered for this evaluation. Customer name, address, and telephone number were used in this record linkage exercise, accounting for potential variations in spelling and abbreviations in the text fields.
3. Next, the output file from the previous step was linked to the tracking file (File #5) in order to determine when Home Upgrade measures were installed. The data items of interest at this step were measure installation date and completion date. As noted earlier, a blackout period was defined using these data items for each participant. Additional discussion on the duration and timing of the blackout period is presented below.
4. The consumption data from File #3 and #4 above were then merged with the gas/electric participant-level file from the previous step. Consumption data were sought and retained (if possible) for each participant for the 460-day period before and after the participant's blackout period.
5. Lastly, DNV GL examined records and determined whether they were suitable for inclusion in the final billing analysis. For various reasons, a large number of participants could not be included in the billing analysis and were therefore omitted from the analysis file at this final step.
6. The primary reason customers were not included in the billing analysis was that they did not have enough monthly data in either the pre or post periods. Some of this is due to data simply not being available; for example, a new customer may not have enough data prior to the blackout period, and a customer who moved may not have enough data in the post period. Since most Home Upgrade projects occurred later in the program cycle most customers were excluded because they did not have sufficient data available in the post-period due to the timing of the consumption data files that were used. As an example, the disposition of records for the gas analysis is reported in Table 13.

Table 13: Disposition of Gas Records

Disposition	PG&E	BayREN	SCG	SoCalRen	SDG&E
1: Ample Days of Data Before and After Blackout	56	527	8	1	31
2: Ample Days of Data Before but Not After Blackout	13	60	91	101	185
3: Ample Days of Data After but Not Before Blackout	0	4	1	2	6
4: No Ample Days of Data Before and After Blackout	0	0	6	5	96
5: Does Not Receive Gas Service	53	12	4	4	22
6: Ample Days of Data Before and After, But Have Readings from a Varying Number of Meters	0	1	0	0	2
7: Ample Days of Data Before and After, But Have No Variation in Readings Before or After Blackout	2	2	0	0	0
8 On tracking file, No HUP measures	16	1	6	1	0
9 On tracking file, No ZIP code	0	0	1	0	0

Disposition	PG&E	BayREN	SCG	SoCalRen	SDG&E
10 Not on Tracking File	246	17	20	31	7
11 Omitted – participant was in another EE program	8	58	2	0	3
12 Total	394	682	139	145	352

Note: The number of projects were determined by subtracting row 10 and row 8 from row 12.

A.2.1 Timing and Duration of the Participants' Blackout Period

As noted earlier, the blackout period for any participant is defined as the time span between the earliest installation date and the latest completion date for the home. These fields are in the tracking data identified as "StartDate" and "ProjectCompletionDate". These are separate from other fields for application dates, contract sign dates, and rebate payment dates. The average blackout period varied across PAs and ranged from 1 to 300 days. For our analysis when the blackout period was one-day, the minimum blackout period was adjusted to 30 days (project start date plus 30 days). We adjusted this period to mitigate any date reporting quality issues and to be sure that the upgrade was fully completed for pre- and post- comparisons. The PA with the longest average blackout period was SCE with 179 days. The shortest average was SoCalREN at 30 days.

A.3 Weather Data and Defining Heating, Cooling, and Dew-Point Degree Days

The next step in the billing analysis was to gather appropriate temperature and dew-point data that would be used to construct some independent variables for the billing models. Two sets of data were obtained. The first set is the actual 2011-2014 hourly temperature and dew-point data recorded from various weather stations in California. Temperature and dew-point values were assigned to each program participant using weather station data from the three geographically closest weather stations to the participant. These data were obtained from the National Oceanic and Atmospheric Administration (NOAA). Three stations were considered in order to account for anomalous weather data in the NOAA files. For each day and each hour in the participant's pre- and post-blackout periods, an outside temperature and dew point were assigned to the participant as the median value from the three closest stations that had data available.

The second set of weather data obtained was the Typical Meteorological Year (TMY) weather data[35] for the same set of weather stations in California. The TMY data are also available from NOAA. These temperatures and dew points were derived using 30 years of historical data. These normalized temperatures and dew points represent the outside temperature/dew point per hour for every day in a "typical" calendar year that one would expect at any given weather station. For this analysis, DNV GL used the third edition of the published TMY data (TMY3 data, for short) to derive normalized annual predications of energy savings from the Home Upgrade Program. As with the actual 2011-2014 data, TMY data were assigned as the median value of temperature and dew point among the three geographically closest stations to each participant.

As noted earlier, one of the distinguishing features of the PRISM linear regression model is the use of weather data as predictors. Weather data were included in the billing models estimated in this evaluation in

[35] The TYM3 data sets derived from the 1961-1990 and 1991-2005 National Solar Radiation Data Base (NSRDB) archives (http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/tmy3/).

the form of heating, cooling, and dew-point degree days, and are included in the PRISM model [see Equation (1)] as components of the explanatory variables in the vectors $\mathbf{z}_{ki}$ and $\mathbf{x}_{ki}$. The degree days are computed by comparing the outside temperature and dew point to some fixed base values. Optimal base values for the heating, cooling, and dew-point degree days were computed separately for each participant. The use of base values that are allowed to vary among participants improved the fit of the pooled billing model (discussed below) by accounting for a greater proportion of the variation in energy use among participants.

In general, heating and cooling degree days are a measure of the deviation between the outside temperature and some specified heating and cooling degree base values. For each billing period and for each household participant, heating and cooling degree days are defined as:

Heating Degree Days

$$HDD_{i,k} = \sum_{\substack{j \in Hours\ in \\ Time\ Period\ k}} Max\{BASE_{heat,i} - Hourly\ Temperature_j, 0\} \quad (5)$$

Cooling Degree Days

$$CDD_{i,k} = \sum_{\substack{j \in Hours\ in \\ Time\ Period\ k}} Max\{Hourly\ Temperature_j - BASE_{cool,i}, 0\} \quad (6)$$

Dew-Point Degree Days

The dew point degree days were computed in a manner similar to the cooling degree days, as follows:

$$DDD_{i,k} = \sum_{\substack{j \in Hours\ in \\ Time\ Period\ k}} Max\{Hourly\ Dewpoint_j - BASE_{dew,i}\} \quad (7)$$

The heating and cooling degree base values were computed for each program participant by fitting the following variation of Equation (1) for each household participant independently.

$$E_{ki} = \mathbf{z}_{ki}\boldsymbol{\gamma}_i + \mathbf{x}_{ki}\boldsymbol{\beta}_i + \varepsilon_{ki} \quad (8)$$

Where:

- E_{ki} is the kWh or therm consumption value for participant *i* and time period *k*.
- $\mathbf{z}_{ki}$ is a set of model explanatory variables that are <u>not</u> a function of any program-related variables. This vector included an intercept term, HDD_{ki} and CDD_{ki}.
- $\mathbf{x}_{ki}$ is a set of model explanatory variables that are a function of program-related variable(s). This vector included the main effect term $PROGRAM_{ki}$ (0/1 program indicator for *k,i*) as well as the interaction terms $PROGRAM_{ki} \cdot HDD_{ki}$ and $PROGRAM_{ki} \cdot CDD_{ki}$.

For each participant, the model parameters that were estimated in Equation (8) via nonlinear least squares are $\hat{\boldsymbol{\gamma}}_i$, $\hat{\boldsymbol{\beta}}_i$ as well as the base values $BASE_{heat,i}$ and $BASE_{cool,i}$. This is considered a nonlinear model because the base values, in addition to the model parameters, are model unknowns whose values are

determined via the least squares process. At this step, the primary outcomes of interest are the estimated base values $BASE_{heat,i}$ and $BASE_{cool,i}$ for each participant *i*.

The optimal dew-point degree day base value was computed using a second set of participant-level models that were analogous to those used to obtain the heating and cooling degree day base values for each participant. For the dew-point degree day base value models, the vector $\mathbf{z}_{ki}$ contained the term DDD_{ki}, and $\mathbf{x}_{ki}$ contained $PROGRAM_{ki}$ and $PROGRAM_{ki} \cdot DDD_{ki}$.

The average degree day base values by region are presented in Table 14. The average heating, cooling, and dew-point degree base values over the 619 participants used in the kWh billing analysis were 61.1, 70.7, and 49.0 degrees, respectively. For the therm billing analysis, only heating degree day base values were computed, since cooling and dew-point degree days are generally not correlated with gas use. The average heating degree day base value over the 132 participants used in the therm billing analysis was 63.5 degrees. A generally accepted assumption is that households would begin using their heating systems at around 60 degrees and their air conditioning systems at around 70 degrees,[36] and that dew points greater than 60 are generally considered "uncomfortable."

Table 14: Average Degree Day Base Value Among Participants Used in the Billing Analysis

Fuel	PA	Heating	Cooling	Dew Point
Electric	Total	61.1	70.7	49.0
	BayREN	59.5	70.3	46.8
	PG&E	61.0	71.5	48.0
	SCE	61.6	70.2	49.6
	SoCalREN	61.1	68.6	51.4
	SDG&E	61.5	67.6	53.4
Gas	Total	63.5	n/a	n/a
	BayREN	70.1	n/a	n/a
	PG&E	69.7	n/a	n/a
	SoCalGas	63.1	n/a	n/a
	SoCalREN	61.4	n/a	n/a
	SDG&E	61.4	n/a	n/a

A.4 Gathering Additional Explanatory Variables

In order to account for a greater portion of the variability in the consumption data, various additional data items were extracted from the 2009-2013 American Community Survey (ACS) and merged to the analysis file by zip code. Data items included:

- Percent of households in zip code with gas heat
- Percent of households in zip code with electric heat
- Median number of rooms in households
- Number of occupants per room
- House value
- Number of bedrooms

[36] The 60 and 70 degree heating and cooling degree base values are recommended in Jayaweera and Haeri (2013) when individual base values are not computed.

- Year house built

These variables were categorized by computing the 33rd and 66th percentiles among participants; the categorical versions of the variables were included in the vectors $\mathbf{z}_{ki}$ and $\mathbf{x}_{ki}$ in Equation (1). The exact boundaries established in the categorization are displayed—along with some additional model-fitting statistics—in Section A.5 and in Appendix B.

We acknowledge there is measurement error associated with variables constructed from the American Community Survey (ACS). The measurement error is small however relative to the model prediction error. The effect of measurement error is further reduced because (1) the ACS variables were only used to classify zip codes into categories and membership in these categories were used as independent indicator variables in the models and (2) the overall effect of using the ACS variables on the model fit was relatively small. For example, we found on average, including the ACS variables in the model improved the fit of the kWh day-level models by only 0.6%.

A.5 Estimating the Final Fixed Effects Models

As noted in the introduction of this appendix, two separate billing analyses were conducted: one to estimate the effect of the Home Upgrade Program on electric (kWh) use, and a second to estimate the effect of the program on gas (therm) use. Results from the electric billing analysis were also used to estimate electric demand (kW); this is discussed in Section A.7. Additionally, Section A.1 noted two variations of Equation (1) were fit for each of the two fuel types. So, in total, four model sets were estimated:

Electricity

- **Day-Level kWh Model.** The first model was actually a set of 365-pooled billing models, each of the form displayed in Equation (1). This was model was used to produce the final estimates of kWh savings attributed to the Home Upgrade Program.[37]
- **Monthly-Level kWh Model**. Hourly interval data was collapsed to the month level and a more classical monthly billing analysis was performed. This was done for comparative and quality control purposes only.

Gas

- **Monthly-Level Therm Model, Annual**. A billing analysis was conducted using the monthly therm billing data. This analysis used billing data associated with all months in the pre- and post-program periods. The final estimates of the impact of the program on gas use were derived from this model.
- **Monthly-Level Therm Model, Winter Months Only**. A billing analysis was conducted using the monthly therm billing data, winter months only. The winter months were November 1 to April 30. Using the winter months only to examine the effect of a program on gas usage is common. Gas use tends to be relatively low and constant during the warmer months, and the fixed effects billing model tends to fit the therm billing data better when only the winter months are considered.

This section discusses each of these four model sets in turn.

A.5.1 Day-Level kWh Model

To estimate the effect of the program on hourly electric use, a separate billing model was fit using the 457 participants for each day of the year. So, 365 models were estimated. Parameters for each of these day-

[37] Prediction estimates of kWh savings and consumption were computed for each day in a typical meteorological year (TMY) using the day-level models. These estimates were summed across days to get the annual estimates.

level models were estimated using the billing data for the day under consideration, as well as the seven days prior to and the seven days after the day under consideration. For example, the model used to estimate savings on January 1 used billing data from January 1, as well as billing data from December 25-31 and January 2-8. The 15-day period was included in each of the day-level models for two main reasons:

- To include the effect of the day of the week in the model. For example, a calendar day such as January 1 will not fall on the same day of the week each year.
- Using 15 days of data helped ensure continuity among model predictions for consecutive days. Note the parameters of the models associated with any two consecutive days will be estimated using 14/15 = 93% of the same consumption data, so one would not expect to see unnatural, sudden jumps in the estimated savings between consecutive days in an 8,760 day-by-hour analysis.
- For example, a model for January 1 was estimated using billing data from December 25-January 8, and a model for January 2 was estimated using billing data from December 26-January 9. The two 15-day time periods overlap by 93%.

Each of the 365 models included 15 intercept terms to identify whether the consumption value was associated with the day under consideration (considered day=0), day-1,…, day-7 or day+1,…, day+7.

Other terms incorporated in each of the day-level models included:

1. A separate intercept term for each participant
2. Year indicator to identify whether a particular consumption value was from the 2011, 2012, 2013, 2014, or 2015 billing data
3. Hour-level indicators for each hour of the day
4. Day of the week and holiday indicators. The holiday indicator flagged particular "holiday" days of the year that don't naturally fall on the weekend and in which one would expect energy consumption to be atypical. For this billing analysis, holidays were defined as: Christmas Eve, Christmas Day, New Year's Eve, New Year's Day, Labor Day, Memorial Day, Independence Day, Thanksgiving, and the Friday after Thanksgiving.
5. Heating, cooling, and dew-point degree days
6. The interaction of heating degree days with a weekday/weekend indicator and hour-level indicators
7. The interaction of cooling degree days with a weekday/weekend indicator and hour-level indicators
8. The interaction of dew-point degree days with a weekday/weekend indicator and hour-level indicators
9. The interaction of heating and cooling degree-days with a gas customer indicator. The gas customer indicator identifies whether or not the participant was a gas CPUC customer.
10. The interactions of heating and cooling degree days with various zip code level indicators derived from the American Community Survey (ACS) [see Section A.4]
11. PROGRAM indicator. This was set to 1 when a billing consumption value corresponded to a post period for a participant; otherwise, it was set to 0
12. PROGRAM indicator interaction with #3-#10 above

Main effects for the gas customer indicator mentioned in #9 and the ACS indicators mentioned in #10 were not included in the day-level models because these are participant-level variables, and the model already contained a separate intercept for each participant.

A summary of the significance of the model parameters in the 365 models is presented in Appendix B. Most of the results are fairly intuitive. For example:

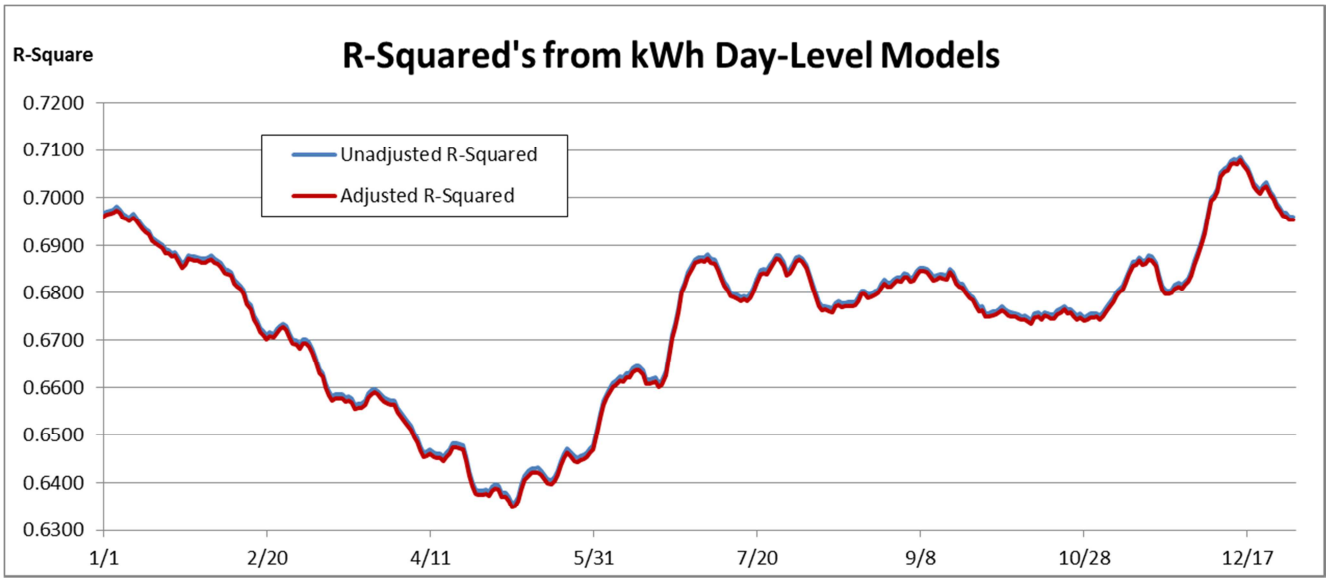
- Heating and cooling degree-days were only significant in roughly 45% of the models. This makes senses because one would expect heating degree-days to be significant only in the colder months and cooling degree-days only in the warmer months.
- Some variables were excluded from all of the day-level models because they served as a reference level for a particular categorization. For example, as discussed in Appendix B, the Hour #24 indicator was excluded from all models.
- The holiday indicator was only included in 17% of the models. This variable naturally drops out of those day-level models in which the 15-day time period does not include a holiday.

On average, the 365 models were fit with 444,126 hourly consumption data points. On average, 50.0% of the hourly consumption data points were associated with consumption in a pre-program period.

One of the statistics that is often used to measure the fit of a fixed-effects model is the coefficient of determination, or R-squared. The coefficient of determination ranges from 0 to 1 for a linear model such as Equation (1), and values closer to 1 indicate a "better fit." Higher R-squared values indicate the explanatory variables are explaining a larger proportion of the variation in the dependent variable, and hence the model is a "better fit" for the data.

The average R-squared value over the 365 models was 0.6358. The R-square and adjusted R-square[38] values by day-level model are shown in Figure 11. The average adjusted R-square was 0.6735 among the 365 KWH, day-level models and 0.7576 for the therm model. These values tend to be a little greater during months when consumption is greater: the colder months (December and January) and the hotter months (July and August).

Figure 11: R-Square by Day-Level, kWh Model



[38] Adjusted R-square compares the explanatory power of the model relative to the number of explanatory variables used.

A.5.2 Monthly Level Therm Model

The monthly level therm model was very similar to the monthly kWh model, at least from a statistical and model estimation viewpoint. The explanatory variables used in the model included:

1. A separate intercept term for each participant
2. Month-level indicator
3. Year indicator to identify whether a particular consumption value was from the 2011, 2012, 2013, 2014, or 2015 billing data
4. The interaction of year and month
5. Heating degree days (cooling and dew-point degree days were not included in the therm model)
6. The interaction of heating degree days with a gas customer indicator (identifies whether or not the participant was a gas CPUC customer)
7. The interactions of heating degree days with various zip code level indicators derived from the American Community Survey (ACS) [see Section A4]
8. PROGRAM indicator. This was set to 1 when a billing consumption value was taken in the post period for a participant; otherwise, it was set to 0.
9. PROGRAM indicator interaction with #5 and #6 above

A summary of the model parameters is presented in Appendix B.

