2013 SCE Home Energy Reports Program

Review and Validation of Impact Evaluation

ED Res 3.2

California Public Utility Commission, Energy Division
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1 INTRODUCTION

This report provides the results of an ex post validation of Southern California Edison's (SCE) 2013 Home Energy Reports (HER) program energy savings estimates produced by Applied Energy Group (AEG). DNV GL conducted this review on behalf of the California Public Utilities Commission (CPUC). It includes a detailed technical assessment of the final program savings estimates and peak demand savings estimates.

This is DNV GL's first year as the independent evaluator of the SCE HER program. As such, DNV GL has access to a full set of SCE's billing data and program tracking data, which allowed evaluators to produce fully independent savings estimates to compare with AEG's. DNV GL also had access to SCE's peak demand data from advanced metering infrastructure (AMI), which allowed evaluators to replicate AEG's peak demand analysis and validate demand savings estimates for 2013. This ex post validation goes well beyond simply vetting the approach used by AEG. By replicating the analysis, our evaluation provides a more robust validation of the estimated savings that are occurring under the program.

2 BACKGROUND

The HER program provides randomly selected residential customers with bimonthly home energy reports that compare customer's energy use to that of similar neighbors. The program started in December 2012 and continued through December 2013.

The HER program was structured as a randomized controlled trial (RCT) wherein the initial eligible population was randomly assigned to the treatment and control groups. The pilot program initially included 150,000 residential customers with relatively high electricity consumption in San Gabriel/Rancho Cucamonga. The program population was equally assigned to the treatment and control groups but there was an issue with mismatched addresses in the billing system that caused participants to never receive the home energy report. This issue of mismatched addresses is present in both treatment and control groups and affects 12% of the overall HER population.

Table 1 presents the number of sites in each the treatment and control groups.

Table 1. HER Experimental Waves and Launch Dates

HER sample	No. of accounts in control group	No. of accounts in treatment group	Total
Full sample	75,000	75,000	150,000
No. of sites with mismatched addresses	9,090	9,179	18,269
No. of sites without mismatched addresses	65,910	65,821	131,731

3 FINDINGS

DNV GL reviewed four main components that resulted in final program savings and demand savings estimates for 2013. These components are:

- Reduction in consumption estimates
- Downstream/tracked rebate-program joint savings estimates
- Upstream/untracked rebate-program joint savings estimates
- Peak demand analysis

DNV GL reviewed AEG's methods stated in its evaluation report[1] (SCE's report, hereafter) and in SAS codes submitted by AEG. DNV GL also produced a set of comparison results for validating consumption reduction estimation and peak demand analysis using DNV GL methods and data SCE provided to the CPUC.

Determining reduction in consumption estimates the total effect of a program on consumption and provides the primary estimate of program-related savings. Joint savings estimates for upstream and downstream energy efficiency program savings identifies the portion of savings that are possibly shared with other programs.

3.1 Consumption Reduction

DNV GL independently estimated reductions in first year consumption for the HER program. The objective was not necessarily to produce identical results but to verify whether AEG's results are consistent with independently produced results.

DNV GL's independent model to estimate program savings is consistent with the best practices as delineated in State and Local Energy Efficiency Action Network's report (SEE Action, hereafter)[2]. In particular, DNV GL followed the recommended fixed-effects regression model specification and clustered standard errors to allow for arbitrary correlations within each customer. AEG's approach included testing different program- and non-program-related variables for statistical significance and included only statistically significant coefficients in the final model. AEG diverged from the SEE Action report by incorporating cooling degree days (CDD) during the treatment period in their regression model and not using clustered standard errors. Section 5.4 of the Appendix presents the difference in AEG's and DNV GL's model specifications.

The SEE Action report also recommends that households that close their accounts should be dropped from the evaluation. A more standard practice of addressing residential move-outs is to include households up to the point of closing their accounts. AEG allows both treatment and control group households to be included in the regression model until residents close their accounts. This approach provides monthly savings estimates that are representative of the active

[1] *SCE's Home Energy Report Program Savings Assessment: Ex-post Evaluation Results, Program Year 2013.* Applied Energy Group, September 3, 2014.

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

treatment households in each month. When aggregating to program level savings, the monthly savings per household are multiplied by the number of active accounts in each month. DNV GL supports AEG's approach as it captures valid partial savings in households that move out prior to the end of the evaluation period.