This model was estimated using 10,128 monthly billing values from the 623 participants used in the billing analysis; 52.1% of these were associated with consumption in a pre-participation period. The R-square associated with the final estimated model was 0.8049.

A.5.3 Monthly Level Therm Model (Winter Months Only)

The monthly level therm model (winter months only) was analogous to the model described in the previous section. The only difference is the data used to estimate the model parameters. For this model, only the monthly consumption data in November to April were considered. A summary of the model parameters is presented in Appendix B.

This model was estimated using monthly billing values for 608 participants; 53.8% of these were associated with consumption in a pre-participation period. The R-square associated with the final estimated model was 0.8531. This is higher than the 0.7517 noted in the 12-month model (Section A.5.3), as expected.

A.6 Estimating Demand (kW) Savings

Peak kW savings was estimated using predictions from the day-level kWh billing models and the definition of kW savings suggested by the PG&E Avoided Cost Calculator in the document "INSTRUCTIONS for PG&E Avoided Cost Calculator (E-3 Calculator, Version 2d3)" (PGE, 2015). These instructions indicate peak kW savings should be estimated as follows:

> "…peak kW savings is defined as the average grid impact for the measure from 2 PM to 5 PM during the three consecutive weekday period containing the weekday with the hottest temperature of the year. This definition is consistent with the definition used in the 2005 Database for Energy Efficiency Resources (DEER)."

To apply this definition to our billing analysis model predictions, DNV GL took the following steps:

- The hottest day and time of the year was identified using the average TMY temperature over the participants used in the kWh billing analysis. At the total participant level (across all regions), this date and time was 8/11, 3 pm.

- The average temperatures for the three, three-day periods that touch 8/11 were compared, considering only the three hours 3 pm-5 pm. These three-day periods are 8/09-8/11, 8/10-8/12, and 8/11-8/13. The 8/10-8/12 period had the highest average temperature during these hours at the total program level.
- DNV GL used the estimated day-level models to compute a pre-program prediction for each of the nine hours in the three days, assuming the three days fell on Mon-Wed, Tues-Thu, or Wed-Fri. The Mon-Wed period had the largest mean pre-energy consumption at the total program level.
- DNV GL used the estimated models to compute the average pre and post energy consumption for 8/10-8/12, 2 pm-4 pm, assuming the days fell on Mon-Wed. The final estimated demand was equal to the sum of these energy consumption fields over the nine hours, divided by the number of participants, and then divided by 9 (for the 9 hours).

The above algorithm was repeated by region, by month, and:

1. Looking at the hottest day of the year, 3 pm-5 pm only, and considering only Mon-Fri. This is the closest thing to the above DEER definition.
2. Looking at the coldest day of the year, 3 pm-5 pm only, and considering only Mon-Fri. This is similar to the DEER definition, but looks at the coldest time of the year.
3. Looking at the hottest day of the year, the three-hour period that yielded the highest mean temperature and considering any day of the week.
4. Looking at the coldest day of the year, the three-hour period that yielded the lowest mean temperature and considering any day of the week.

A.7 Bibliography

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APPENDIX B. SUMMARY OF THE SIGNIFICANCE OF THE MODEL EXPLANATORY VARIABLES

This appendix summarizes the significance of the model parameters estimated for each of the four model sets discussed in Appendix A, Section A.5. Four exhibits are presented:

- Table 15 summarizes the significance of the model parameters from the 365 fitted models associated with the day-level, kWh model set discussed in Section A.5. These models were used to generate the final estimates of kWh savings from the Home Upgrade Program.

Separate intercept terms for each participant were included in all models. The statistical significance of these terms is not available due to the methodology used to estimate the model parameters.

Some model parameters will have a significance of "n/a." These are generally associated with levels of categorical variables that are serving as the reference cell in the model.

Table 15: Summary of the Significance of the Model Parameters for kWh Models

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
PROGRAM	Program Indicator	100.0%	85.5%
XHDD	Heating DD	100.0%	45.2%
XCDD	Cooling DD	100.0%	13.2%
XDDD	Dewpoint Degree Days	100.0%	20.3%
XPREVDAY_T1	Average Temperature on Previous Day, 9 am-3 pm	100.0%	68.2%
XPREVDAY_T2	Average Temperature on Previous Day, 4 pm-10 pm	100.0%	61.1%
LINEART	Temperature 3 Hour Linear Lag	100.0%	97.3%
LINEARD	Dewpoint 3 Hour Linear Lag	100.0%	68.8%
XHOUR1	Hour #1 Indicator	100.0%	95.9%
XHOUR2	Hour #2 Indicator	100.0%	99.7%
XHOUR3	Hour #3 Indicator	100.0%	99.7%
XHOUR4	Hour #4 Indicator	100.0%	97.8%
XHOUR5	Hour #5 Indicator	100.0%	87.1%
XHOUR6	Hour #6 Indicator	100.0%	82.7%
XHOUR7	Hour #7 Indicator	100.0%	85.2%
XHOUR8	Hour #8 Indicator	100.0%	99.5%
XHOUR9	Hour #9 Indicator	100.0%	95.9%
XHOUR10	Hour #10 Indicator	100.0%	89.6%
XHOUR11	Hour #11 Indicator	100.0%	91.8%
XHOUR12	Hour #12 Indicator	100.0%	97.5%
XHOUR13	Hour #13 Indicator	100.0%	98.1%
XHOUR14	Hour #14 Indicator	100.0%	96.7%
XHOUR15	Hour #15 Indicator	100.0%	92.9%
XHOUR16	Hour #16 Indicator	100.0%	86.0%
XHOUR17	Hour #17 Indicator	100.0%	100.0%
XHOUR18	Hour #18 Indicator	100.0%	100.0%
XHOUR19	Hour #19 Indicator	100.0%	100.0%
XHOUR20	Hour #20 Indicator	100.0%	100.0%
XHOUR21	Hour #21 Indicator	100.0%	100.0%
XHOUR22	Hour #22 Indicator	100.0%	100.0%
XHOUR23	Hour #23 Indicator	100.0%	100.0%
XDIFF0	Day Indicator	100.0%	69.3%
XDIFF1	Day-7 Indicator	100.0%	74.8%
XDIFF2	Day-6 Indicator	100.0%	69.0%
XDIFF3	Day-5 Indicator	100.0%	68.8%

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
XDIFF4	Day-4 Indicator	100.0%	67.9%
XDIFF5	Day-3 Indicator	100.0%	64.4%
XDIFF6	Day-2 Indicator	100.0%	65.2%
XDIFF7	Day-1 Indicator	100.0%	67.7%
XDIFF8	Day+1 Indicator	100.0%	63.8%
XDIFF9	Day+2 Indicator	100.0%	64.9%
XDIFF10	Day+3 Indicator	100.0%	68.2%
XDIFF11	Day+4 Indicator	100.0%	62.7%
XDIFF12	Day+5 Indicator	100.0%	64.9%
XDIFF13	Day+6 Indicator	100.0%	60.0%
X2012	2012 Indicator	93.7%	86.3%
X2013	2013 Indicator	100.0%	94.0%
X2014	2014 Indicator	100.0%	85.8%
XSUN	Sunday Indicator	100.0%	62.2%
XMON	Monday Indicator	100.0%	60.8%
XTUE	Tuesday Indicator	100.0%	76.4%
XWED	Wednesday Indicator	100.0%	68.2%
XTHU	Thursday Indicator	100.0%	68.5%
XFRI	Friday Indicator	100.0%	66.0%
XHOLIDAY	Holiday Indicator	16.7%	72.1%
XHDD_TIME1	HDD*Weekday*Hour 1	100.0%	12.9%
XHDD_TIME2	HDD*Weekday*Hour 2	100.0%	22.5%
XHDD_TIME3	HDD*Weekday*Hour 3	100.0%	41.1%
XHDD_TIME4	HDD*Weekday*Hour 4	100.0%	60.3%
XHDD_TIME5	HDD*Weekday*Hour 5	100.0%	72.9%
XHDD_TIME6	HDD*Weekday*Hour 6	100.0%	87.1%
XHDD_TIME7	HDD*Weekday*Hour 7	100.0%	92.1%
XHDD_TIME8	HDD*Weekday*Hour 8	100.0%	89.0%
XHDD_TIME9	HDD*Weekday*Hour 9	100.0%	74.5%
HDD_TIME10	HDD*Weekday*Hour 10	100.0%	54.8%
HDD_TIME11	HDD*Weekday*Hour 11	100.0%	51.8%
XHDD_TIME12	HDD*Weekday*Hour 12	100.0%	45.8%
XHDD_TIME13	HDD*Weekday*Hour 13	100.0%	35.3%
XHDD_TIME14	HDD*Weekday*Hour 14	100.0%	19.5%
XHDD_TIME15	HDD*Weekday*Hour 15	100.0%	30.7%
XHDD_TIME16	HDD*Weekday*Hour 16	100.0%	36.4%

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
XHDD_TIME17	HDD*Weekday*Hour 17	100.0%	50.4%
XHDD_TIME18	HDD*Weekday*Hour 18	100.0%	58.4%
XHDD_TIME19	HDD*Weekday*Hour 19	100.0%	59.5%
XHDD_TIME20	HDD*Weekday*Hour 20	100.0%	52.3%
XHDD_TIME21	HDD*Weekday*Hour 21	100.0%	44.4%
XHDD_TIME22	HDD*Weekday*Hour 22	100.0%	11.0%
XHDD_TIME23	HDD*Weekday*Hour 23	100.0%	4.4%
XHDD_TIME24	HDD*Weekday*Hour 24	100.0%	32.3%
XHDD_TIME25	HDD*Weekend*Hour 1	100.0%	0.0%
XHDD_TIME26	HDD*Weekend*Hour 2	100.0%	0.0%
XHDD_TIME27	HDD*Weekend*Hour 3	100.0%	0.3%
XHDD_TIME28	HDD*Weekend*Hour 4	100.0%	4.7%
XHDD_TIME29	HDD*Weekend*Hour 5	100.0%	2.2%
XHDD_TIME30	HDD*Weekend*Hour 6	100.0%	12.1%
XHDD_TIME31	HDD*Weekend*Hour 7	100.0%	29.0%
XHDD_TIME32	HDD*Weekend*Hour 8	100.0%	51.0%
XHDD_TIME33	HDD*Weekend*Hour 9	100.0%	96.4%
XHDD_TIME34	HDD*Weekend*Hour 10	100.0%	91.5%
XHDD_TIME35	HDD*Weekend*Hour 11	100.0%	74.2%
XHDD_TIME36	HDD*Weekend*Hour 12	100.0%	68.2%
XHDD_TIME37	HDD*Weekend*Hour 13	98.4%	57.1%
XHDD_TIME38	HDD*Weekend*Hour 14	98.6%	56.1%
XHDD_TIME39	HDD*Weekend*Hour 15	98.9%	53.7%
XHDD_TIME40	HDD*Weekend*Hour 16	100.0%	46.3%
XHDD_TIME41	HDD*Weekend*Hour 17	100.0%	50.1%
XHDD_TIME42	HDD*Weekend*Hour 18	100.0%	43.6%
XHDD_TIME43	HDD*Weekend*Hour 19	100.0%	18.4%
XHDD_TIME44	HDD*Weekend*Hour 20	100.0%	14.2%
XHDD_TIME45	HDD*Weekend*Hour 21	100.0%	19.5%
XHDD_TIME46	HDD*Weekend*Hour 22	100.0%	18.6%
XHDD_TIME47	HDD*Weekend*Hour 23	100.0%	6.6%
XCDD_TIME1	CDD*Weekday*Hour 1	100.0%	6.0%
XCDD_TIME2	CDD*Weekday*Hour 2	100.0%	8.2%
XCDD_TIME3	CDD*Weekday*Hour 3	100.0%	5.8%
XCDD_TIME4	CDD*Weekday*Hour 4	98.9%	8.6%
XCDD_TIME5	CDD*Weekday*Hour 5	98.6%	5.0%

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
XCDD_TIME6	CDD*Weekday*Hour 6	100.0%	15.1%
XCDD_TIME7	CDD*Weekday*Hour 7	98.6%	25.3%
XCDD_TIME8	CDD*Weekday*Hour 8	98.9%	21.1%
XCDD_TIME9	CDD*Weekday*Hour 9	100.0%	8.2%
XCDD_TIME10	CDD*Weekday*Hour 10	100.0%	4.1%
XCDD_TIME11	CDD*Weekday*Hour 11	100.0%	8.5%
XCDD_TIME12	CDD*Weekday*Hour 12	100.0%	12.6%
XCDD_TIME13	CDD*Weekday*Hour 13	100.0%	15.3%
XCDD_TIME14	CDD*Weekday*Hour 14	100.0%	15.9%
XCDD_TIME15	CDD*Weekday*Hour 15	100.0%	16.2%
XCDD_TIME16	CDD*Weekday*Hour 16	100.0%	16.2%
XCDD_TIME17	CDD*Weekday*Hour 17	100.0%	16.2%
XCDD_TIME18	CDD*Weekday*Hour 18	100.0%	17.8%
XCDD_TIME19	CDD*Weekday*Hour 19	100.0%	21.4%
XCDD_TIME20	CDD*Weekday*Hour 20	100.0%	22.2%
XCDD_TIME21	CDD*Weekday*Hour 21	100.0%	22.5%
XCDD_TIME22	CDD*Weekday*Hour 22	100.0%	14.5%
XCDD_TIME23	CDD*Weekday*Hour 23	100.0%	12.9%
XCDD_TIME24	CDD*Weekday*Hour 24	98.1%	7.0%
XCDD_TIME25	CDD*Weekend*Hour 1	98.6%	5.6%
XCDD_TIME26	CDD*Weekend*Hour 2	98.6%	9.7%
XCDD_TIME27	CDD*Weekend*Hour 3	94.8%	8.4%
XCDD_TIME28	CDD*Weekend*Hour 4	94.8%	9.2%
XCDD_TIME29	CDD*Weekend*Hour 5	96.2%	12.3%
XCDD_TIME30	CDD*Weekend*Hour 6	96.2%	17.9%
XCDD_TIME31	CDD*Weekend*Hour 7	95.1%	29.1%
XCDD_TIME32	CDD*Weekend*Hour 8	96.4%	19.3%
XCDD_TIME33	CDD*Weekend*Hour 9	100.0%	11.8%
XCDD_TIME34	CDD*Weekend*Hour 10	100.0%	3.8%
XCDD_TIME35	CDD*Weekend*Hour 11	100.0%	10.7%
XCDD_TIME36	CDD*Weekend*Hour 12	100.0%	12.9%
XCDD_TIME37	CDD*Weekend*Hour 13	100.0%	22.2%
XCDD_TIME38	CDD*Weekend*Hour 14	100.0%	24.9%
XCDD_TIME39	CDD*Weekend*Hour 15	100.0%	23.8%
XCDD_TIME40	CDD*Weekend*Hour 16	100.0%	24.7%
XCDD_TIME41	CDD*Weekend*Hour 17	100.0%	23.6%

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
XCDD_TIME42	CDD*Weekend*Hour 18	100.0%	22.5%
XCDD_TIME43	CDD*Weekend*Hour 19	100.0%	23.0%
XCDD_TIME44	CDD*Weekend*Hour 20	100.0%	24.9%
XCDD_TIME45	CDD*Weekend*Hour 21	100.0%	26.6%
XCDD_TIME46	CDD*Weekend*Hour 22	99.7%	14.3%
XCDD_TIME47	CDD*Weekend*Hour 23	99.7%	3.0%
XCDD_TIME48	CDD*Weekend*Hour 24	13.7%	0.0%
XDDD_TIME1	Dew DD*Weekday*Hour 1	99.7%	7.7%
XDDD_TIME2	Dew DD*Weekday*Hour 2	99.5%	8.0%
XDDD_TIME3	Dew DD*Weekday*Hour 3	99.2%	13.0%
XDDD_TIME4	Dew DD*Weekday*Hour 4	99.2%	16.3%
XDDD_TIME5	Dew DD*Weekday*Hour 5	99.2%	18.0%
XDDD_TIME6	Dew DD*Weekday*Hour 6	99.2%	27.1%
XDDD_TIME7	Dew DD*Weekday*Hour 7	99.2%	26.2%
XDDD_TIME8	Dew DD*Weekday*Hour 8	99.2%	22.4%
XDDD_TIME9	Dew DD*Weekday*Hour 9	99.5%	27.3%
XDDD_TIME10	Dew DD*Weekday*Hour 10	98.6%	20.3%
XDDD_TIME11	Dew DD*Weekday*Hour 11	98.6%	18.3%
XDDD_TIME12	Dew DD*Weekday*Hour 12	99.5%	28.9%
XDDD_TIME13	Dew DD*Weekday*Hour 13	100.0%	38.9%
XDDD_TIME14	Dew DD*Weekday*Hour 14	100.0%	44.4%
XDDD_TIME15	Dew DD*Weekday*Hour 15	99.5%	45.7%
XDDD_TIME16	Dew DD*Weekday*Hour 16	100.0%	47.1%
XDDD_TIME17	Dew DD*Weekday*Hour 17	100.0%	41.9%
XDDD_TIME18	Dew DD*Weekday*Hour 18	100.0%	43.0%
XDDD_TIME19	Dew DD*Weekday*Hour 19	100.0%	42.2%
XDDD_TIME20	Dew DD*Weekday*Hour 20	100.0%	37.0%
XDDD_TIME21	Dew DD*Weekday*Hour 21	100.0%	32.1%
XDDD_TIME22	Dew DD*Weekday*Hour 22	99.7%	20.9%
XDDD_TIME23	Dew DD*Weekday*Hour 23	100.0%	17.3%
XDDD_TIME24	Dew DD*Weekday*Hour 24	100.0%	14.2%
XDDD_TIME25	Dew DD*Weekend*Hour 1	99.7%	3.6%
XDDD_TIME26	Dew DD*Weekend*Hour 2	99.7%	8.2%
XDDD_TIME27	Dew DD*Weekend*Hour 3	99.7%	13.2%
XDDD_TIME28	Dew DD*Weekend*Hour 4	99.5%	23.4%
XDDD_TIME29	Dew DD*Weekend*Hour 5	98.4%	30.6%