According to SCE, there was an issue with mismatched addresses in SCE billing system that caused some customers in the treatment group to not receive the report. The issue of mismatched addresses affected both the treatment and control group at the same rate and was not program-related. AEG's results showed that the removal of customers with mismatched addresses did not result in statistically significant differences in average consumption during the pre-report period. DNV GL's validation confirmed AEG's test of differences and details on DNV GL's results are provided in Section 5.1 of the Appendix.

AEG's final estimates are based on the sample without mismatched addresses. AEG calculated overall program savings by aggregating monthly savings estimates using monthly treatment counts for the HER sample without mismatched addresses. DNV GL's final estimates are based on the HER sample with mismatched addresses. DNV GL found that the removal of mismatched addresses have small and positive effect on program savings. Inclusion of the customers with mismatched addresses in the treatment and control groups retains the experimental design of the HER program and avoids any potential bias in estimation of program impact. To protect the experimental design of the HER program, DNV GL recommends basing the HER final estimate on the full sample.

Table **2** presents a comparison of DNV GL's and AEG's calculation of the aggregate electric savings for HER program year 2013.

Table 2. Aggregate Electric (kWh) Savings

HER sample	AEG	DNV GL	% DNV / AEG[2]
Mismatches included	Not available[1]	8,795,195	97.0%
Mismatches removed	9,070,952	9,014,457	99.4%

[1] SCE's report did not provide aggregated savings based on HER sample with mismatched addresses included
[2] Based on AEG's estimate for HER population with mismatched addresses removed

DNV GL used AEG's reported monthly counts of active treatment accounts when expanding household-level savings to program-level savings, making this a comparison of the underlying regression model results. As noted above, the issue of mismatched addresses affects 12% of the overall HER population. The monthly counts used for the HER sample without mismatched addresses are lower than that of the HER sample with mismatched addresses. Section 5.2 of the Appendix provides the monthly counts with and without mismatched addresses.

Lastly, DNV GL recommends following the model specification and using clustered standard errors as recommended in the SEE Action report.

3.2 Joint Savings Estimation

3.2.1 Downstream Rebate Programs

DNV GL reviewed AEG's codes and data used in estimating electric joint savings from downstream programs. AEG's approach included prorating kWh savings for each customer who received a rebate by multiplying the tracked kWh savings with the number of days in 2013 after installation. This weighting process reduces the probability of assigning savings when they could not realistically occur.

A more precise calculation of joint savings should consider not only the timing of installation but also end-use load profiles of the rebated measures. DNV GL's recommended approach includes:

1) Developing streams of savings for measures installed after the program for each customer in each experimental wave.

2) Daily savings are then calculated; starting from the installation date; projecting forward on a load shape-weighted basis; and continuing for the life of the measure.

3) Treatment and control savings are aggregated up to the month.

The difference between treatment and control savings represents the estimate of joint savings. This approach estimates joints savings as accurately as possible, both with respect to magnitude and timing. This means, for example, that air conditioner improvements completed late in the cooling season will provide most of their first year savings in the following cooling season.

DNV GL applied the recommended approach described above to CPUC tracking data. The evaluators provide joint savings analysis for customers with and without the issue of mismatched addresses. Table 3 presents a comparison of joint savings estimates from downstream rebate programs. DNV GL estimates are slightly lower (2%) than AEG's joint savings estimates. Consistent with consumption analysis, AEG removed sites with mismatched addresses in joint savings analysis. DNV GL recommends using SCE's estimate for joint savings analysis since joint savings are only a small portion of the energy savings. However, DNV GL recommends the inclusion of all sites in joint savings analysis going forward.

Table 3. Comparison of Joint Savings Estimates from Downstream Program

Downstream Savings	AEG (kWh)	DNV GL (kWh)	% DNV GL / AEG
Mismatches removed	87,319	85,171	98%
Mismatches included	not available	82,623	95%

[1] Based on AEG's estimate for HER population with mismatched addresses removed

Section 5.5 provides more details on joint savings analysis at the measure group level.

3.2.2 Upstream Rebate Programs

DNV GL reviewed the methodology employed for estimating the upstream joint savings estimates, but did not review the data for this aspect of the evaluation. AEG used the assumptions based on the Upstream Lighting Program (ULP)[3] and Compact Fluorescent Lamps (CFL) Market Effects[4] reports. SCE used the following assumptions for 2013 joint savings calculation for upstream programs:

- Excess installed CFL per HER recipient = 0.95
- Customer-years CFLs have been installed = 31,684.5 (average monthly HER participants × 0.5)

- Ratio of total rebated CFLs to total CFL's sold for California = 0.74
- Net to gross ratio for SCE = 0.64
  ➔ All excess CFLs assumed to be attributable to the ULP = 0.4736 (or 0.74 x 0.64)

- ULP CFL hours of use for SCE = 1.9 hours per day
- Annual savings from CFL installation = 44.8 watts
  ➔ 1.9 x 365 x 44.8 / 1000 = 31.0688 kWh per year per excess CFL

AEG assumed CFLs were uniformly installed throughout the year and 1/365 of the customers installed CFLs each day after the treatment group began receiving the report. The total kWh savings attributed to both ULP and HER programs are 442,901 kWh (calculated as 31,684.5 x 0.95 x 0.4736 x 31.0688). The ULP report's estimate for the increased upstream CFL uptake for the HER treatment group is based on the group that received the reports and is not statistically significant. DNV GL supports using HER sample without mismatched addresses in the assumption AEG used for the number of customer-years CFLs have been installed. DNV GL recommends using SCE's estimate for upstream savings.

[3] *Final Evaluation Report: Upstream Lighting Program, Volume 1*. KEMA, 2010.
[4] *Compact Fluorescent Lamps Market Effects Final Report*. The Cadmus Group, Inc.: Energy Services Group (formerly Quantec, LLC), KEMA, Itron, Inc., 2010.

3.3 2013 Per Household Savings

Baseline consumption and per household savings are based on DNV GL's analysis while joint savings analysis are based on AEG's analysis.

Table 4 summarizes per household unadjusted and adjusted electric savings for 2013 SCE HER program based on DNV GL recommendation. Baseline consumption and per household savings are based on DNV GL's analysis while joint savings analysis are based on AEG's analysis.

Table 4. 2013 Per Household Electric Savings (kWh)

HER Sample	Baseline Consumption[3]	Per Household Savings (Unadjusted)	Per Household Savings (Adjusted)	% Savings	
				Unadjusted	Adjusted
Mismatches included[1]	10,391	123	108	1.2%	1.0%
Mismatched included[2]		140	125	1.3%	1.2%
Mismatches removed	10,272	143	127	1.4%	1.2%

[1] DNV GL scaled per household savings estimates from full HER population to reflect per household savings of the treatment group without mismatched addresses (88%). DNV GL's scaled per household kWh savings is calculated as 123 kWh / 0.88 = 140 kWh

[2] Baseline consumption is based on control group usage in 2013

3.4 Peak Demand Analysis

DNV GL reviewed AEG's approach for estimating peak demand savings. AEG conducted two approaches in estimating peak demand savings. The first approach applied residential class load factor to the estimated kWh savings. The second approach used interval data of the control and treatment group during the 3-day heat wave in 2013. The final peak demand savings are based on the second approach.

AEG identified the peak periods that represent the climate zones of the HER participants. AEG identified September 4 to September 6, 2013 as the three hottest, consecutive weekdays and the final 2013 demand savings are based on this period. DNV GL verified the heat wave period using actual 2012 weather data and DEER criteria for the three day demand periods.

DNV GL reviewed and replicated AEG's peak demand analysis, which is new in the context of the HER program. AEG's peak demand analysis only accounts for the post differences in kW between the treatment and control groups. This approach of estimating peak demand savings assumes that there are no pre-existing differences in consumption between the treatment and control groups.

Using interval data, AEG conducted a test of differences in average daily consumption per month between the treatment and control group. AEG's test suggests that there are no significant differences in consumption between the treatment and control group during the pre-treatment period (Table 5). DNV GL also found that the difference in consumption between treatment and control is not statistically significant. DNV GL's validated the tests of differences only for June to September 2013 and results are presented in Table 6.

Table 5. AEG's Test of Differences in Consumption

Month	AEG (mismatches removed)			
	Treatment kWh	Control kWh	t-statistics	p-value
Jan-12	25.66	25.62	-0.67	0.5019
Feb-12	25.05	25.04	-0.22	0.8297
Mar-12	24.27	24.23	-0.6	0.5498
Apr-12	24.15	24.11	-0.6	0.548
May-12	25.89	25.83	-0.91	0.3615
Jun-12	28.94	28.88	-0.61	0.5411
Jul-12	35.63	35.6	-0.25	0.8002
Aug-12	47.08	47.05	-0.25	0.7994
Sep-12	41.76	41.65	-0.97	0.3297
Oct-12	27.36	27.29	-0.95	0.3401
Nov-12	24.79	24.74	-0.66	0.509
Dec-12	26.14	26.12	-0.39	0.6961