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
XDDD_TIME30	Dew DD*Weekend*Hour 6	98.4%	45.7%
XDDD_TIME31	Dew DD*Weekend*Hour 7	98.4%	51.3%
XDDD_TIME32	Dew DD*Weekend*Hour 8	99.2%	21.3%
XDDD_TIME33	Dew DD*Weekend*Hour 9	99.2%	18.2%
XDDD_TIME34	Dew DD*Weekend*Hour 10	99.2%	21.5%
XDDD_TIME35	Dew DD*Weekend*Hour 11	99.5%	41.0%
XDDD_TIME36	Dew DD*Weekend*Hour 12	99.5%	50.7%
XDDD_TIME37	Dew DD*Weekend*Hour 13	99.2%	50.3%
XDDD_TIME38	Dew DD*Weekend*Hour 14	99.5%	53.4%
XDDD_TIME39	Dew DD*Weekend*Hour 15	100.0%	58.6%
XDDD_TIME40	Dew DD*Weekend*Hour 16	100.0%	52.3%
XDDD_TIME41	Dew DD*Weekend*Hour 17	100.0%	44.1%
XDDD_TIME42	Dew DD*Weekend*Hour 18	100.0%	43.6%
XDDD_TIME43	Dew DD*Weekend*Hour 19	100.0%	42.5%
XDDD_TIME44	Dew DD*Weekend*Hour 20	100.0%	41.6%
XDDD_TIME45	Dew DD*Weekend*Hour 21	100.0%	35.9%
XDDD_TIME46	Dew DD*Weekend*Hour 22	99.5%	16.3%
XDDD_TIME47	Dew DD*Weekend*Hour 23	99.5%	8.3%
XDDD_TIME48	Dew DD*Weekend*Hour 24	0.3%	0.0%
XHDD_ZIP1	HDD*Gas Heat <= 67%	100.0%	67.9%
XHDD_ZIP2	HDD*Gas Heat >= 78%	100.0%	57.3%
XHDD_ZIP3	HDD*Electric Heat <= 18%	100.0%	98.6%
XHDD_ZIP4	HDD*Electric Heat >= 28%	100.0%	74.0%
XHDD_ZIP5	HDD*Median Rooms <= 5	100.0%	64.1%
XHDD_ZIP6	HDD*Median Rooms >= 6	100.0%	77.0%
XHDD_ZIP7	HDD*Occupants Per Room Less Than 1.00 <= 95%	100.0%	89.6%
XHDD_ZIP8	HDD*Occupants Per Room Less Than 1.00 >= 98%	100.0%	86.6%
XHDD_ZIP9	HDD*Occupants Per Room Btwn 1.01 and 1.5 <= 1%	100.0%	89.0%
XHDD_ZIP10	HDD*Occupants Per Room Btwn 1.01 and 1.5 >= 4%	100.0%	77.3%
XHDD_ZIP11	HDD*House $150k-$300k <= 4%	100.0%	41.9%
XHDD_ZIP12	HDD*House $150k-$300k >= 27%	100.0%	62.5%
XHDD_ZIP13	HDD*House $300k+ <= 61%	100.0%	81.4%
XHDD_ZIP14	HDD*House $300k+ >= 92%	100.0%	63.8%
XHDD_ZIP15	HDD*0-1 Bedrooms <= 7%	100.0%	63.8%

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
XHDD_ZIP16	HDD*0-1 Bedrooms >= 16%	100.0%	75.6%
XHDD_ZIP17	HDD*2 Bedrooms <= 19%	100.0%	63.8%
XHDD_ZIP18	HDD*2 Bedrooms >= 29%	100.0%	60.3%
XHDD_ZIP19	HDD*3 Bedrooms <= 32%	100.0%	92.1%
XHDD_ZIP20	HDD*3 Bedrooms >= 41%	100.0%	80.8%
XHDD_ZIP21	HDD*House Built 2000+ <= 5%	100.0%	61.9%
XHDD_ZIP22	HDD*House Built 2000+ >= 15%	100.0%	72.9%
XHDD_ZIP23	HDD*House Built 1980-1999 <= 17%	100.0%	100.0%
XHDD_ZIP24	HDD*House Built 1980-1999 >= 38%	100.0%	57.0%
XHDD_ZIP25	HDD*House Built 1960-1979 <= 26%	100.0%	84.7%
XHDD_ZIP26	HDD*House Built 1960-1979 >= 46%	100.0%	87.7%
XCDD_ZIP1	CDD*Gas Heat <= 67%	100.0%	63.0%
XCDD_ZIP2	CDD*Gas Heat >= 78%	100.0%	73.7%
XCDD_ZIP3	CDD*Electric Heat <= 18%	100.0%	71.0%
XCDD_ZIP4	CDD*Electric Heat >= 28%	100.0%	86.0%
XCDD_ZIP5	CDD*Median Rooms <= 5	100.0%	63.8%
XCDD_ZIP6	CDD*Median Rooms >= 6	100.0%	70.1%
XCDD_ZIP7	CDD*Occupants Per Room Less Than 1.00 <= 95%	100.0%	76.4%
XCDD_ZIP8	CDD*Occupants Per Room Less Than 1.00 >= 98%	100.0%	68.8%
XCDD_ZIP9	CDD*Occupants Per Room Btwn 1.01 and 1.5 <= 1%	100.0%	68.2%
XCDD_ZIP10	CDD*Occupants Per Room Btwn 1.01 and 1.5 >= 4%	100.0%	81.6%
XCDD_ZIP11	CDD*House $150k-$300k <= 4%	100.0%	74.2%
XCDD_ZIP12	CDD*House $150k-$300k >= 27%	100.0%	90.4%
XCDD_ZIP13	CDD*House $300k+ <= 61%	100.0%	73.2%
XCDD_ZIP14	CDD*House $300k+ >= 92%	100.0%	76.4%
XCDD_ZIP15	CDD*0-1 Bedrooms <= 7%	100.0%	80.5%
XCDD_ZIP16	CDD*0-1 Bedrooms >= 16%	100.0%	86.0%
XCDD_ZIP17	CDD*2 Bedrooms <= 19%	100.0%	92.1%
XCDD_ZIP18	CDD*2 Bedrooms >= 29%	100.0%	84.7%
XCDD_ZIP19	CDD*3 Bedrooms <= 32%	100.0%	89.6%
XCDD_ZIP20	CDD*3 Bedrooms >= 41%	100.0%	78.9%
XCDD_ZIP21	CDD*House Built 2000+ <= 5%	100.0%	79.2%
XCDD_ZIP22	CDD*House Built 2000+ >= 15%	100.0%	93.7%
XCDD_ZIP23	CDD*House Built 1980-1999 <= 17%	100.0%	78.6%

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
XCDD_ZIP24	CDD*House Built 1980-1999 >= 38%	100.0%	77.0%
XCDD_ZIP25	CDD*House Built 1960-1979 <= 26%	100.0%	98.6%
XCDD_ZIP26	CDD*House Built 1960-1979 >= 46%	100.0%	78.6%
YHDD	PROGRAM * (Heating DD)	100.0%	61.4%
YCDD	PROGRAM * (Cooling DD)	100.0%	18.4%
YDDD	PROGRAM * (Dewpoint Degree Days)	100.0%	12.1%
YPREVDAY_T1	PROGRAM * (Average Temperature on Previous Day, 9am-3pm)	100.0%	74.2%
YPREVDAY_T2	PROGRAM * (Average Temperature on Previous Day, 4am-10pm)	100.0%	67.9%
YLINEART	PROGRAM * (Temperature 3 Hour Linear Lag)	100.0%	84.7%
YLINEARD	PROGRAM * (Dewpoint 3 Hour Linear Lag)	100.0%	60.8%
YHOUR1	PROGRAM * (Hour #1 Indicator)	100.0%	0.5%
YHOUR2	PROGRAM * (Hour #2 Indicator)	100.0%	2.5%
YHOUR3	PROGRAM * (Hour #3 Indicator)	100.0%	3.3%
YHOUR4	PROGRAM * (Hour #4 Indicator)	100.0%	12.3%
YHOUR5	PROGRAM * (Hour #5 Indicator)	100.0%	20.5%
YHOUR6	PROGRAM * (Hour #6 Indicator)	100.0%	28.5%
YHOUR7	PROGRAM * (Hour #7 Indicator)	100.0%	31.8%
YHOUR8	PROGRAM * (Hour #8 Indicator)	100.0%	30.4%
YHOUR9	PROGRAM * (Hour #9 Indicator)	100.0%	61.6%
YHOUR10	PROGRAM * (Hour #10 Indicator)	100.0%	78.6%
YHOUR11	PROGRAM * (Hour #11 Indicator)	100.0%	74.0%
YHOUR12	PROGRAM * (Hour #12 Indicator)	100.0%	63.0%
YHOUR13	PROGRAM * (Hour #13 Indicator)	100.0%	64.4%
YHOUR14	PROGRAM * (Hour #14 Indicator)	100.0%	67.7%
YHOUR15	PROGRAM * (Hour #15 Indicator)	100.0%	67.1%
YHOUR16	PROGRAM * (Hour #16 Indicator)	100.0%	64.1%
YHOUR17	PROGRAM * (Hour #17 Indicator)	100.0%	69.6%
YHOUR18	PROGRAM * (Hour #18 Indicator)	100.0%	60.5%
YHOUR19	PROGRAM * (Hour #19 Indicator)	100.0%	75.6%
YHOUR20	PROGRAM * (Hour #20 Indicator)	100.0%	81.6%
YHOUR21	PROGRAM * (Hour #21 Indicator)	100.0%	72.6%
YHOUR22	PROGRAM * (Hour #22 Indicator)	100.0%	66.8%
YHOUR23	PROGRAM * (Hour #23 Indicator)	100.0%	37.5%
YDIFF0	PROGRAM * (Day Indicator)	100.0%	59.7%
YDIFF1	PROGRAM * (Day-7 Indicator)	100.0%	69.3%

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
YDIFF2	PROGRAM * (Day-6 Indicator)	100.0%	59.7%
YDIFF3	PROGRAM * (Day-5 Indicator)	100.0%	61.9%
YDIFF4	PROGRAM * (Day-4 Indicator)	100.0%	63.3%
YDIFF5	PROGRAM * (Day-3 Indicator)	100.0%	59.2%
YDIFF6	PROGRAM * (Day-2 Indicator)	100.0%	58.9%
YDIFF7	PROGRAM * (Day-1 Indicator)	100.0%	61.1%
YDIFF8	PROGRAM * (Day+1 Indicator)	100.0%	60.5%
YDIFF9	PROGRAM * (Day+2 Indicator)	100.0%	60.8%
YDIFF10	PROGRAM * (Day+3 Indicator)	100.0%	61.4%
YDIFF11	PROGRAM * (Day+4 Indicator)	100.0%	64.7%
YDIFF12	PROGRAM * (Day+5 Indicator)	100.0%	58.1%
YDIFF13	PROGRAM * (Day+6 Indicator)	100.0%	54.8%
YSUN	PROGRAM * (Sunday Indicator)	100.0%	59.7%
YMON	PROGRAM * (Monday Indicator)	100.0%	66.6%
YTUE	PROGRAM * (Tuesday Indicator)	100.0%	72.9%
YWED	PROGRAM * (Wednesday Indicator)	100.0%	67.7%
YTHU	PROGRAM * (Thursday Indicator)	100.0%	54.5%
YFRI	PROGRAM * (Friday Indicator)	100.0%	54.2%
YHOLIDAY	PROGRAM * (Holiday Indicator)	14.0%	51.0%
YHDD_TIME1	PROGRAM * (HDD*Weekday*Hour 1)	100.0%	4.4%
YHDD_TIME2	PROGRAM * (HDD*Weekday*Hour 2)	100.0%	15.3%
YHDD_TIME3	PROGRAM * (HDD*Weekday*Hour 3)	100.0%	5.2%
YHDD_TIME4	PROGRAM * (HDD*Weekday*Hour 4)	100.0%	3.0%
YHDD_TIME5	PROGRAM * (HDD*Weekday*Hour 5)	100.0%	1.9%
YHDD_TIME6	PROGRAM * (HDD*Weekday*Hour 6)	100.0%	13.7%
YHDD_TIME7	PROGRAM * (HDD*Weekday*Hour 7)	100.0%	1.6%
YHDD_TIME8	PROGRAM * (HDD*Weekday*Hour 8)	100.0%	19.7%
YHDD_TIME9	PROGRAM * (HDD*Weekday*Hour 9)	100.0%	9.6%
YHDD_TIME10	PROGRAM * (HDD*Weekday*Hour 10)	100.0%	37.3%
YHDD_TIME11	PROGRAM * (HDD*Weekday*Hour 11)	100.0%	52.3%
YHDD_TIME12	PROGRAM * (HDD*Weekday*Hour 12)	100.0%	40.0%
YHDD_TIME13	PROGRAM * (HDD*Weekday*Hour 13)	100.0%	38.9%
YHDD_TIME14	PROGRAM * (HDD*Weekday*Hour 14)	100.0%	31.2%
YHDD_TIME15	PROGRAM * (HDD*Weekday*Hour 15)	100.0%	20.3%
YHDD_TIME16	PROGRAM * (HDD*Weekday*Hour 16)	100.0%	6.8%
YHDD_TIME17	PROGRAM * (HDD*Weekday*Hour 17)	100.0%	27.9%

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
YHDD_TIME18	PROGRAM * (HDD*Weekday*Hour 18)	100.0%	42.7%
YHDD_TIME19	PROGRAM * (HDD*Weekday*Hour 19)	100.0%	39.5%
YHDD_TIME20	PROGRAM * (HDD*Weekday*Hour 20)	100.0%	15.9%
YHDD_TIME21	PROGRAM * (HDD*Weekday*Hour 21)	100.0%	9.9%
YHDD_TIME22	PROGRAM * (HDD*Weekday*Hour 22)	100.0%	9.6%
YHDD_TIME23	PROGRAM * (HDD*Weekday*Hour 23)	100.0%	1.4%
YHDD_TIME24	PROGRAM * (HDD*Weekday*Hour 24)	100.0%	2.7%
YHDD_TIME25	PROGRAM * (HDD*Weekend*Hour 1)	100.0%	0.8%
YHDD_TIME26	PROGRAM * (HDD*Weekend*Hour 2)	100.0%	16.2%
YHDD_TIME27	PROGRAM * (HDD*Weekend*Hour 3)	100.0%	7.1%
YHDD_TIME28	PROGRAM * (HDD*Weekend*Hour 4)	100.0%	2.5%
YHDD_TIME29	PROGRAM * (HDD*Weekend*Hour 5)	100.0%	3.6%
YHDD_TIME30	PROGRAM * (HDD*Weekend*Hour 6)	100.0%	4.4%
YHDD_TIME31	PROGRAM * (HDD*Weekend*Hour 7)	100.0%	3.6%
YHDD_TIME32	PROGRAM * (HDD*Weekend*Hour 8)	100.0%	11.8%
YHDD_TIME33	PROGRAM * (HDD*Weekend*Hour 9)	100.0%	21.1%
YHDD_TIME34	PROGRAM * (HDD*Weekend*Hour 10)	100.0%	19.7%
YHDD_TIME35	PROGRAM * (HDD*Weekend*Hour 11)	100.0%	42.7%
YHDD_TIME36	PROGRAM * (HDD*Weekend*Hour 12)	98.6%	33.9%
YHDD_TIME37	PROGRAM * (HDD*Weekend*Hour 13)	96.7%	30.0%
YHDD_TIME38	PROGRAM * (HDD*Weekend*Hour 14)	96.4%	33.8%
YHDD_TIME39	PROGRAM * (HDD*Weekend*Hour 15)	98.4%	31.2%
YHDD_TIME40	PROGRAM * (HDD*Weekend*Hour 16)	100.0%	27.9%
YHDD_TIME41	PROGRAM * (HDD*Weekend*Hour 17)	100.0%	38.1%
YHDD_TIME42	PROGRAM * (HDD*Weekend*Hour 18)	100.0%	37.0%
YHDD_TIME43	PROGRAM * (HDD*Weekend*Hour 19)	100.0%	27.4%
YHDD_TIME44	PROGRAM * (HDD*Weekend*Hour 20)	100.0%	6.6%
YHDD_TIME45	PROGRAM * (HDD*Weekend*Hour 21)	100.0%	9.0%
YHDD_TIME46	PROGRAM * (HDD*Weekend*Hour 22)	100.0%	11.2%
YHDD_TIME47	PROGRAM * (HDD*Weekend*Hour 23)	100.0%	2.2%
YCDD_TIME1	PROGRAM * (CDD*Weekday*Hour 1)	94.8%	4.9%
YCDD_TIME2	PROGRAM * (CDD*Weekday*Hour 2)	93.4%	4.1%
YCDD_TIME3	PROGRAM * (CDD*Weekday*Hour 3)	89.9%	6.7%
YCDD_TIME4	PROGRAM * (CDD*Weekday*Hour 4)	87.9%	11.8%
YCDD_TIME5	PROGRAM * (CDD*Weekday*Hour 5)	83.3%	10.9%
YCDD_TIME6	PROGRAM * (CDD*Weekday*Hour 6)	83.6%	16.1%

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
YCDD_TIME7	PROGRAM * (CDD*Weekday*Hour 7)	91.8%	10.1%
YCDD_TIME8	PROGRAM * (CDD*Weekday*Hour 8)	93.4%	7.3%
YCDD_TIME9	PROGRAM * (CDD*Weekday*Hour 9)	100.0%	10.1%
YCDD_TIME10	PROGRAM * (CDD*Weekday*Hour 10)	100.0%	8.8%
YCDD_TIME11	PROGRAM * (CDD*Weekday*Hour 11)	100.0%	9.0%
YCDD_TIME12	PROGRAM * (CDD*Weekday*Hour 12)	100.0%	7.9%
YCDD_TIME13	PROGRAM * (CDD*Weekday*Hour 13)	100.0%	5.8%
YCDD_TIME14	PROGRAM * (CDD*Weekday*Hour 14)	100.0%	5.5%
YCDD_TIME15	PROGRAM * (CDD*Weekday*Hour 15)	100.0%	5.8%
YCDD_TIME16	PROGRAM * (CDD*Weekday*Hour 16)	100.0%	5.5%
YCDD_TIME17	PROGRAM * (CDD*Weekday*Hour 17)	100.0%	5.2%
YCDD_TIME18	PROGRAM * (CDD*Weekday*Hour 18)	100.0%	6.8%
YCDD_TIME19	PROGRAM * (CDD*Weekday*Hour 19)	100.0%	9.9%
YCDD_TIME20	PROGRAM * (CDD*Weekday*Hour 20)	100.0%	13.4%
YCDD_TIME21	PROGRAM * (CDD*Weekday*Hour 21)	99.5%	9.6%
YCDD_TIME22	PROGRAM * (CDD*Weekday*Hour 22)	98.6%	6.7%
YCDD_TIME23	PROGRAM * (CDD*Weekday*Hour 23)	97.8%	5.9%
YCDD_TIME24	PROGRAM * (CDD*Weekday*Hour 24)	96.4%	6.5%
YCDD_TIME25	PROGRAM * (CDD*Weekend*Hour 1)	93.4%	1.5%
YCDD_TIME26	PROGRAM * (CDD*Weekend*Hour 2)	90.1%	4.3%
YCDD_TIME27	PROGRAM * (CDD*Weekend*Hour 3)	86.6%	7.6%
YCDD_TIME28	PROGRAM * (CDD*Weekend*Hour 4)	87.1%	7.5%
YCDD_TIME29	PROGRAM * (CDD*Weekend*Hour 5)	77.8%	15.5%
YCDD_TIME30	PROGRAM * (CDD*Weekend*Hour 6)	85.5%	11.9%
YCDD_TIME31	PROGRAM * (CDD*Weekend*Hour 7)	84.4%	11.4%
YCDD_TIME32	PROGRAM * (CDD*Weekend*Hour 8)	93.7%	9.9%
YCDD_TIME33	PROGRAM * (CDD*Weekend*Hour 9)	97.8%	6.4%
YCDD_TIME34	PROGRAM * (CDD*Weekend*Hour 10)	100.0%	7.9%
YCDD_TIME35	PROGRAM * (CDD*Weekend*Hour 11)	100.0%	4.9%
YCDD_TIME36	PROGRAM * (CDD*Weekend*Hour 12)	100.0%	4.9%
YCDD_TIME37	PROGRAM * (CDD*Weekend*Hour 13)	100.0%	6.6%
YCDD_TIME38	PROGRAM * (CDD*Weekend*Hour 14)	100.0%	6.3%
YCDD_TIME39	PROGRAM * (CDD*Weekend*Hour 15)	100.0%	7.1%
YCDD_TIME40	PROGRAM * (CDD*Weekend*Hour 16)	100.0%	8.8%
YCDD_TIME41	PROGRAM * (CDD*Weekend*Hour 17)	100.0%	9.3%
YCDD_TIME42	PROGRAM * (CDD*Weekend*Hour 18)	100.0%	11.0%

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
YCDD_TIME43	PROGRAM * (CDD*Weekend*Hour 19)	99.7%	13.2%
YCDD_TIME44	PROGRAM * (CDD*Weekend*Hour 20)	99.7%	17.6%
YCDD_TIME45	PROGRAM * (CDD*Weekend*Hour 21)	98.4%	18.4%
YCDD_TIME46	PROGRAM * (CDD*Weekend*Hour 22)	96.2%	8.5%
YCDD_TIME47	PROGRAM * (CDD*Weekend*Hour 23)	95.6%	2.0%
YCDD_TIME48	PROGRAM * (CDD*Weekend*Hour 24)	11.8%	0.0%
YDDD_TIME1	PROGRAM * (Dew DD*Weekday*Hour 1)	99.2%	5.5%
YDDD_TIME2	PROGRAM * (Dew DD*Weekday*Hour 2)	95.6%	4.9%
YDDD_TIME3	PROGRAM * (Dew DD*Weekday*Hour 3)	95.6%	6.0%
YDDD_TIME4	PROGRAM * (Dew DD*Weekday*Hour 4)	94.8%	4.6%
YDDD_TIME5	PROGRAM * (Dew DD*Weekday*Hour 5)	95.1%	5.8%
YDDD_TIME6	PROGRAM * (Dew DD*Weekday*Hour 6)	95.1%	9.5%
YDDD_TIME7	PROGRAM * (Dew DD*Weekday*Hour 7)	95.1%	9.8%
YDDD_TIME8	PROGRAM * (Dew DD*Weekday*Hour 8)	95.1%	7.8%
YDDD_TIME9	PROGRAM * (Dew DD*Weekday*Hour 9)	95.6%	12.0%
YDDD_TIME10	PROGRAM * (Dew DD*Weekday*Hour 10)	95.9%	12.0%
YDDD_TIME11	PROGRAM * (Dew DD*Weekday*Hour 11)	95.3%	14.1%
YDDD_TIME12	PROGRAM * (Dew DD*Weekday*Hour 12)	98.6%	18.1%
YDDD_TIME13	PROGRAM * (Dew DD*Weekday*Hour 13)	98.9%	19.9%
YDDD_TIME14	PROGRAM * (Dew DD*Weekday*Hour 14)	98.9%	21.9%
YDDD_TIME15	PROGRAM * (Dew DD*Weekday*Hour 15)	95.3%	23.6%
YDDD_TIME16	PROGRAM * (Dew DD*Weekday*Hour 16)	99.5%	22.3%
YDDD_TIME17	PROGRAM * (Dew DD*Weekday*Hour 17)	99.7%	22.0%
YDDD_TIME18	PROGRAM * (Dew DD*Weekday*Hour 18)	100.0%	20.3%
YDDD_TIME19	PROGRAM * (Dew DD*Weekday*Hour 19)	99.5%	27.5%
YDDD_TIME20	PROGRAM * (Dew DD*Weekday*Hour 20)	99.5%	12.7%
YDDD_TIME21	PROGRAM * (Dew DD*Weekday*Hour 21)	98.4%	12.3%
YDDD_TIME22	PROGRAM * (Dew DD*Weekday*Hour 22)	98.1%	8.7%
YDDD_TIME23	PROGRAM * (Dew DD*Weekday*Hour 23)	99.2%	5.8%
YDDD_TIME24	PROGRAM * (Dew DD*Weekday*Hour 24)	98.6%	7.5%
YDDD_TIME25	PROGRAM * (Dew DD*Weekend*Hour 1)	91.0%	0.6%
YDDD_TIME26	PROGRAM * (Dew DD*Weekend*Hour 2)	91.0%	2.1%
YDDD_TIME27	PROGRAM * (Dew DD*Weekend*Hour 3)	91.2%	1.5%
YDDD_TIME28	PROGRAM * (Dew DD*Weekend*Hour 4)	94.0%	1.7%
YDDD_TIME29	PROGRAM * (Dew DD*Weekend*Hour 5)	89.9%	2.1%
YDDD_TIME30	PROGRAM * (Dew DD*Weekend*Hour 6)	91.5%	9.0%

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
YDDD_TIME31	PROGRAM * (Dew DD*Weekend*Hour 7)	93.2%	5.9%
YDDD_TIME32	PROGRAM * (Dew DD*Weekend*Hour 8)	94.5%	7.2%
YDDD_TIME33	PROGRAM * (Dew DD*Weekend*Hour 9)	95.3%	5.7%
YDDD_TIME34	PROGRAM * (Dew DD*Weekend*Hour 10)	95.1%	15.9%
YDDD_TIME35	PROGRAM * (Dew DD*Weekend*Hour 11)	95.1%	30.3%
YDDD_TIME36	PROGRAM * (Dew DD*Weekend*Hour 12)	95.1%	29.4%
YDDD_TIME37	PROGRAM * (Dew DD*Weekend*Hour 13)	95.1%	27.7%
YDDD_TIME38	PROGRAM * (Dew DD*Weekend*Hour 14)	99.2%	35.4%
YDDD_TIME39	PROGRAM * (Dew DD*Weekend*Hour 15)	97.5%	32.0%
YDDD_TIME40	PROGRAM * (Dew DD*Weekend*Hour 16)	97.5%	30.6%
YDDD_TIME41	PROGRAM * (Dew DD*Weekend*Hour 17)	97.5%	25.3%
YDDD_TIME42	PROGRAM * (Dew DD*Weekend*Hour 18)	99.5%	26.4%
YDDD_TIME43	PROGRAM * (Dew DD*Weekend*Hour 19)	99.5%	27.8%
YDDD_TIME44	PROGRAM * (Dew DD*Weekend*Hour 20)	99.5%	27.8%
YDDD_TIME45	PROGRAM * (Dew DD*Weekend*Hour 21)	99.5%	16.3%
YDDD_TIME46	PROGRAM * (Dew DD*Weekend*Hour 22)	98.4%	9.2%
YDDD_TIME47	PROGRAM * (Dew DD*Weekend*Hour 23)	98.4%	4.2%
YDDD_TIME48	PROGRAM * (Dew DD*Weekend*Hour 24)	0.3%	0.0%
YHDD_ZIP1	PROGRAM * (HDD*Gas Heat <= 67%)	100.0%	51.5%
YHDD_ZIP2	PROGRAM * (HDD*Gas Heat >= 78%)	100.0%	81.9%
YHDD_ZIP3	PROGRAM * (HDD*Electric Heat <= 18%)	100.0%	39.5%
YHDD_ZIP4	PROGRAM * (HDD*Electric Heat >= 28%)	100.0%	79.5%
YHDD_ZIP5	PROGRAM * (HDD*Median Rooms <= 5)	100.0%	86.6%
YHDD_ZIP6	PROGRAM * (HDD*Median Rooms >= 6)	100.0%	69.0%
YHDD_ZIP7	PROGRAM * (HDD*Occupants Per Room Less Than 1.00 <= 95%)	100.0%	73.7%
YHDD_ZIP8	PROGRAM * (HDD*Occupants Per Room Less Than 1.00 >= 98%)	100.0%	60.3%
YHDD_ZIP9	PROGRAM * (HDD*Occupants Per Room Btwn 1.01 and 1.5 <= 1%)	100.0%	72.9%
YHDD_ZIP10	PROGRAM * (HDD*Occupants Per Room Btwn 1.01 and 1.5 >= 4%)	100.0%	84.4%
YHDD_ZIP11	PROGRAM * (HDD*House $150k-$300k <= 4%)	100.0%	76.7%
YHDD_ZIP12	PROGRAM * (HDD*House $150k-$300k >= 27%)	100.0%	53.7%
YHDD_ZIP13	PROGRAM * (HDD*House $300k+ <= 61%)	100.0%	58.1%
YHDD_ZIP14	PROGRAM * (HDD*House $300k+ >= 92%)	100.0%	62.7%
YHDD_ZIP15	PROGRAM * (HDD*0-1 Bedrooms <= 7%)	100.0%	60.0%

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
YHDD_ZIP16	PROGRAM * (HDD*0-1 Bedrooms >= 16%)	100.0%	49.3%
YHDD_ZIP17	PROGRAM * (HDD*2 Bedrooms <= 19%)	100.0%	61.9%
YHDD_ZIP18	PROGRAM * (HDD*2 Bedrooms >= 29%)	100.0%	52.3%
YHDD_ZIP19	PROGRAM * (HDD*3 Bedrooms <= 32%)	100.0%	68.5%
YHDD_ZIP20	PROGRAM * (HDD*3 Bedrooms >= 41%)	100.0%	75.9%
YHDD_ZIP21	PROGRAM * (HDD*House Built 2000+ <= 5%)	100.0%	67.9%
YHDD_ZIP22	PROGRAM * (HDD*House Built 2000+ >= 15%)	100.0%	63.0%
YHDD_ZIP23	PROGRAM * (HDD*House Built 1980-1999 <= 17%)	100.0%	95.9%
YHDD_ZIP24	PROGRAM * (HDD*House Built 1980-1999 >= 38%)	100.0%	67.7%
YHDD_ZIP25	PROGRAM * (HDD*House Built 1960-1979 <= 26%)	100.0%	71.5%
YHDD_ZIP26	PROGRAM * (HDD*House Built 1960-1979 >= 46%)	100.0%	60.0%
YCDD_ZIP1	PROGRAM * (CDD*Gas Heat <= 67%)	100.0%	83.6%
YCDD_ZIP2	PROGRAM * (CDD*Gas Heat >= 78%)	100.0%	63.6%
YCDD_ZIP3	PROGRAM * (CDD*Electric Heat <= 18%)	100.0%	74.0%
YCDD_ZIP4	PROGRAM * (CDD*Electric Heat >= 28%)	100.0%	76.2%
YCDD_ZIP5	PROGRAM * (CDD*Median Rooms <= 5)	100.0%	70.4%
YCDD_ZIP6	PROGRAM * (CDD*Median Rooms >= 6)	100.0%	83.3%
YCDD_ZIP7	PROGRAM * (CDD*Occupants Per Room Less Than 1.00 <= 95%)	100.0%	75.1%
YCDD_ZIP8	PROGRAM * (CDD*Occupants Per Room Less Than 1.00 >= 98%)	100.0%	79.2%
YCDD_ZIP9	PROGRAM * (CDD*Occupants Per Room Btwn 1.01 and 1.5 <= 1%)	100.0%	72.3%
YCDD_ZIP10	PROGRAM * (CDD*Occupants Per Room Btwn 1.01 and 1.5 >= 4%)	100.0%	78.4%
YCDD_ZIP11	PROGRAM * (CDD*House $150k-$300k <= 4%)	100.0%	69.6%
YCDD_ZIP12	PROGRAM * (CDD*House $150k-$300k >= 27%)	100.0%	83.0%
YCDD_ZIP13	PROGRAM * (CDD*House $300k+ <= 61%)	100.0%	80.5%
YCDD_ZIP14	PROGRAM * (CDD*House $300k+ >= 92%)	100.0%	81.4%
YCDD_ZIP15	PROGRAM * (CDD*0-1 Bedrooms <= 7%)	100.0%	88.8%
YCDD_ZIP16	PROGRAM * (CDD*0-1 Bedrooms >= 16%)	100.0%	83.6%
YCDD_ZIP17	PROGRAM * (CDD*2 Bedrooms <= 19%)	100.0%	77.5%
YCDD_ZIP18	PROGRAM * (CDD*2 Bedrooms >= 29%)	100.0%	75.3%
YCDD_ZIP19	PROGRAM * (CDD*3 Bedrooms <= 32%)	100.0%	74.0%
YCDD_ZIP20	PROGRAM * (CDD*3 Bedrooms >= 41%)	100.0%	72.3%
YCDD_ZIP21	PROGRAM * (CDD*House Built 2000+ <= 5%)	100.0%	81.1%

Variable Name	Variable Label	Percent of Models Where Term Appeared	Percent of Time Variable Was Significant at 10% Level
YCDD_ZIP22	PROGRAM * (CDD*House Built 2000+ >= 15%)	100.0%	87.4%
YCDD_ZIP23	PROGRAM * (CDD*House Built 1980-1999 <= 17%)	100.0%	79.7%
YCDD_ZIP24	PROGRAM * (CDD*House Built 1980-1999 >= 38%)	100.0%	91.2%
YCDD_ZIP25	PROGRAM * (CDD*House Built 1960-1979 <= 26%)	100.0%	75.6%
YCDD_ZIP26	PROGRAM * (CDD*House Built 1960-1979 >= 46%)	100.0%	82.5%

Table 16: Summary of the Significance of the Model Parameters for the Therm Model

Variable Name	Variable Label	Was Variable Significant at the 10% Level
PROGRAM	Program Indicator	Yes
XHDD	Heating DD	Yes
X2011	2011 Indicator	
X2012	2012 Indicator	Yes
X2013	2013 Indicator	Yes
X2014	2014 Indicator	Yes
X2015	2015 Indicator	Yes
XHDD_ZIP1	HDD*Gas Heat <= 67%	
XHDD_ZIP2	HDD*Gas Heat >= 78%	
XHDD_ZIP3	HDD*Electric Heat <= 18%	
XHDD_ZIP4	HDD*Electric Heat >= 28%	Yes
XHDD_ZIP5	HDD*Median Rooms <= 5	Yes
XHDD_ZIP6	HDD*Median Rooms >= 6	Yes
XHDD_ZIP7	HDD*Occupants Per Room Less Than 1.00 <= 95%	
XHDD_ZIP8	HDD*Occupants Per Room Less Than 1.00 >= 98%	Yes
XHDD_ZIP9	HDD*Occupants Per Room Btwn 1.01 and 1.5 <= 1%	Yes
XHDD_ZIP10	HDD*Occupants Per Room Btwn 1.01 and 1.5 >= 4%	
XHDD_ZIP11	HDD*House $150k-$300k <= 4%	Yes
XHDD_ZIP12	HDD*House $150k-$300k >= 27%	Yes
XHDD_ZIP13	HDD*House $300k+ <= 61%	Yes
XHDD_ZIP14	HDD*House $300k+ >= 92%	Yes
XHDD_ZIP15	HDD*0-1 Bedrooms <= 7%	Yes
XHDD_ZIP16	HDD*0-1 Bedrooms >= 16%	Yes
XHDD_ZIP17	HDD*2 Bedrooms <= 19%	Yes
XHDD_ZIP18	HDD*2 Bedrooms >= 29%	
XHDD_ZIP19	HDD*3 Bedrooms <= 32%	
XHDD_ZIP20	HDD*3 Bedrooms >= 41%	Yes
XHDD_ZIP21	HDD*House Built 2000+ <= 5%	Yes
XHDD_ZIP22	HDD*House Built 2000+ >= 15%	Yes
XHDD_ZIP23	HDD*House Built 1980-1999 <= 17%	Yes
XHDD_ZIP24	HDD*House Built 1980-1999 >= 38%	Yes
XHDD_ZIP25	HDD*House Built 1960-1979 <= 26%	Yes
XHDD_ZIP26	HDD*House Built 1960-1979 >= 46%	Yes
XMON1	Fraction of Billing Period Falling in Jan	Yes
XMON2	Fraction of Billing Period Falling in Feb	Yes

Variable Name	Variable Label	Was Variable Significant at the 10% Level
XMON3	Fraction of Billing Period Falling in Mar	Yes
XMON4	Fraction of Billing Period Falling in Apr	Yes
XMON11	Fraction of Billing Period Falling in Nov	Yes
XMON12	Fraction of Billing Period Falling in Dec	Yes
XMONTH1	Fraction of Billing Period Falling in Jan, 2011	Yes
XMONTH2	Fraction of Billing Period Falling in Feb, 2011	Yes
XMONTH3	Fraction of Billing Period Falling in Mar, 2011	Yes
XMONTH4	Fraction of Billing Period Falling in Apr, 2011	
XMONTH11	Fraction of Billing Period Falling in Nov, 2011	
XMONTH12	Fraction of Billing Period Falling in Dec, 2011	Yes
XMONTH13	Fraction of Billing Period Falling in Jan, 2012	
XMONTH14	Fraction of Billing Period Falling in Feb, 2012	
XMONTH15	Fraction of Billing Period Falling in Mar, 2012	Yes
XMONTH16	Fraction of Billing Period Falling in Apr, 2012	
XMONTH23	Fraction of Billing Period Falling in Nov, 2012	Yes
XMONTH24	Fraction of Billing Period Falling in Dec, 2012	
XMONTH25	Fraction of Billing Period Falling in Jan, 2013	Yes
XMONTH26	Fraction of Billing Period Falling in Feb, 2013	Yes
XMONTH27	Fraction of Billing Period Falling in Mar, 2013	Yes
XMONTH28	Fraction of Billing Period Falling in Apr, 2013	Yes
XMONTH35	Fraction of Billing Period Falling in Nov, 2013	Yes
XMONTH36	Fraction of Billing Period Falling in Dec, 2013	Yes
XMONTH37	Fraction of Billing Period Falling in Jan, 2014	Yes
XMONTH38	Fraction of Billing Period Falling in Feb, 2014	
XMONTH39	Fraction of Billing Period Falling in Mar, 2014	
XMONTH40	Fraction of Billing Period Falling in Apr, 2014	Yes
XMONTH47	Fraction of Billing Period Falling in Nov, 2014	Yes
XMONTH48	Fraction of Billing Period Falling in Dec, 2014	
YHDD	PROGRAM * (Heating DD)	Yes
YHDD_ZIP1	PROGRAM * (HDD*Gas Heat <= 67%)	
YHDD_ZIP2	PROGRAM * (HDD*Gas Heat >= 78%)	
YHDD_ZIP3	PROGRAM * (HDD*Electric Heat <= 18%)	
YHDD_ZIP4	PROGRAM * (HDD*Electric Heat >= 28%)	Yes
YHDD_ZIP5	PROGRAM * (HDD*Median Rooms <= 5)	Yes
YHDD_ZIP6	PROGRAM * (HDD*Median Rooms >= 6)	
YHDD_ZIP7	PROGRAM * (HDD*Occupants Per Room Less Than 1.00 <= 95%)	

Variable Name	Variable Label	Was Variable Significant at the 10% Level
YHDD_ZIP8	PROGRAM * (HDD*Occupants Per Room Less Than 1.00 >= 98%)	Yes
YHDD_ZIP9	PROGRAM * (HDD*Occupants Per Room Btwn 1.01 and 1.5 <= 1%)	
YHDD_ZIP10	PROGRAM * (HDD*Occupants Per Room Btwn 1.01 and 1.5 >= 4%)	
YHDD_ZIP11	PROGRAM * (HDD*House $150k-$300k <= 4%)	
YHDD_ZIP12	PROGRAM * (HDD*House $150k-$300k >= 27%)	Yes
YHDD_ZIP13	PROGRAM * (HDD*House $300k+ <= 61%)	
YHDD_ZIP14	PROGRAM * (HDD*House $300k+ >= 92%)	
YHDD_ZIP15	PROGRAM * (HDD*0-1 Bedrooms <= 7%)	Yes
YHDD_ZIP16	PROGRAM * (HDD*0-1 Bedrooms >= 16%)	Yes
YHDD_ZIP17	PROGRAM * (HDD*2 Bedrooms <= 19%)	Yes
YHDD_ZIP18	PROGRAM * (HDD*2 Bedrooms >= 29%)	Yes
YHDD_ZIP19	PROGRAM * (HDD*3 Bedrooms <= 32%)	
YHDD_ZIP20	PROGRAM * (HDD*3 Bedrooms >= 41%)	Yes
YHDD_ZIP21	PROGRAM * (HDD*House Built 2000+ <= 5%)	Yes
YHDD_ZIP22	PROGRAM * (HDD*House Built 2000+ >= 15%)	
YHDD_ZIP23	PROGRAM * (HDD*House Built 1980-1999 <= 17%)	
YHDD_ZIP24	PROGRAM * (HDD*House Built 1980-1999 >= 38%)	Yes
YHDD_ZIP25	PROGRAM * (HDD*House Built 1960-1979 <= 26%)	Yes
YHDD_ZIP26	PROGRAM * (HDD*House Built 1960-1979 >= 46%)	Yes

APPENDIX C. UPGRADE MEASURES

Table 17 lists the technical specifications and the REN point value for each measure included in the Home Upgrade Program.