Table 6. DNV GL's Test of Differences in Consumption

Month	DNV GL (mismatches removed)				DNV GL (mismatches included)			
	Treatment kWh	Control kWh	t-statistics	p-value	Treatment kWh	Control kWh	t-statistics	p-value
Jun-12	28.52	28.47	-0.53	0.5976	28.96	28.92	-0.59	0.5527
Jul-12	35.12	35.10	-0.19	0.8494	35.67	35.65	-0.24	0.8101
Aug-12	46.51	46.48	-0.24	0.8086	47.18	47.15	-0.23	0.8188
Sep-12	41.31	41.20	-0.89	0.3748	41.82	41.71	-0.95	0.3396

Pre-treatment consumption is balanced between the treatment and control groups because of the random assignment of participants to these groups. However, the test of balance on average consumption does not necessarily mean that peak load is also balanced between the treatment and control groups during the pre-period. A difference-in-differences approach will account for pre-existing imbalances in demand. DNV GL recommends testing peak load differences instead of monthly consumption differences during the pre-treatment period when using post-only differences going forward.

Using DEER criteria for the three-day demand period, DNV GL identified August 8 to August 10, 2012 as the three-day demand period in 2012. DNV GL tested for pre-existing differences in peak load consumption between the treatment and control to validate AEG's peak demand results. DNV GL confirms that the difference in peak load consumption is not statistically significant (Table 7)

Table 7. DNV GL's Test of Differences in Peak Load in 2012

Group	Mean kW (Aug 8-10, 2012) – mismatches included
Control	3.533
Treatment	3.535
Difference (Control-Treatment)	-0.002[ns]

DNV GL's peak demand savings are also based on the three-day heat wave period, September 4 to September 6, 2013, that AEG identified. The evaluators conducted post-only differences to validate AEG's peak demand results. Because the program has an RCT design, issues that exist in the data are shared more or less equally by the treatment and control group. Given that the incidence of issues is small across the treatment and control groups, the evaluators do not expect the data issue to have substantial effect on the estimates. In contrast, AEG applied some exclusion criteria on the AMI data and removed around 1% of the records due to missing, zero, negative and outliers.

Table 8 compares peak demand savings based on AEG's and DNV GL's analyses. AEG's peak demand savings are 0.046 kW and final aggregate demand reduction due to HER is 2,876 kW. The final aggregate peak savings are calculated by multiplying peak savings estimate with 62,657, the number of active customers in the treatment group in September 2013. Also, AEG's peak demand analysis is based on the HER sample without mismatched addresses while DNV GL's final demand savings included accounts with mismatched addresses.

Table 8. Comparison of Peak Demand Savings

Group	AEG (kW) Mismatches removed	DNV GL (kW)	
		Mismatches removed	Mismatches included
Control - Average kW per household	3.513	3.537	3.563
Treatment - Average kW per household	3.467	3.495	3.525
Peak demand savings Per Household (Control-Treatment)	0.0459	0.042	0.043[1]
Program-level demand savings	2,876	2,613	2,694

[1] Scaled by the percentage of households in the treatment group without mismatched address (88%). DNV GL's adjusted per household kW savings is calculated as (3.563 - 3.525)/0.88.

DNV GL's final per household kW savings are based on the full HER sample. In particular, DNV GL's final kW savings considered all active households in the treatment group regardless of the issue of mismatched addresses. On the other hand, AEG's analysis only included households that actually received the report (without mismatched addresses) in the treatment group. It is necessary to adjust the demand savings estimates using the percentage of households in the treatment group that actually received the report in order to compare per household savings between with and without mismatched addresses. DNV GL applied an adjustment to the final peak demand savings per household by dividing the difference in average kW per household between the control and treatment group by 88%.

Both DNV GL's and AEG's results suggest that HER program reduces peak consumption. DNV GL's peak demand savings are 0.003 kW lower than that of AEG. DNV GL recommends inclusion

of all sites and recommends using the demand savings based on the full HER sample as the final estimate.

AEG adjusted peak demand savings estimate to account for potentially double counted savings between HER and SCE rebate programs. AEG estimates 28.55 kW and 38.38 kW HER demand savings that can also be attributed to downstream and upstream rebate programs, respectively.