Table 17: Home Upgrade Program Measures and Points

Category	Upgrade Measure	Technical Specifications	REN Point Value
Base Measures (1 or more)	Duct Sealing	Seal to ≤10% for existing systems	25
	Duct Replacement	Seal to ≤6% for replacement ducts	65
	Whole Building Air Sealing	≥15% leakage reduction from vintage table defaults	25
	Whole Building Air Sealing	≥ 30% leakage reduction from vintage table defaults	45
	Attic Insulation & Air Sealing	Insulation ≥ R-30 (≥ R-38 in climate zones 1 & 11-16)	55
Base Measure Kickers	2nd Base Measure	Total of two base measures	15
	3rd Base Measure	Total of three base measures	20
Flex Measures	Wall Insulation	Insulate ≥R-13	50
	Floor Insulation	Insulate ≥R-19	-55
	Duct Insulation	Insulate ≥R-8	40
	Furnace	≥92% AFUE	60
	Air Conditioner	≥14 SEER/12 EER	65
	Gas Storage Water Heater	EF ≥0.62	20
	Gas Storage Water Heater	EF ≥0.67	35
	Gas On-Demand Water Heater	EF ≥ 0.82	90
	Electric Storage Water Heater	EF ≥ 0.93	40

The Modified Home Upgrade Program also provides a bonus to the homeowner for installing more than one base measure. The first additional base measure (2 of 3) will receive a bonus of 15 points, and the second additional base measure (3 of 3) will receive an additional bonus of 20 points. The measure point values and bonuses are cumulative.[39]

[39] MOTION FOR CONSIDERATION OF THE SAN FRANCISCO BAY AREA REGIONAL ENERGY NETWORK, Appendix A, San Francisco Bay Area Regional Energy Network (BayREN) Program Implementation Plan, Revised February 24, 2014.

APPENDIX D. STATISTICS FROM SAMPLE

These tables present model statistics for the sample data. The realization rates for each PA are the same as those reported in the body of this evaluation. The difference between sample and population savings per household and the statewide values are due to the differences in the number of projects between geographical locations of the sample and the population projects.

Table 18: kWh Estimates (sample only)

Statistic (kWh)	kWh Savings	*Standard Error*	Percent Savings	*Standard Error %*	Realization Rate	*Standard Error %*	R-Square	Adj R-Square
Statewide	**227.0**	***8.7***	**3.1%**	***0.1%***	**56.8%**	***2.2%***	**0.6743**	**0.6735**
BayREN	162.7	*8.4*	2.3%	*0.1%*	42.0%	*2.2%*		
PG&E	607.6	*8.6*	6.3%	*0.1%*	157.9%	*2.2%*		
SCE	133.4	*8.9*	1.6%	*0.1%*	17.0%	*1.1%*		
SoCalGas	---	---	---	---	---	---		
SoCalREN	212.3	*8.7*	2.4%	*0.1%*	34.5%	*1.4%*		
SDG&E	65.7	*8.3*	1.1%	*0.1%*	26.6%	*3.3%*		

Note: R-square and Adjusted R-square is an average over 365 models

Table 19: kW Estimates (sample only)

Statistic (kW)	kW Reduction	*Standard Error*	Percent Savings	*Standard Error %*	Realization Rate	*Standard Error %*
Statewide	**0.12**	***0.01***	**7.4%**	***0.8%***	**18.4%**	***2.0%***
BayREN	-0.08	*0.01*	-8.1%	*1.1%*	-13.6%	*1.8%*
PG&E	0.43	*0.01*	17.8%	*0.5%*	57.7%	*1.7%*
SCE	0.32	*0.01*	14.4%	*0.6%*	20.6%	*0.8%*
SoCalGas	---	---	---	---	---	---
SoCalREN	0.34	*0.01*	14.9%	*0.6%*	32.0%	*1.3%*
SDG&E	0.04	*0.02*	3.3%	*1.2%*	11.1%	*3.9%*

Table 20: Therm Estimates 12-month (sample only)

Statistic (Therm)	Therm Savings	*Standard Error*	Percent Savings	*Standard Error %*	Realization Rate	*Standard Error %*	R-Square	Adj R-Square
Statewide	**146.18**	***12.50***	**29.3%**	***2.5%***	**161.2%**	***13.8%***	**0.7688**	**0.7576**
BayREN	158.00	*12.67*	30.7%	*2.5%*	168.4%	*13.5%*		
PG&E	93.16	*16.07*	21.0%	*3.6%*	184.7%	*31.9%*		
SCE	---	---	---	---	---	---		
SoCalGas	34.78	*22.69*	7.8%	*5.1%*	52.2%	*34.1%*		
SoCalREN	137.34	*20.66*	21.3%	*3.2%*	92.6%	*13.9%*		
SDG&E	47.04	*14.01*	15.4%	*4.6%*	49.0%	*14.6%*		

Note: R-square and Adjusted R-square is an average over 365 models

APPENDIX AA. STANDARDIZED HIGH LEVEL SAVINGS

Tables presented in this appendix may not match report values due to differences resulting from tracking data values and calculations. These appendices include all single-family Home Upgrade Program records (HUP and Advanced HUP). Projects and savings are aggregated as reported in the closed tracking data (not corrected for typos, project mis-classification or other tracking data anomalies). In addition, the evaluation findings are generated after the dataset has been cleaned of any anomalies or outliers. The appendices are generated automatically and include the tracking data as reported - before any additional cleaning takes place.

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)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
BAYREN	Climate Zone 02	686	146	0.21	0.0%	0.21
BAYREN	Climate Zone 03	140	227	1.62	0.0%	1.62
BAYREN	Climate Zone 04	305	122	0.40	0.0%	0.40
BAYREN	Climate Zone 12	1,272	596	0.47	0.0%	0.47
BAYREN	Passthru: Home Upgrade	52	52	1.00	100.0%	
BAYREN	**Total**	**2,455**	**1,143**	**0.47**	**2.1%**	**0.45**
PGE	Climate Zone 02	10	0	-0.02	0.0%	-0.02
PGE	Climate Zone 04	0	0			
PGE	Climate Zone 11	1,457	384	0.26	0.0%	0.26
PGE	Climate Zone 12	900	456	0.51	0.0%	0.51
PGE	Climate Zone 13	181	63	0.35	0.0%	0.35
PGE	Climate Zone 16	9	13	1.43	0.0%	1.43
PGE	Passthru: Home Upgrade	70,287	70,287	1.00	100.0%	
PGE	**Total**	**72,845**	**71,204**	**0.98**	**96.5%**	**0.36**
SCE	Climate Zone 06	25	-1	-0.06	0.0%	-0.06
SCE	Climate Zone 08	57	-2	-0.03	0.0%	-0.03
SCE	Climate Zone 09	5	11	1.93	0.0%	1.93
SCE	Climate Zone 10	510	91	0.18	0.0%	0.18
SCE	Climate Zone 14	3	1	0.17	0.0%	0.17
SCE	Climate Zone 16	11	5	0.47	0.0%	0.47
SCE	Passthru: Home Upgrade	40,403	40,403	1.00	100.0%	
SCE	**Total**	**41,016**	**40,507**	**0.99**	**98.5%**	**0.17**
SCG	Climate Zone 05	0	0			
SCG	Climate Zone 06	9	0	0.00	0.0%	0.00
SCG	Climate Zone 08	5	-6	-1.06	0.0%	-1.06
SCG	Climate Zone 09	32	0	0.00	0.0%	0.00
SCG	Climate Zone 10	6	3	0.53	0.0%	0.53
SCG	Climate Zone 13	0	0			
SCG	Climate Zone 14	0	0			
SCG	Climate Zone 15	0	0			
SCG	Climate Zone 16	0	0			
SCG	Passthru: Home Upgrade	13,636	13,636	1.00	100.0%	
SCG	**Total**	**13,688**	**13,633**	**1.00**	**99.6%**	**-0.05**
SDGE	Climate Zone 06	40	11	0.26	0.0%	0.26
SDGE	Climate Zone 07	1,528	416	0.27	0.0%	0.27
SDGE	Climate Zone 08	78	17	0.22	0.0%	0.22
SDGE	Climate Zone 09	34	9	0.27	0.0%	0.27
SDGE	Climate Zone 10	1,232	319	0.26	0.0%	0.26
SDGE	Climate Zone 14	8	2	0.27	0.0%	0.27
SDGE	Climate Zone 15	3	1	0.27	0.0%	0.27
SDGE	Passthru: Home Upgrade	1,374	1,374	1.00	100.0%	

Gross Lifecycle Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	**Total**	**4,296**	**2,149**	**0.50**	**32.0%**	**0.27**
SOCALREN	Climate Zone 08	-359	-140	0.39	0.0%	0.39
SOCALREN	Climate Zone 09	-1,798	-604	0.34	0.0%	0.34
SOCALREN	Climate Zone 14	22	8	0.34	0.0%	0.34
SOCALREN	Passthru: Home Upgrade	2,920	2,920	1.00	100.0%	
SOCALREN	**Total**	**785**	**2,183**	**2.78**	**371.7%**	**0.34**
	Statewide	***135,085***	***130,820***	***0.97***	***95.3%***	***0.33***

Net Lifecycle Savings (MWh)

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
BAYREN	Climate Zone 02	583	124	0.21	100.0%	0.85	0.85		
BAYREN	Climate Zone 03	119	193	1.62	100.0%	0.85	0.85		
BAYREN	Climate Zone 04	259	104	0.40	100.0%	0.85	0.85		
BAYREN	Climate Zone 12	1,082	507	0.47	100.0%	0.85	0.85		
BAYREN	Passthru: Home Upgrade	45	45	1.00	100.0%	0.85	0.85		
BAYREN	**Total**	**2,087**	**972**	**0.47**	**100.0%**	**0.85**	**0.85**		
PGE	Climate Zone 02	9	0	-0.02	100.0%	0.85	0.85		
PGE	Climate Zone 04	0	0						
PGE	Climate Zone 11	1,238	327	0.26	100.0%	0.85	0.85		
PGE	Climate Zone 12	765	388	0.51	100.0%	0.85	0.85		
PGE	Climate Zone 13	154	54	0.35	100.0%	0.85	0.85		
PGE	Climate Zone 16	8	11	1.43	100.0%	0.85	0.85		
PGE	Passthru: Home Upgrade	59,744	59,744	1.00	100.0%	0.85	0.85		
PGE	**Total**	**61,918**	**60,523**	**0.98**	**100.0%**	**0.85**	**0.85**		
SCE	Climate Zone 06	21	-1	-0.06	100.0%	0.85	0.85		
SCE	Climate Zone 08	48	-2	-0.03	100.0%	0.85	0.85		
SCE	Climate Zone 09	5	9	1.93	100.0%	0.85	0.85		
SCE	Climate Zone 10	432	77	0.18	100.0%	0.85	0.85		
SCE	Climate Zone 14	2	0	0.17	100.0%	0.55	0.55		
SCE	Climate Zone 16	10	4	0.47	100.0%	0.85	0.85		
SCE	Passthru: Home Upgrade	22,287	22,287	1.00	100.0%	0.55	0.55		
SCE	**Total**	**22,805**	**22,375**	**0.98**	**100.0%**	**0.56**	**0.55**		
SCG	Climate Zone 05	0	0						
SCG	Climate Zone 06	8	0	0.00	100.0%	0.85			
SCG	Climate Zone 08	5	-5	-1.06	100.0%	0.85	0.85		
SCG	Climate Zone 09	27	0	0.00	100.0%	0.85			
SCG	Climate Zone 10	5	3	0.53	100.0%	0.85	0.85		
SCG	Climate Zone 13	0	0						
SCG	Climate Zone 14	0	0						

Net Lifecycle Savings (MWh)

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
SCG	Climate Zone 15	0	0						
SCG	Climate Zone 16	0	0						
SCG	Passthru: Home Upgrade	11,590	11,590	1.00	100.0%	0.85	0.85		
SCG	**Total**	**11,635**	**11,588**	**1.00**	**100.0%**	**0.85**	**0.85**		
SDGE	Climate Zone 06	34	9	0.26	100.0%	0.85	0.85		
SDGE	Climate Zone 07	1,299	354	0.27	100.0%	0.85	0.85		
SDGE	Climate Zone 08	66	15	0.22	100.0%	0.85	0.85		
SDGE	Climate Zone 09	29	8	0.27	100.0%	0.85	0.85		
SDGE	Climate Zone 10	1,047	271	0.26	100.0%	0.85	0.85		
SDGE	Climate Zone 14	6	2	0.27	100.0%	0.85	0.85		
SDGE	Climate Zone 15	2	1	0.27	100.0%	0.85	0.85		
SDGE	Passthru: Home Upgrade	1,168	1,168	1.00	100.0%	0.85	0.85		
SDGE	**Total**	**3,651**	**1,827**	**0.50**	**100.0%**	**0.85**	**0.85**		
SOCALREN	Climate Zone 08	-305	-119	0.39	100.0%	0.85	0.85		
SOCALREN	Climate Zone 09	-1,528	-513	0.34	100.0%	0.85	0.85		
SOCALREN	Climate Zone 14	19	6	0.34	100.0%	0.85	0.85		
SOCALREN	Passthru: Home Upgrade	2,482	2,482	1.00	100.0%	0.85	0.85		
SOCALREN	**Total**	**668**	**1,856**	**2.78**	**100.0%**	**0.85**	**0.85**		
	Statewide	***102,764***	***99,141***	***0.96***	***100.0%***	***0.76***	***0.76***		

Gross Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
BAYREN	Climate Zone 02	1.6	-0.2	-0.15	0.0%	-0.15
BAYREN	Climate Zone 03	0.2	0.0	-0.02	0.0%	-0.02
BAYREN	Climate Zone 04	0.5	-0.1	-0.25	0.0%	-0.25
BAYREN	Climate Zone 12	5.6	-0.7	-0.13	0.0%	-0.13
BAYREN	Passthru: Home Upgrade	0.1	0.1	1.00	100.0%	
BAYREN	**Total**	**8.1**	**-1.0**	**-0.13**	**1.0%**	**-0.14**
PGE	Climate Zone 02	0.0	0.0	-0.05	0.0%	-0.05
PGE	Climate Zone 04	0.0	0.0			
PGE	Climate Zone 11	2.3	0.2	0.10	0.0%	0.10
PGE	Climate Zone 12	2.4	0.4	0.15	0.0%	0.15
PGE	Climate Zone 13	0.3	0.0	0.15	0.0%	0.15
PGE	Climate Zone 16	0.0	0.0	0.21	0.0%	0.21
PGE	Passthru: Home Upgrade	95.7	95.7	1.00	100.0%	
PGE	**Total**	**100.7**	**96.3**	**0.96**	**95.0%**	**0.13**
SCE	Climate Zone 06	0.0	0.0	0.25	0.0%	0.25
SCE	Climate Zone 08	0.1	0.0	0.10	0.0%	0.10
SCE	Climate Zone 09	0.0	0.0	51.24	0.0%	51.24
SCE	Climate Zone 10	1.1	0.2	0.20	0.0%	0.20
SCE	Climate Zone 14	0.0	0.0	0.21	0.0%	0.21
SCE	Climate Zone 16	0.0	0.0	0.07	0.0%	0.07
SCE	Passthru: Home Upgrade	52.2	52.2	1.00	100.0%	
SCE	**Total**	**53.6**	**52.5**	**0.98**	**97.5%**	**0.20**
SCG	Climate Zone 05	0.0	0.0			
SCG	Climate Zone 06	0.0	0.0			
SCG	Climate Zone 08	0.0	0.0	-0.31	0.0%	-0.31
SCG	Climate Zone 09	0.0	0.0			
SCG	Climate Zone 10	0.0	0.0			
SCG	Climate Zone 13	0.0	0.0			
SCG	Climate Zone 14	0.0	0.0			
SCG	Climate Zone 15	0.0	0.0			
SCG	Climate Zone 16	0.0	0.0			
SCG	Passthru: Home Upgrade	0.0	0.0			
SCG	**Total**	**0.0**	**0.0**	**-0.31**	**0.0%**	**-0.31**
SDGE	Climate Zone 06	0.0	0.0	0.11	0.0%	0.11
SDGE	Climate Zone 07	3.3	0.4	0.11	0.0%	0.11
SDGE	Climate Zone 08	0.1	0.0	0.09	0.0%	0.09
SDGE	Climate Zone 09	0.0	0.0	0.11	0.0%	0.11
SDGE	Climate Zone 10	1.7	0.2	0.10	0.0%	0.10
SDGE	Climate Zone 14	0.0	0.0	0.11	0.0%	0.11
SDGE	Climate Zone 15	0.0	0.0	0.11	0.0%	0.11
SDGE	Passthru: Home Upgrade	1.1	1.1	1.00	100.0%	

Gross Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	**Total**	**6.3**	**1.7**	**0.27**	**18.0%**	**0.11**
SOCALREN	Climate Zone 08	-0.1	0.0	0.31	0.0%	0.31
SOCALREN	Climate Zone 09	-0.4	-0.1	0.32	0.0%	0.32
SOCALREN	Climate Zone 14	0.0	0.0	0.32	0.0%	0.32
SOCALREN	Passthru: Home Upgrade	0.5	0.5	1.00	100.0%	
SOCALREN	**Total**	**0.0**	**0.3**	**-18.99**	**-2,827.1%**	**0.32**
	Statewide	***168.7***	***149.8***	***0.89***	***88.7%***	***0.01***

Net Lifecycle Savings (MW)

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
BAYREN	Climate Zone 02	1.4	-0.2	-0.15	100.0%	0.85	0.85		
BAYREN	Climate Zone 03	0.2	0.0	-0.02	100.0%	0.85	0.85		
BAYREN	Climate Zone 04	0.4	-0.1	-0.25	100.0%	0.85	0.85		
BAYREN	Climate Zone 12	4.8	-0.6	-0.13	100.0%	0.85	0.85		
BAYREN	Passthru: Home Upgrade	0.1	0.1	1.00	100.0%	0.85	0.85		
BAYREN	**Total**	**6.9**	**-0.9**	**-0.13**	**100.0%**	**0.85**	**0.85**		
PGE	Climate Zone 02	0.0	0.0	-0.05	100.0%	0.85	0.85		
PGE	Climate Zone 04	0.0	0.0						
PGE	Climate Zone 11	1.9	0.2	0.10	100.0%	0.85	0.85		
PGE	Climate Zone 12	2.0	0.3	0.15	100.0%	0.85	0.85		
PGE	Climate Zone 13	0.3	0.0	0.15	100.0%	0.85	0.85		
PGE	Climate Zone 16	0.0	0.0	0.21	100.0%	0.85	0.85		
PGE	Passthru: Home Upgrade	81.3	81.3	1.00	100.0%	0.85	0.85		
PGE	**Total**	**85.6**	**81.9**	**0.96**	**100.0%**	**0.85**	**0.85**		
SCE	Climate Zone 06	0.0	0.0	0.25	100.0%	0.85	0.85		
SCE	Climate Zone 08	0.1	0.0	0.10	100.0%	0.85	0.85		
SCE	Climate Zone 09	0.0	0.0	51.24	100.0%	0.85	0.85		
SCE	Climate Zone 10	0.9	0.2	0.20	100.0%	0.84	0.84		
SCE	Climate Zone 14	0.0	0.0	0.21	100.0%	0.55	0.55		
SCE	Climate Zone 16	0.0	0.0	0.07	100.0%	0.85	0.85		
SCE	Passthru: Home Upgrade	28.8	28.8	1.00	100.0%	0.55	0.55		
SCE	**Total**	**29.9**	**29.0**	**0.97**	**100.0%**	**0.56**	**0.55**		
SCG	Climate Zone 05	0.0	0.0						
SCG	Climate Zone 06	0.0	0.0						
SCG	Climate Zone 08	0.0	0.0	-0.31	100.0%	0.85	0.85		
SCG	Climate Zone 09	0.0	0.0						
SCG	Climate Zone 10	0.0	0.0						
SCG	Climate Zone 13	0.0	0.0						
SCG	Climate Zone 14	0.0	0.0						

Net Lifecycle Savings (MW)

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
SCG	Climate Zone 15	0.0	0.0						
SCG	Climate Zone 16	0.0	0.0						
SCG	Passthru: Home Upgrade	0.0	0.0						
SCG	**Total**	**0.0**	**0.0**	**-0.31**	**100.0%**	**0.85**	**0.85**		
SDGE	Climate Zone 06	0.0	0.0	0.11	100.0%	0.85	0.85		
SDGE	Climate Zone 07	2.8	0.3	0.11	100.0%	0.85	0.85		
SDGE	Climate Zone 08	0.1	0.0	0.09	100.0%	0.85	0.85		
SDGE	Climate Zone 09	0.0	0.0	0.11	100.0%	0.85	0.85		
SDGE	Climate Zone 10	1.4	0.1	0.10	100.0%	0.85	0.85		
SDGE	Climate Zone 14	0.0	0.0	0.11	100.0%	0.85	0.85		
SDGE	Climate Zone 15	0.0	0.0	0.11	100.0%	0.85	0.85		
SDGE	Passthru: Home Upgrade	1.0	1.0	1.00	100.0%	0.85	0.85		
SDGE	**Total**	**5.4**	**1.5**	**0.27**	**100.0%**	**0.85**	**0.85**		
SOCALREN	Climate Zone 08	-0.1	0.0	0.31	100.0%	0.85	0.85		
SOCALREN	Climate Zone 09	-0.4	-0.1	0.32	100.0%	0.85	0.85		
SOCALREN	Climate Zone 14	0.0	0.0	0.32	100.0%	0.85	0.85		
SOCALREN	Passthru: Home Upgrade	0.4	0.4	1.00	100.0%	0.85	0.85		
SOCALREN	**Total**	**0.0**	**0.3**	**-18.99**	**100.0%**	**0.85**	**0.85**		
	Statewide	***127.7***	***111.7***	***0.87***	***100.0%***	***0.76***	***0.75***		

Gross Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
BAYREN	Climate Zone 02	327	573	1.75	0.0%	1.75
BAYREN	Climate Zone 03	218	345	1.58	0.0%	1.58
BAYREN	Climate Zone 04	123	217	1.76	0.0%	1.76
BAYREN	Climate Zone 12	321	693	2.16	0.0%	2.16
BAYREN	Passthru: Home Upgrade	28	28	1.00	100.0%	
BAYREN	**Total**	**1,018**	**1,856**	**1.82**	**2.8%**	**1.85**
PGE	Climate Zone 02	6	0	0.00	0.0%	0.00
PGE	Climate Zone 04	0	0			
PGE	Climate Zone 11	233	68	0.29	0.0%	0.29
PGE	Climate Zone 12	215	44	0.21	0.0%	0.21
PGE	Climate Zone 13	27	8	0.28	0.0%	0.28
PGE	Climate Zone 16	3	0	0.00	0.0%	0.00
PGE	Passthru: Home Upgrade	17,350	17,350	1.00	100.0%	
PGE	**Total**	**17,833**	**17,470**	**0.98**	**97.3%**	**0.25**
SCE	Climate Zone 06	35	27	0.77	0.0%	0.77
SCE	Climate Zone 08	17	10	0.57	0.0%	0.57
SCE	Climate Zone 09	19	13	0.68	0.0%	0.68
SCE	Climate Zone 10	120	105	0.88	0.0%	0.88
SCE	Climate Zone 14	0	1	1.57	0.0%	1.57
SCE	Climate Zone 16	3	3	0.93	0.0%	0.93
SCE	Passthru: Home Upgrade	3,419	3,419	1.00	100.0%	
SCE	**Total**	**3,613**	**3,577**	**0.99**	**94.6%**	**0.82**
SCG	Climate Zone 05	3	3	0.93	0.0%	0.93
SCG	Climate Zone 06	22	21	0.91	0.0%	0.91
SCG	Climate Zone 08	11	10	0.91	0.0%	0.91
SCG	Climate Zone 09	15	23	1.53	0.0%	1.53
SCG	Climate Zone 10	62	56	0.90	0.0%	0.90
SCG	Climate Zone 13	1	1	0.93	0.0%	0.93
SCG	Climate Zone 14	2	2	1.23	0.0%	1.23
SCG	Climate Zone 15	1	0	0.93	0.0%	0.93
SCG	Climate Zone 16	1	1	0.93	0.0%	0.93
SCG	Passthru: Home Upgrade	5,407	5,407	1.00	100.0%	
SCG	**Total**	**5,525**	**5,524**	**1.00**	**97.9%**	**0.99**
SDGE	Climate Zone 06	6	3	0.43	0.0%	0.43
SDGE	Climate Zone 07	257	124	0.48	0.0%	0.48
SDGE	Climate Zone 08	8	4	0.42	0.0%	0.42
SDGE	Climate Zone 09	3	2	0.49	0.0%	0.49
SDGE	Climate Zone 10	140	58	0.42	0.0%	0.42
SDGE	Climate Zone 14	1	0	0.00	0.0%	0.00
SDGE	Climate Zone 15	1	0	0.49	0.0%	0.49
SDGE	Passthru: Home Upgrade	205	205	1.00	100.0%	

Gross Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	**Total**	**621**	**396**	**0.64**	**33.0%**	**0.46**
SOCALREN	Climate Zone 08	-73	-38	0.52	0.0%	0.52
SOCALREN	Climate Zone 09	-351	-175	0.50	0.0%	0.50
SOCALREN	Climate Zone 14	2	1	0.52	0.0%	0.52
SOCALREN	Passthru: Home Upgrade	-21	-21	1.00	100.0%	
SOCALREN	**Total**	**-444**	**-233**	**0.53**	**4.8%**	**0.50**
	Statewide	***28,166***	***28,590***	***1.02***	***93.7%***	***1.24***

Net Lifecycle Savings (MTherms)

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
BAYREN	Climate Zone 02	278	487	1.75	100.0%	0.85	0.85		
BAYREN	Climate Zone 03	185	293	1.58	100.0%	0.85	0.85		
BAYREN	Climate Zone 04	105	184	1.76	100.0%	0.85	0.85		
BAYREN	Climate Zone 12	273	589	2.16	100.0%	0.85	0.85		
BAYREN	Passthru: Home Upgrade	24	24	1.00	100.0%	0.85	0.85		
BAYREN	**Total**	**865**	**1,578**	**1.82**	**100.0%**	**0.85**	**0.85**		
PGE	Climate Zone 02	5	0	0.00	100.0%	0.85			
PGE	Climate Zone 04	0	0						
PGE	Climate Zone 11	198	57	0.29	100.0%	0.85	0.85		
PGE	Climate Zone 12	182	38	0.21	100.0%	0.85	0.85		
PGE	Climate Zone 13	23	6	0.28	100.0%	0.85	0.85		
PGE	Climate Zone 16	3	0	0.00	100.0%	0.85			
PGE	Passthru: Home Upgrade	14,748	14,748	1.00	100.0%	0.85	0.85		
PGE	**Total**	**15,158**	**14,849**	**0.98**	**100.0%**	**0.85**	**0.85**		
SCE	Climate Zone 06	30	23	0.77	100.0%	0.85	0.85		
SCE	Climate Zone 08	15	8	0.57	100.0%	0.85	0.85		
SCE	Climate Zone 09	16	11	0.68	100.0%	0.85	0.85		
SCE	Climate Zone 10	101	89	0.88	100.0%	0.85	0.85		
SCE	Climate Zone 14	0	0	1.57	100.0%	0.55	0.55		
SCE	Climate Zone 16	3	2	0.93	100.0%	0.85	0.85		
SCE	Passthru: Home Upgrade	1,881	1,881	1.00	100.0%	0.55	0.55		
SCE	**Total**	**2,046**	**2,015**	**0.99**	**100.0%**	**0.57**	**0.56**		
SCG	Climate Zone 05	2	2	0.93	100.0%	0.85	0.85		
SCG	Climate Zone 06	19	17	0.91	100.0%	0.85	0.85		
SCG	Climate Zone 08	9	8	0.91	100.0%	0.85	0.85		
SCG	Climate Zone 09	13	20	1.53	100.0%	0.85	0.85		
SCG	Climate Zone 10	53	48	0.90	100.0%	0.85	0.85		
SCG	Climate Zone 13	1	1	0.93	100.0%	0.85	0.85		
SCG	Climate Zone 14	1	2	1.23	100.0%	0.85	0.85		

Net Lifecycle Savings (MTherms)

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
SCG	Climate Zone 15	0	0	0.93	100.0%	0.85	0.85		
SCG	Climate Zone 16	1	1	0.93	100.0%	0.85	0.85		
SCG	Passthru: Home Upgrade	4,596	4,596	1.00	100.0%	0.85	0.85		
SCG	**Total**	**4,696**	**4,695**	**1.00**	**100.0%**	**0.85**	**0.85**		
SDGE	Climate Zone 06	6	2	0.43	100.0%	0.85	0.85		
SDGE	Climate Zone 07	218	106	0.48	100.0%	0.85	0.85		
SDGE	Climate Zone 08	7	3	0.42	100.0%	0.85	0.85		
SDGE	Climate Zone 09	3	1	0.49	100.0%	0.85	0.85		
SDGE	Climate Zone 10	119	50	0.42	100.0%	0.85	0.85		
SDGE	Climate Zone 14	1	0	0.00	100.0%	0.85			
SDGE	Climate Zone 15	1	0	0.49	100.0%	0.85	0.85		
SDGE	Passthru: Home Upgrade	174	174	1.00	100.0%	0.85	0.85		
SDGE	**Total**	**528**	**336**	**0.64**	**100.0%**	**0.85**	**0.85**		
SOCALREN	Climate Zone 08	-62	-33	0.52	100.0%	0.85	0.85		
SOCALREN	Climate Zone 09	-299	-148	0.50	100.0%	0.85	0.85		
SOCALREN	Climate Zone 14	2	1	0.52	100.0%	0.85	0.85		
SOCALREN	Passthru: Home Upgrade	-18	-18	1.00	100.0%	0.85	0.85		
SOCALREN	**Total**	**-378**	**-198**	**0.53**	**100.0%**	**0.85**	**0.85**		
	Statewide	***22,916***	***23,276***	***1.02***	***100.0%***	***0.81***	***0.81***		

Gross First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
BAYREN	Climate Zone 02	57	12	0.21	0.0%	0.21
BAYREN	Climate Zone 03	11	19	1.62	0.0%	1.62
BAYREN	Climate Zone 04	30	12	0.40	0.0%	0.40
BAYREN	Climate Zone 12	119	56	0.47	0.0%	0.47
BAYREN	Passthru: Home Upgrade	5	5	1.00	100.0%	
BAYREN	**Total**	**223**	**104**	**0.46**	**2.3%**	**0.45**
PGE	Climate Zone 02	1	0	-0.02	0.0%	-0.02
PGE	Climate Zone 04	0	0			
PGE	Climate Zone 11	140	37	0.26	0.0%	0.26
PGE	Climate Zone 12	77	39	0.51	0.0%	0.51
PGE	Climate Zone 13	14	5	0.35	0.0%	0.35
PGE	Climate Zone 16	1	1	1.43	0.0%	1.43
PGE	Passthru: Home Upgrade	4,290	4,290	1.00	100.0%	
PGE	**Total**	**4,523**	**4,372**	**0.97**	**94.9%**	**0.35**
SCE	Climate Zone 06	2	0	-0.06	0.0%	-0.06
SCE	Climate Zone 08	4	0	-0.03	0.0%	-0.03
SCE	Climate Zone 09	0	1	1.93	0.0%	1.93
SCE	Climate Zone 10	49	9	0.18	0.0%	0.18
SCE	Climate Zone 14	0	0	0.17	0.0%	0.17
SCE	Climate Zone 16	1	1	0.47	0.0%	0.47
SCE	Passthru: Home Upgrade	2,926	2,926	1.00	100.0%	
SCE	**Total**	**2,982**	**2,935**	**0.98**	**98.1%**	**0.17**
SCG	Climate Zone 05	0	0			
SCG	Climate Zone 06	1	0	0.00	0.0%	0.00
SCG	Climate Zone 08	0	0	-1.06	0.0%	-1.06
SCG	Climate Zone 09	2	0	0.00	0.0%	0.00
SCG	Climate Zone 10	0	0	0.53	0.0%	0.53
SCG	Climate Zone 13	0	0			
SCG	Climate Zone 14	0	0			
SCG	Climate Zone 15	0	0			
SCG	Climate Zone 16	0	0			
SCG	Passthru: Home Upgrade	826	826	1.00	100.0%	
SCG	**Total**	**830**	**826**	**1.00**	**99.6%**	**-0.05**
SDGE	Climate Zone 06	2	1	0.26	0.0%	0.26
SDGE	Climate Zone 07	93	25	0.27	0.0%	0.27
SDGE	Climate Zone 08	5	1	0.22	0.0%	0.22
SDGE	Climate Zone 09	2	1	0.27	0.0%	0.27
SDGE	Climate Zone 10	75	19	0.26	0.0%	0.26
SDGE	Climate Zone 14	0	0	0.27	0.0%	0.27
SDGE	Climate Zone 15	0	0	0.27	0.0%	0.27
SDGE	Passthru: Home Upgrade	86	86	1.00	100.0%	

Gross First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	**Total**	**264**	**133**	**0.51**	**32.7%**	**0.27**
SOCALREN	Climate Zone 08	7	3	0.39	0.0%	0.39
SOCALREN	Climate Zone 09	69	23	0.34	0.0%	0.34
SOCALREN	Climate Zone 14	2	1	0.34	0.0%	0.34
SOCALREN	Passthru: Home Upgrade	388	388	1.00	100.0%	
SOCALREN	**Total**	**466**	**414**	**0.89**	**83.1%**	**0.34**
	Statewide	***9,287***	***8,785***	***0.95***	***91.8%***	***0.34***

Net First Year Savings (MWh)

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
BAYREN	Climate Zone 02	49	10	0.21	100.0%	0.85	0.85		
BAYREN	Climate Zone 03	10	16	1.62	100.0%	0.85	0.85		
BAYREN	Climate Zone 04	25	10	0.40	100.0%	0.85	0.85		
BAYREN	Climate Zone 12	101	47	0.47	100.0%	0.85	0.85		
BAYREN	Passthru: Home Upgrade	4	4	1.00	100.0%	0.85	0.85		
BAYREN	**Total**	**189**	**88**	**0.46**	**100.0%**	**0.85**	**0.85**		
PGE	Climate Zone 02	1	0	-0.02	100.0%	0.85	0.85		
PGE	Climate Zone 04	0	0						
PGE	Climate Zone 11	119	31	0.26	100.0%	0.85	0.85		
PGE	Climate Zone 12	65	33	0.51	100.0%	0.85	0.85		
PGE	Climate Zone 13	12	4	0.35	100.0%	0.85	0.85		
PGE	Climate Zone 16	1	1	1.43	100.0%	0.85	0.85		
PGE	Passthru: Home Upgrade	3,647	3,647	1.00	100.0%	0.85	0.85		
PGE	**Total**	**3,844**	**3,716**	**0.97**	**100.0%**	**0.85**	**0.85**		
SCE	Climate Zone 06	2	0	-0.06	100.0%	0.85	0.85		
SCE	Climate Zone 08	3	0	-0.03	100.0%	0.85	0.85		
SCE	Climate Zone 09	0	1	1.93	100.0%	0.85	0.85		
SCE	Climate Zone 10	42	7	0.18	100.0%	0.85	0.85		
SCE	Climate Zone 14	0	0	0.17	100.0%	0.55	0.55		
SCE	Climate Zone 16	1	0	0.47	100.0%	0.85	0.85		
SCE	Passthru: Home Upgrade	1,614	1,614	1.00	100.0%	0.55	0.55		
SCE	**Total**	**1,661**	**1,622**	**0.98**	**100.0%**	**0.56**	**0.55**		
SCG	Climate Zone 05	0	0						
SCG	Climate Zone 06	0	0	0.00	100.0%	0.85			
SCG	Climate Zone 08	0	0	-1.06	100.0%	0.85	0.85		
SCG	Climate Zone 09	2	0	0.00	100.0%	0.85			
SCG	Climate Zone 10	0	0	0.53	100.0%	0.85	0.85		
SCG	Climate Zone 13	0	0						
SCG	Climate Zone 14	0	0						

Net First Year Savings (MWh)

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
SCG	Climate Zone 15	0	0						
SCG	Climate Zone 16	0	0						
SCG	Passthru: Home Upgrade	702	702	1.00	100.0%	0.85	0.85		
SCG	**Total**	**705**	**702**	**1.00**	**100.0%**	**0.85**	**0.85**		
SDGE	Climate Zone 06	2	1	0.26	100.0%	0.85	0.85		
SDGE	Climate Zone 07	79	22	0.27	100.0%	0.85	0.85		
SDGE	Climate Zone 08	4	1	0.22	100.0%	0.85	0.85		
SDGE	Climate Zone 09	2	0	0.27	100.0%	0.85	0.85		
SDGE	Climate Zone 10	64	17	0.26	100.0%	0.85	0.85		
SDGE	Climate Zone 14	0	0	0.27	100.0%	0.85	0.85		
SDGE	Climate Zone 15	0	0	0.27	100.0%	0.85	0.85		
SDGE	Passthru: Home Upgrade	73	73	1.00	100.0%	0.85	0.85		
SDGE	**Total**	**224**	**113**	**0.51**	**100.0%**	**0.85**	**0.85**		
SOCALREN	Climate Zone 08	6	2	0.39	100.0%	0.85	0.85		
SOCALREN	Climate Zone 09	59	20	0.34	100.0%	0.85	0.85		
SOCALREN	Climate Zone 14	2	1	0.34	100.0%	0.85	0.85		
SOCALREN	Passthru: Home Upgrade	329	329	1.00	100.0%	0.85	0.85		
SOCALREN	**Total**	**396**	**352**	**0.89**	**100.0%**	**0.85**	**0.85**		
	Statewide	***7,021***	***6,594***	***0.94***	***100.0%***	***0.76***	***0.75***		

Gross First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
BAYREN	Climate Zone 02	0.1	0.0	-0.15	0.0%	-0.15
BAYREN	Climate Zone 03	0.0	0.0	-0.02	0.0%	-0.02
BAYREN	Climate Zone 04	0.0	0.0	-0.25	0.0%	-0.25
BAYREN	Climate Zone 12	0.2	0.0	-0.13	0.0%	-0.13
BAYREN	Passthru: Home Upgrade	0.0	0.0	1.00	100.0%	
BAYREN	**Total**	**0.3**	**0.0**	**-0.12**	**2.2%**	**-0.15**
PGE	Climate Zone 02	0.0	0.0	-0.05	0.0%	-0.05
PGE	Climate Zone 04	0.0	0.0			
PGE	Climate Zone 11	0.2	0.0	0.10	0.0%	0.10
PGE	Climate Zone 12	0.2	0.0	0.15	0.0%	0.15
PGE	Climate Zone 13	0.0	0.0	0.15	0.0%	0.15
PGE	Climate Zone 16	0.0	0.0	0.21	0.0%	0.21
PGE	Passthru: Home Upgrade	6.0	6.0	1.00	100.0%	
PGE	**Total**	**6.4**	**6.0**	**0.94**	**92.9%**	**0.13**
SCE	Climate Zone 06	0.0	0.0	0.25	0.0%	0.25
SCE	Climate Zone 08	0.0	0.0	0.10	0.0%	0.10
SCE	Climate Zone 09	0.0	0.0	51.24	0.0%	51.24
SCE	Climate Zone 10	0.1	0.0	0.20	0.0%	0.20
SCE	Climate Zone 14	0.0	0.0	0.21	0.0%	0.21
SCE	Climate Zone 16	0.0	0.0	0.07	0.0%	0.07
SCE	Passthru: Home Upgrade	3.7	3.7	1.00	100.0%	
SCE	**Total**	**3.9**	**3.8**	**0.98**	**97.0%**	**0.20**
SCG	Climate Zone 05	0.0	0.0			
SCG	Climate Zone 06	0.0	0.0			
SCG	Climate Zone 08	0.0	0.0	-0.31	0.0%	-0.31
SCG	Climate Zone 09	0.0	0.0			
SCG	Climate Zone 10	0.0	0.0			
SCG	Climate Zone 13	0.0	0.0			
SCG	Climate Zone 14	0.0	0.0			
SCG	Climate Zone 15	0.0	0.0			
SCG	Climate Zone 16	0.0	0.0			
SCG	Passthru: Home Upgrade	0.0	0.0			
SCG	**Total**	**0.0**	**0.0**	**-0.31**	**0.0%**	**-0.31**
SDGE	Climate Zone 06	0.0	0.0	0.11	0.0%	0.11
SDGE	Climate Zone 07	0.2	0.0	0.11	0.0%	0.11
SDGE	Climate Zone 08	0.0	0.0	0.09	0.0%	0.09
SDGE	Climate Zone 09	0.0	0.0	0.11	0.0%	0.11
SDGE	Climate Zone 10	0.1	0.0	0.10	0.0%	0.10
SDGE	Climate Zone 14	0.0	0.0	0.11	0.0%	0.11
SDGE	Climate Zone 15	0.0	0.0	0.11	0.0%	0.11
SDGE	Passthru: Home Upgrade	0.1	0.1	1.00	100.0%	

Gross First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	**Total**	**0.4**	**0.1**	**0.27**	**18.1%**	**0.11**
SOCALREN	Climate Zone 08	0.0	0.0	0.31	0.0%	0.31
SOCALREN	Climate Zone 09	0.1	0.0	0.32	0.0%	0.32
SOCALREN	Climate Zone 14	0.0	0.0	0.32	0.0%	0.32
SOCALREN	Passthru: Home Upgrade	0.1	0.1	1.00	100.0%	
SOCALREN	**Total**	**0.2**	**0.1**	**0.58**	**38.8%**	**0.32**
	Statewide	***11.2***	***10.0***	***0.89***	***87.9%***	***0.08***

Net First Year Savings (MW)

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
BAYREN	Climate Zone 02	0.1	0.0	-0.15	100.0%	0.85	0.85		
BAYREN	Climate Zone 03	0.0	0.0	-0.02	100.0%	0.85	0.85		
BAYREN	Climate Zone 04	0.0	0.0	-0.25	100.0%	0.85	0.85		
BAYREN	Climate Zone 12	0.2	0.0	-0.13	100.0%	0.85	0.85		
BAYREN	Passthru: Home Upgrade	0.0	0.0	1.00	100.0%	0.85	0.85		
BAYREN	**Total**	**0.3**	**0.0**	**-0.12**	**100.0%**	**0.85**	**0.85**		
PGE	Climate Zone 02	0.0	0.0	-0.05	100.0%	0.85	0.85		
PGE	Climate Zone 04	0.0	0.0						
PGE	Climate Zone 11	0.2	0.0	0.10	100.0%	0.85	0.85		
PGE	Climate Zone 12	0.2	0.0	0.15	100.0%	0.85	0.85		
PGE	Climate Zone 13	0.0	0.0	0.15	100.0%	0.85	0.85		
PGE	Climate Zone 16	0.0	0.0	0.21	100.0%	0.85	0.85		
PGE	Passthru: Home Upgrade	5.1	5.1	1.00	100.0%	0.85	0.85		
PGE	**Total**	**5.5**	**5.1**	**0.94**	**100.0%**	**0.85**	**0.85**		
SCE	Climate Zone 06	0.0	0.0	0.25	100.0%	0.85	0.85		
SCE	Climate Zone 08	0.0	0.0	0.10	100.0%	0.85	0.85		
SCE	Climate Zone 09	0.0	0.0	51.24	100.0%	0.85	0.85		
SCE	Climate Zone 10	0.1	0.0	0.20	100.0%	0.85	0.85		
SCE	Climate Zone 14	0.0	0.0	0.21	100.0%	0.55	0.55		
SCE	Climate Zone 16	0.0	0.0	0.07	100.0%	0.85	0.85		
SCE	Passthru: Home Upgrade	2.1	2.1	1.00	100.0%	0.55	0.55		
SCE	**Total**	**2.2**	**2.1**	**0.96**	**100.0%**	**0.56**	**0.55**		
SCG	Climate Zone 05	0.0	0.0						
SCG	Climate Zone 06	0.0	0.0						
SCG	Climate Zone 08	0.0	0.0	-0.31	100.0%	0.85	0.85		
SCG	Climate Zone 09	0.0	0.0						
SCG	Climate Zone 10	0.0	0.0						
SCG	Climate Zone 13	0.0	0.0						
SCG	Climate Zone 14	0.0	0.0						

Net First Year Savings (MW)

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
SCG	Climate Zone 15	0.0	0.0						
SCG	Climate Zone 16	0.0	0.0						
SCG	Passthru: Home Upgrade	0.0	0.0						
SCG	**Total**	**0.0**	**0.0**	**-0.31**	**100.0%**	**0.85**	**0.85**		
SDGE	Climate Zone 06	0.0	0.0	0.11	100.0%	0.85	0.85		
SDGE	Climate Zone 07	0.2	0.0	0.11	100.0%	0.85	0.85		
SDGE	Climate Zone 08	0.0	0.0	0.09	100.0%	0.85	0.85		
SDGE	Climate Zone 09	0.0	0.0	0.11	100.0%	0.85	0.85		
SDGE	Climate Zone 10	0.1	0.0	0.10	100.0%	0.85	0.85		
SDGE	Climate Zone 14	0.0	0.0	0.11	100.0%	0.85	0.85		
SDGE	Climate Zone 15	0.0	0.0	0.11	100.0%	0.85	0.85		
SDGE	Passthru: Home Upgrade	0.1	0.1	1.00	100.0%	0.85	0.85		
SDGE	**Total**	**0.3**	**0.1**	**0.27**	**100.0%**	**0.85**	**0.85**		
SOCALREN	Climate Zone 08	0.0	0.0	0.31	100.0%	0.85	0.85		
SOCALREN	Climate Zone 09	0.1	0.0	0.32	100.0%	0.85	0.85		
SOCALREN	Climate Zone 14	0.0	0.0	0.32	100.0%	0.85	0.85		
SOCALREN	Passthru: Home Upgrade	0.1	0.1	1.00	100.0%	0.85	0.85		
SOCALREN	**Total**	**0.2**	**0.1**	**0.58**	**100.0%**	**0.85**	**0.85**		
	Statewide	***8.4***	***7.4***	***0.87***	***100.0%***	***0.75***	***0.74***		

Gross First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
BAYREN	Climate Zone 02	18	32	1.75	0.0%	1.75
BAYREN	Climate Zone 03	13	21	1.58	0.0%	1.58
BAYREN	Climate Zone 04	8	13	1.76	0.0%	1.76
BAYREN	Climate Zone 12	18	39	2.16	0.0%	2.16
BAYREN	Passthru: Home Upgrade	2	2	1.00	100.0%	
BAYREN	**Total**	**59**	**107**	**1.82**	**2.7%**	**1.84**
PGE	Climate Zone 02	0	0	0.00	0.0%	0.00
PGE	Climate Zone 04	0	0			
PGE	Climate Zone 11	15	4	0.29	0.0%	0.29
PGE	Climate Zone 12	14	3	0.21	0.0%	0.21
PGE	Climate Zone 13	2	1	0.28	0.0%	0.28
PGE	Climate Zone 16	0	0	0.00	0.0%	0.00
PGE	Passthru: Home Upgrade	894	894	1.00	100.0%	
PGE	**Total**	**926**	**902**	**0.97**	**96.6%**	**0.25**
SCE	Climate Zone 06	2	2	0.77	0.0%	0.77
SCE	Climate Zone 08	1	1	0.57	0.0%	0.57
SCE	Climate Zone 09	1	1	0.68	0.0%	0.68
SCE	Climate Zone 10	8	7	0.88	0.0%	0.88
SCE	Climate Zone 14	0	0	1.57	0.0%	1.57
SCE	Climate Zone 16	0	0	0.93	0.0%	0.93
SCE	Passthru: Home Upgrade	244	244	1.00	100.0%	
SCE	**Total**	**256**	**254**	**0.99**	**95.2%**	**0.82**
SCG	Climate Zone 05	0	0	0.93	0.0%	0.93
SCG	Climate Zone 06	1	1	0.91	0.0%	0.91
SCG	Climate Zone 08	1	1	0.91	0.0%	0.91
SCG	Climate Zone 09	1	1	1.53	0.0%	1.53
SCG	Climate Zone 10	4	3	0.90	0.0%	0.90
SCG	Climate Zone 13	0	0	0.93	0.0%	0.93
SCG	Climate Zone 14	0	0	1.23	0.0%	1.23
SCG	Climate Zone 15	0	0	0.93	0.0%	0.93
SCG	Climate Zone 16	0	0	0.93	0.0%	0.93
SCG	Passthru: Home Upgrade	331	331	1.00	100.0%	
SCG	**Total**	**338**	**338**	**1.00**	**97.9%**	**0.99**
SDGE	Climate Zone 06	0	0	0.43	0.0%	0.43
SDGE	Climate Zone 07	16	8	0.48	0.0%	0.48
SDGE	Climate Zone 08	1	0	0.42	0.0%	0.42
SDGE	Climate Zone 09	0	0	0.49	0.0%	0.49
SDGE	Climate Zone 10	9	4	0.42	0.0%	0.42
SDGE	Climate Zone 14	0	0	0.00	0.0%	0.00
SDGE	Climate Zone 15	0	0	0.49	0.0%	0.49
SDGE	Passthru: Home Upgrade	13	13	1.00	100.0%	

Gross First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	**Total**	**39**	**25**	**0.64**	**34.3%**	**0.46**
SOCALREN	Climate Zone 08	1	1	0.52	0.0%	0.52
SOCALREN	Climate Zone 09	9	5	0.50	0.0%	0.50
SOCALREN	Climate Zone 14	0	0	0.52	0.0%	0.52
SOCALREN	Passthru: Home Upgrade	15	15	1.00	100.0%	
SOCALREN	**Total**	**26**	**21**	**0.79**	**58.1%**	**0.50**
	Statewide	***1,643***	***1,646***	***1.00***	***91.2%***	***1.02***

Net First Year Savings (MTherms)

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
BAYREN	Climate Zone 02	16	27	1.75	100.0%	0.85	0.85		
BAYREN	Climate Zone 03	11	18	1.58	100.0%	0.85	0.85		
BAYREN	Climate Zone 04	6	11	1.76	100.0%	0.85	0.85		
BAYREN	Climate Zone 12	15	33	2.16	100.0%	0.85	0.85		
BAYREN	Passthru: Home Upgrade	1	1	1.00	100.0%	0.85	0.85		
BAYREN	**Total**	**50**	**91**	**1.82**	**100.0%**	**0.85**	**0.85**		
PGE	Climate Zone 02	0	0	0.00	100.0%	0.85			
PGE	Climate Zone 04	0	0						
PGE	Climate Zone 11	13	4	0.29	100.0%	0.85	0.85		
PGE	Climate Zone 12	12	2	0.21	100.0%	0.85	0.85		
PGE	Climate Zone 13	2	0	0.28	100.0%	0.85	0.85		
PGE	Climate Zone 16	0	0	0.00	100.0%	0.85			
PGE	Passthru: Home Upgrade	760	760	1.00	100.0%	0.85	0.85		
PGE	**Total**	**787**	**767**	**0.97**	**100.0%**	**0.85**	**0.85**		
SCE	Climate Zone 06	2	1	0.77	100.0%	0.85	0.85		
SCE	Climate Zone 08	1	0	0.57	100.0%	0.85	0.85		
SCE	Climate Zone 09	1	1	0.68	100.0%	0.85	0.85		
SCE	Climate Zone 10	7	6	0.88	100.0%	0.85	0.85		
SCE	Climate Zone 14	0	0	1.57	100.0%	0.55	0.55		
SCE	Climate Zone 16	0	0	0.93	100.0%	0.85	0.85		
SCE	Passthru: Home Upgrade	134	134	1.00	100.0%	0.55	0.55		
SCE	**Total**	**145**	**143**	**0.99**	**100.0%**	**0.56**	**0.56**		
SCG	Climate Zone 05	0	0	0.93	100.0%	0.85	0.85		
SCG	Climate Zone 06	1	1	0.91	100.0%	0.85	0.85		
SCG	Climate Zone 08	1	1	0.91	100.0%	0.85	0.85		
SCG	Climate Zone 09	1	1	1.53	100.0%	0.85	0.85		
SCG	Climate Zone 10	3	3	0.90	100.0%	0.85	0.85		
SCG	Climate Zone 13	0	0	0.93	100.0%	0.85	0.85		
SCG	Climate Zone 14	0	0	1.23	100.0%	0.85	0.85		

Net First Year Savings (MTherms)

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
SCG	Climate Zone 15	0	0	0.93	100.0%	0.85	0.85		
SCG	Climate Zone 16	0	0	0.93	100.0%	0.85	0.85		
SCG	Passthru: Home Upgrade	281	281	1.00	100.0%	0.85	0.85		
SCG	**Total**	**288**	**288**	**1.00**	**100.0%**	**0.85**	**0.85**		
SDGE	Climate Zone 06	0	0	0.43	100.0%	0.85	0.85		
SDGE	Climate Zone 07	13	6	0.48	100.0%	0.85	0.85		
SDGE	Climate Zone 08	0	0	0.42	100.0%	0.85	0.85		
SDGE	Climate Zone 09	0	0	0.49	100.0%	0.85	0.85		
SDGE	Climate Zone 10	7	3	0.42	100.0%	0.85	0.85		
SDGE	Climate Zone 14	0	0	0.00	100.0%	0.85			
SDGE	Climate Zone 15	0	0	0.49	100.0%	0.85	0.85		
SDGE	Passthru: Home Upgrade	11	11	1.00	100.0%	0.85	0.85		
SDGE	**Total**	**33**	**21**	**0.64**	**100.0%**	**0.85**	**0.85**		
SOCALREN	Climate Zone 08	1	1	0.52	100.0%	0.85	0.85		
SOCALREN	Climate Zone 09	8	4	0.50	100.0%	0.85	0.85		
SOCALREN	Climate Zone 14	0	0	0.52	100.0%	0.85	0.85		
SOCALREN	Passthru: Home Upgrade	13	13	1.00	100.0%	0.85	0.85		
SOCALREN	**Total**	**22**	**17**	**0.79**	**100.0%**	**0.85**	**0.85**		
	Statewide	***1,324***	***1,326***	***1.00***	***100.0%***	***0.81***	***0.81***		

APPENDIX AB. STANDARDIZED PER UNIT SAVINGS

Per Unit (Quantity) Gross Energy Savings (kWh)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
BAYREN	Climate Zone 02	0	100.0%		18.2	670.7	56.1	36.8
BAYREN	Climate Zone 03	0	100.0%		18.5	1,921.0	157.1	105.9
BAYREN	Climate Zone 04	0	100.0%		17.8	1,439.2	140.4	80.4
BAYREN	Climate Zone 12	0	100.0%		18.0	2,442.6	228.9	135.3
BAYREN	Passthru: Home Upgrade	1	100.0%		18.7	2,623.1	257.4	141.2
PGE	Climate Zone 02	0	83.3%		15.9	-36.7	-2.4	-2.0
PGE	Climate Zone 04	0	0.0%		10.0	0.0	0.0	0.0
PGE	Climate Zone 11	0	99.3%		17.9	1,372.9	131.6	76.4
PGE	Climate Zone 12	0	4.5%		16.0	69.7	6.0	3.9
PGE	Climate Zone 13	0	95.1%		17.7	1,541.8	123.1	87.9
PGE	Climate Zone 16	0	100.0%		18.0	2,205.8	180.5	122.5
PGE	Passthru: Home Upgrade	1	0.0%		16.8	8.3	0.5	0.5
SCE	Climate Zone 06	0	66.7%		17.5	-44.1	-3.4	-2.5
SCE	Climate Zone 08	0	36.8%		18.9	-104.6	-6.8	-5.5
SCE	Climate Zone 09	0	100.0%		17.5	619.5	40.5	35.5
SCE	Climate Zone 10	0	93.3%		17.0	766.9	73.7	45.3
SCE	Climate Zone 14	0	0.0%		14.0	592.2	42.3	42.3
SCE	Climate Zone 16	0	100.0%		18.0	1,752.8	169.8	97.4
SCE	Passthru: Home Upgrade	1	0.0%		14.0	12.9	0.9	0.9
SCG	Climate Zone 05	0	0.0%		16.5	0.0	0.0	0.0
SCG	Climate Zone 06	0	0.0%		16.5	0.0	0.0	0.0
SCG	Climate Zone 08	0	0.0%		16.5	-433.6	-26.3	-26.3
SCG	Climate Zone 09	0	0.0%		16.5	0.0	0.0	0.0
SCG	Climate Zone 10	0	0.0%		16.5	55.6	3.4	3.4
SCG	Climate Zone 13	0	0.0%		16.5	0.0	0.0	0.0
SCG	Climate Zone 14	0	0.0%		16.5	0.0	0.0	0.0
SCG	Climate Zone 15	0	0.0%		16.5	0.0	0.0	0.0
SCG	Climate Zone 16	0	0.0%		16.5	0.0	0.0	0.0
SCG	Passthru: Home Upgrade	1	0.0%		15.0	5,328.5	322.9	322.9
SDGE	Climate Zone 06	0	0.0%		16.4	1,759.3	106.9	106.9

Per Unit (Quantity) Gross Energy Savings (kWh)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
SDGE	Climate Zone 07	0	0.0%		16.4	2,041.2	124.0	124.0
SDGE	Climate Zone 08	0	0.0%		16.4	2,179.9	133.1	133.1
SDGE	Climate Zone 09	0	0.0%		16.5	4,502.9	272.9	272.9
SDGE	Climate Zone 10	0	0.0%		16.4	2,532.2	154.1	154.1
SDGE	Climate Zone 14	0	0.0%		16.5	2,040.4	123.7	123.7
SDGE	Climate Zone 15	0	0.0%		16.0	695.2	43.5	43.5
SDGE	Passthru: Home Upgrade	1	0.0%		2.6	141.6	8.9	8.9
SOCALREN	Climate Zone 08	0	100.0%		16.0	-10,003.8	193.0	-716.7
SOCALREN	Climate Zone 09	0	100.0%		15.7	-6,161.4	237.6	-405.4
SOCALREN	Climate Zone 14	0	100.0%		16.2	2,544.1	279.5	155.6
SOCALREN	Passthru: Home Upgrade	1	100.0%		15.4	417,104.5	55,366.5	23,155.9

Per Unit (Quantity) Gross Energy Savings (Therms)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
BAYREN	Climate Zone 02	0	100.0%		18.2	2,642.4	147.5	145.1
BAYREN	Climate Zone 03	0	100.0%		18.5	2,922.3	176.2	157.2
BAYREN	Climate Zone 04	0	100.0%		17.8	2,549.5	157.2	142.9
BAYREN	Climate Zone 12	0	100.0%		18.0	2,841.0	159.3	156.0
BAYREN	Passthru: Home Upgrade	1	100.0%		18.7	1,412.5	80.5	74.9
PGE	Climate Zone 02	0	83.3%		15.9	0.0	0.0	0.0
PGE	Climate Zone 04	0	0.0%		10.0	0.0	0.0	0.0
PGE	Climate Zone 11	0	99.3%		17.9	241.5	15.5	13.4
PGE	Climate Zone 12	0	4.5%		16.0	6.8	0.4	0.4
PGE	Climate Zone 13	0	95.1%		17.7	185.0	12.3	10.6
PGE	Climate Zone 16	0	100.0%		18.0	0.0	0.0	0.0
PGE	Passthru: Home Upgrade	1	0.0%		16.8	2.1	0.1	0.1
SCE	Climate Zone 06	0	66.7%		17.5	805.8	50.5	45.7
SCE	Climate Zone 08	0	36.8%		18.9	521.7	27.4	27.5
SCE	Climate Zone 09	0	100.0%		17.5	754.7	46.9	42.8
SCE	Climate Zone 10	0	93.3%		17.0	885.8	57.2	51.7
SCE	Climate Zone 14	0	0.0%		14.0	631.0	45.1	45.1
SCE	Climate Zone 16	0	100.0%		18.0	946.2	58.1	52.6
SCE	Passthru: Home Upgrade	1	0.0%		14.0	1.1	0.1	0.1
SCG	Climate Zone 05	0	0.0%		16.5	1,340.1	81.2	81.2
SCG	Climate Zone 06	0	0.0%		16.5	1,208.9	73.3	73.3
SCG	Climate Zone 08	0	0.0%		16.5	756.7	45.9	45.9
SCG	Climate Zone 09	0	0.0%		16.5	1,800.2	109.1	109.1
SCG	Climate Zone 10	0	0.0%		16.5	966.2	58.6	58.6
SCG	Climate Zone 13	0	0.0%		16.5	1,214.1	73.6	73.6
SCG	Climate Zone 14	0	0.0%		16.5	1,035.3	62.7	62.7
SCG	Climate Zone 15	0	0.0%		16.5	482.8	29.3	29.3
SCG	Climate Zone 16	0	0.0%		16.5	728.9	44.2	44.2
SCG	Passthru: Home Upgrade	1	0.0%		15.0	2,112.9	129.4	129.4
SDGE	Climate Zone 06	0	0.0%		16.4	462.7	28.2	28.2

Per Unit (Quantity) Gross Energy Savings (Therms)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
SDGE	Climate Zone 07	0	0.0%		16.4	609.7	37.1	37.1
SDGE	Climate Zone 08	0	0.0%		16.4	438.4	26.7	26.7
SDGE	Climate Zone 09	0	0.0%		16.5	776.1	47.0	47.0
SDGE	Climate Zone 10	0	0.0%		16.4	463.5	28.2	28.2
SDGE	Climate Zone 14	0	0.0%		16.5	0.0	0.0	0.0
SDGE	Climate Zone 15	0	0.0%		16.0	324.6	20.3	20.3
SDGE	Passthru: Home Upgrade	1	0.0%		2.6	21.1	1.4	1.4
SOCALREN	Climate Zone 08	0	100.0%		16.0	-2,734.9	52.2	-199.7
SOCALREN	Climate Zone 09	0	100.0%		15.7	-1,782.7	47.3	-117.0
SOCALREN	Climate Zone 14	0	100.0%		16.2	317.4	24.3	19.7
SOCALREN	Passthru: Home Upgrade	1	100.0%		15.4	-3,065.3	2,152.7	-166.6

Per Unit (Quantity) Net Energy Savings (kWh)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
BAYREN	Climate Zone 02	1	100.0%		18.2	570.1	47.7	31.3
BAYREN	Climate Zone 03	1	100.0%		18.5	1,632.9	133.5	90.0
BAYREN	Climate Zone 04	1	100.0%		17.8	1,223.3	119.3	68.4
BAYREN	Climate Zone 12	1	100.0%		18.0	2,076.2	194.5	115.0
BAYREN	Passthru: Home Upgrade	1	100.0%		18.7	2,229.6	218.8	120.0
PGE	Climate Zone 02	1	83.3%		15.9	-31.2	-2.0	-1.7
PGE	Climate Zone 04	1	0.0%		10.0	0.0	0.0	0.0
PGE	Climate Zone 11	1	99.3%		17.9	1,166.8	111.9	64.9
PGE	Climate Zone 12	1	4.5%		16.0	59.2	5.1	3.3
PGE	Climate Zone 13	1	95.1%		17.7	1,306.5	104.3	74.4
PGE	Climate Zone 16	1	100.0%		18.0	1,874.9	153.4	104.2
PGE	Passthru: Home Upgrade	1	0.0%		16.8	7.1	0.4	0.4
SCE	Climate Zone 06	1	66.7%		17.5	-37.5	-2.9	-2.1
SCE	Climate Zone 08	1	36.8%		18.9	-88.9	-5.8	-4.7
SCE	Climate Zone 09	1	100.0%		17.5	526.6	34.5	30.1
SCE	Climate Zone 10	1	93.3%		17.0	650.0	62.5	38.4
SCE	Climate Zone 14	1	0.0%		14.0	325.7	23.3	23.3
SCE	Climate Zone 16	1	100.0%		18.0	1,489.9	144.3	82.8
SCE	Passthru: Home Upgrade	1	0.0%		14.0	7.1	0.5	0.5
SCG	Climate Zone 05	1	0.0%		16.5	0.0	0.0	0.0
SCG	Climate Zone 06	1	0.0%		16.5	0.0	0.0	0.0
SCG	Climate Zone 08	1	0.0%		16.5	-368.5	-22.3	-22.3
SCG	Climate Zone 09	1	0.0%		16.5	0.0	0.0	0.0
SCG	Climate Zone 10	1	0.0%		16.5	47.3	2.9	2.9
SCG	Climate Zone 13	1	0.0%		16.5	0.0	0.0	0.0
SCG	Climate Zone 14	1	0.0%		16.5	0.0	0.0	0.0
SCG	Climate Zone 15	1	0.0%		16.5	0.0	0.0	0.0
SCG	Climate Zone 16	1	0.0%		16.5	0.0	0.0	0.0
SCG	Passthru: Home Upgrade	1	0.0%		15.0	4,529.3	274.5	274.5
SDGE	Climate Zone 06	1	0.0%		16.4	1,495.4	90.8	90.8

Per Unit (Quantity) Net Energy Savings (kWh)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
SDGE	Climate Zone 07	1	0.0%		16.4	1,735.0	105.4	105.4
SDGE	Climate Zone 08	1	0.0%		16.4	1,852.9	113.1	113.1
SDGE	Climate Zone 09	1	0.0%		16.5	3,827.5	232.0	232.0
SDGE	Climate Zone 10	1	0.0%		16.4	2,152.4	131.0	131.0
SDGE	Climate Zone 14	1	0.0%		16.5	1,734.4	105.1	105.1
SDGE	Climate Zone 15	1	0.0%		16.0	590.9	36.9	36.9
SDGE	Passthru: Home Upgrade	1	0.0%		2.6	120.3	7.6	7.6
SOCALREN	Climate Zone 08	1	100.0%		16.0	-8,503.2	164.1	-609.2
SOCALREN	Climate Zone 09	1	100.0%		15.7	-5,237.2	202.0	-344.6
SOCALREN	Climate Zone 14	1	100.0%		16.2	2,162.5	237.6	132.2
SOCALREN	Passthru: Home Upgrade	1	100.0%		15.4	354,538.8	47,061.5	19,682.5

Per Unit (Quantity) Net Energy Savings (Therms)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
BAYREN	Climate Zone 02	1	100.0%		18.2	2,246.0	125.4	123.3
BAYREN	Climate Zone 03	1	100.0%		18.5	2,484.0	149.7	133.6
BAYREN	Climate Zone 04	1	100.0%		17.8	2,167.1	133.6	121.4
BAYREN	Climate Zone 12	1	100.0%		18.0	2,414.8	135.4	132.6
BAYREN	Passthru: Home Upgrade	1	100.0%		18.7	1,200.6	68.4	63.7
PGE	Climate Zone 02	1	83.3%		15.9	0.0	0.0	0.0
PGE	Climate Zone 04	1	0.0%		10.0	0.0	0.0	0.0
PGE	Climate Zone 11	1	99.3%		17.9	205.2	13.2	11.4
PGE	Climate Zone 12	1	4.5%		16.0	5.8	0.4	0.3
PGE	Climate Zone 13	1	95.1%		17.7	156.6	10.4	9.0
PGE	Climate Zone 16	1	100.0%		18.0	0.0	0.0	0.0
PGE	Passthru: Home Upgrade	1	0.0%		16.8	1.7	0.1	0.1
SCE	Climate Zone 06	1	66.7%		17.5	684.9	42.9	38.9
SCE	Climate Zone 08	1	36.8%		18.9	443.5	23.3	23.4
SCE	Climate Zone 09	1	100.0%		17.5	641.5	39.8	36.4
SCE	Climate Zone 10	1	93.3%		17.0	750.7	48.5	43.8
SCE	Climate Zone 14	1	0.0%		14.0	347.1	24.8	24.8
SCE	Climate Zone 16	1	100.0%		18.0	804.3	49.4	44.7
SCE	Passthru: Home Upgrade	1	0.0%		14.0	0.6	0.0	0.0
SCG	Climate Zone 05	1	0.0%		16.5	1,139.1	69.0	69.0
SCG	Climate Zone 06	1	0.0%		16.5	1,027.6	62.3	62.3
SCG	Climate Zone 08	1	0.0%		16.5	643.2	39.0	39.0
SCG	Climate Zone 09	1	0.0%		16.5	1,530.1	92.7	92.7
SCG	Climate Zone 10	1	0.0%		16.5	821.2	49.8	49.8
SCG	Climate Zone 13	1	0.0%		16.5	1,032.0	62.5	62.5
SCG	Climate Zone 14	1	0.0%		16.5	880.0	53.3	53.3
SCG	Climate Zone 15	1	0.0%		16.5	410.4	24.9	24.9
SCG	Climate Zone 16	1	0.0%		16.5	619.6	37.6	37.6
SCG	Passthru: Home Upgrade	1	0.0%		15.0	1,796.0	110.0	110.0
SDGE	Climate Zone 06	1	0.0%		16.4	393.3	24.0	24.0

Per Unit (Quantity) Net Energy Savings (Therms)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
SDGE	Climate Zone 07	1	0.0%		16.4	518.3	31.6	31.6
SDGE	Climate Zone 08	1	0.0%		16.4	372.6	22.7	22.7
SDGE	Climate Zone 09	1	0.0%		16.5	659.7	40.0	40.0
SDGE	Climate Zone 10	1	0.0%		16.4	394.0	24.0	24.0
SDGE	Climate Zone 14	1	0.0%		16.5	0.0	0.0	0.0
SDGE	Climate Zone 15	1	0.0%		16.0	275.9	17.2	17.2
SDGE	Passthru: Home Upgrade	1	0.0%		2.6	17.9	1.2	1.2
SOCALREN	Climate Zone 08	1	100.0%		16.0	-2,324.6	44.3	-169.7
SOCALREN	Climate Zone 09	1	100.0%		15.7	-1,515.3	40.2	-99.4
SOCALREN	Climate Zone 14	1	100.0%		16.2	269.8	20.7	16.7
SOCALREN	Passthru: Home Upgrade	1	100.0%		15.4	-2,605.5	1,829.8	-141.6

APPENDIX AC. Recommendations

Study ID	Study Type	Study Title	Study Manager
CPU0118.01	Impact Evaluation	Focused Impact Evaluation of the 2013-2014 Home Upgrade Program	CPUC

Recommendation	Program or Database	Summary of Findings	Additional Supporting Information	Best Practice / Recommendations	Recommendation Recipient	Affected Workpaper or DEER
1	Home Upgrade	Statewide we found annual electric energy savings, averaging 3.1%. Two climate zones showed annual household savings of 5% or more. In descending order from greatest to least savings, these climate zones were 16 and 11.	Details in Appendix B	These evaluation results suggest the 2013-14 Home Upgrade Program is more effective at saving gas and reducing demand than saving electric energy. It may be worth reviewing the current program to redefine the savings goals. Any changes to the savings targets will affect future, and redefining program design and delivery to achieve greater savings.	All PAs	PGECOALL108, SCE13MI005 WPSDGEREMI0005 SCR15MI001 EUCA calculator
2	Home Upgrade	Statewide we found annual gas savings, averaging 29.3%. Three climate zones showed annual household savings of 30% or more. In descending order from greatest to least savings, these climate zones were 3, 4, and 9. These are climate zones with more than 2,500 Heating Degree Days	Details in Appendix B	When higher electric energy savings and demand reductions, concentrate on are program goals, the Program Administrators should concentrate on the inland climate zones. The program seems to be more effective at producing electric energy savings in climate zones and areas with wider temperature ranges. One approach might be to concentrate on climate zones with higher and a nearly equal number of Heating and Cooling Degree Days. For example, climate zones in the central portion of the state (4, 11, 12, and 13) have more defined seasons with hotter temperatures in the summer and cooler temperatures in the winter.	CPUC, All PAs	NA

3, 4, 5	Home Upgrade	Statewide we estimated a reduction in demand of 7.4% between 3pm and 5pm during the hottest days of the year (August and September), except for two PAs	Details in Appendix A	Conduct additional research on customer decision making and behavior relative to the Home Upgrade Program. In addition, considerboth program paths using a larger sample to refine savings estimates. Include analyzing the differences in the measures that are implemented by each PAs territory. Depending on the primary savings goal for the program (demand reduction or therm savings). For example, including measures focusing on kW or therms could earn customers higher rebates than the current design of increasing the number of shell measures offered through the programIn addition, we suggest surveys and interviews with participating homeowners to find out drivers for big reductions, increases, and little change to energy usage. This will included a comparison of savings and costs for Home Upgrade and Advanced Home Upgrade.	All PAs	PGECOALL108, SCE13MI005 WPSDGEREMI0005 SCR15MI001 EUCA calculator
4	Home Upgrade	Savings vary considerably by PA, for kW and therms. For example, statewide average demand (kW) reduction was 7.4%. The changes however ranged from an average reduction of 17.8% (PG&E) to an average kW increase of 8.1% (BayREN). This difference may reflect the fact that PG&E projects were in predominantly hotter climate zones while BayREN projects were predominantly in cooler climate zones.	Details in Appendix A, B	See recommendation 3	CPUC, All PAs	NA

5	Home Upgrade	For therms, the statewide average savings was 29.3%. This range spanned from 30.7% (BayREN) to 7.8% (SoCalREN).		See recommendation 3	CPUC, All PAs	NA
6	Home Upgrade	Sample sizes are very small in the Southern part of the state (particularly for gas). These results are as accurate as they can be given the quality and quantity of data.		For Southern California, the results should not be considered statistically representative of the program population. Given the design and demographics of the program however, there is no evidence to suggest they are not an accurate estimate of all program participants.	CPUC, All PAs	
7	Home Upgrade	Tracking data sets were not complete and changed during the analysis period. For example, • the Home Upgrade and Advanced home Upgrade projects were not clearly labeled or flagged among all project administrators • For some projects, multiple records separated each measure. Unfortunately, the total savings for the entire project was associated with each record. Simply adding all measure savings together resulted in savings that were greater than the total usage for the home. • the reported duration of most Home Upgrade projects (66%) was cataloged as only 1 day. These projects were set to a 30-day blackout period. • account numbers were reported for only one fuel type only and matching accounts via premise ID was not consistent across program administrators • In addition the deemed savings reported in the tracking data had some anomalies. Specifically, the average reported kW savings was 0.64. Considering a typical residential household draws an approximate maximum 2.0kW at peak, this implies savings of 32%.	2013-2104 Tracking data	The quality of tracking data needs to be improved prior to an evaluation to ensure that all PAs are recording data that is understandable and useable. • Energy Division ex-ante tracking data should be coded consistently across all PAs • The CPUC and IOUs should identify a mechanism to check data prior to the start of an evaluation, to ensure it has been properly coded • Tracking data should be checked thoroughly by PAs prior to submission. Specifically, - Home Upgrade and Advanced Home Upgrade projects should be clearly differentiated - Projects that receive financing should be clearly differentiated - Projects from other programs should be coded differently, so that if they are included in the data, they can immediately be identified and removed, such as multi-	CPUC, All PAs	Tracking data

				family and energy savings assistance program projects - Projects should include well-defined and verified project start and end dates - Tracking data should identify and verify valid electric and gas account numbers when possible - Where account numbers are not available, due to service territory overlap for example, service provider should be identified for each fuel type - Data should be checked for accuracy with project files and reasonableness in terms of magnitude		
7	Home Upgrade	Applies to finding 6	Current and future tracking data	We suggest replicating this billing analysis again when all of the 2015 tracking data and a full year of 2016 billing data become available. A billing analysis of Home Upgrade could be included in the next impact evaluation of the Advanced Home Upgrade program.	CPUC, All PAs	Tracking data

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