For downstream joint savings, AEG calculated savings by getting the difference in kW savings between the treatment and control group. Only measures installed by September 4, 2013, the first day of the peak period, were included in AEG's calculation. For upstream joint savings calculation, AEG used a similar approach as reported in Section 3.2.2 but using SCE-specific assumptions for peak periods. In particular, AEG applied a diversity factor of 0.0449 to reflect per CFL kW savings at the peak. Also, AEG only accounted for customers active as of September 2013 in joint savings calculation. Consistent with joint savings recommendations for energy savings, DNV GL recommends using SCE's joint savings adjustments for demand savings.

4 RECOMMENDATIONS

Overall, DNV GL evaluators recommend that energy and demand savings be based on all participants in the control and treatment groups of the HER program. Evaluation based on the full HER population preserves the integrity of the program's experimental design and therefore ensures unbiased savings estimates. SCE report did not provide kW and kWh savings estimates based on the full population. DNV GL recommends own kW and kWh savings estimates based on the full HER population.

Specifically, DNV GL recommends the following savings estimates for 2013 SCE HER program:

- Energy savings = 8,795,195 kWh
    - Joint savings for downstream programs = 87,319 kWh
    - Joint savings for upstream programs = 442,901 kWh
    - Energy Savings (with joint savings adjustments): = 8,264,975 kWh
- Demand savings = 2,694 kW
    - Joint savings for downstream programs = 28.55 kW
    - Joint savings for upstream programs = 38.38 kW
    - Demand Savings (with joint savings adjustments): = 2,627 kW

5 APPENDIX

5.1 Sample Validation

Table 9 presents a comparison of tests of differences in average consumption between the treatment and control groups. Similar to AEG's findings, DNV GL found that the difference in average daily consumption between the two groups is not statistically significant for the sample that includes mismatched addresses and the sample without mismatched addresses.

Table 9.Test of Differences between Treatment and Control Groups

Group	AEG		DNV GL	
	Average Daily Electricity Usage (kWh/day)		Average Daily Electricity Usage (kWh/day)	
	Mean	Difference = (T-C)	Mean	Difference = (T-C)
Mismatches included				
Control	29.90	0.05 ns	29.89	0.06 ns
Treatment	29.96		29.95	
Mismatches removed				
Control	29.53	0.04 ns	29.52	0.05 ns
Treatment	29.57		29.57	

ns means that the difference in consumption is not statistically significant at 95% confidence interval

A better approach would be to validate the sample for each month in the pre-period using the billing data. Performing the test at the monthly level will give information whether consumption is balanced between control and treatment for each pre-treatment month and also will provide insights on the potential effect of customer attrition on sample's randomization.

5.2 Customer Attrition

Population counts are used to expand estimated savings per household to the aggregate savings at the program level. The population counts are a key component of the final savings estimates because of the size of the program. The process is complicated by ongoing attrition in both the treatment and control groups.

Table 10 and Table 11 presents the number of active accounts in the treatment and control group as reported by AEG and validated by DNV GL. DNV GL population counts approximately recreate the counts reported by AEG. Exact counts depend on details such as how move-out date is assigned and data quality criteria for inclusion in the regression. Evaluators did not attempt to recreate the exact average population AEG used to produce the savings estimates. DNV GL used SCE billing data to establish a move-out date. Overall, DNV GL control and treatment counts are similar to the counts reported by AEG.

Table 10. Customer Attrition for SCE HER (without mismatched addresses)

Month	AEG		DNV GL		% DNV / AEG	
	Control	Treatment	Control	Treatment	Control	Treatment
Jan-13	64,939	64,893	65,194	65,821	100%	101%
Feb-13	64,645	64,556	64,938	65,567	100%	102%
Mar-13	64,436	64,315	64,735	65,319	100%	102%
Apr-13	64,187	64,053	64,496	65,026	100%	102%
May-13	63,902	63,787	64,204	64,739	100%	101%
Jun-13	63,599	63,493	63,904	64,461	100%	102%
Jul-13	63,270	63,189	63,622	64,192	101%	102%
Aug-13	62,972	62,918	63,274	63,869	100%	102%
Sep-13	62,704	62,659	62,961	63,571	100%	101%
Oct-13	62,481	62,421	62,720	63,311	100%	101%
Nov-13	62,253	62,186	62,478	63,085	100%	101%
Dec-13	62,051	61,976	62,278	62,891	100%	101%

Table 11. Customer Attrition for SCE HER (with mismatched addresses)

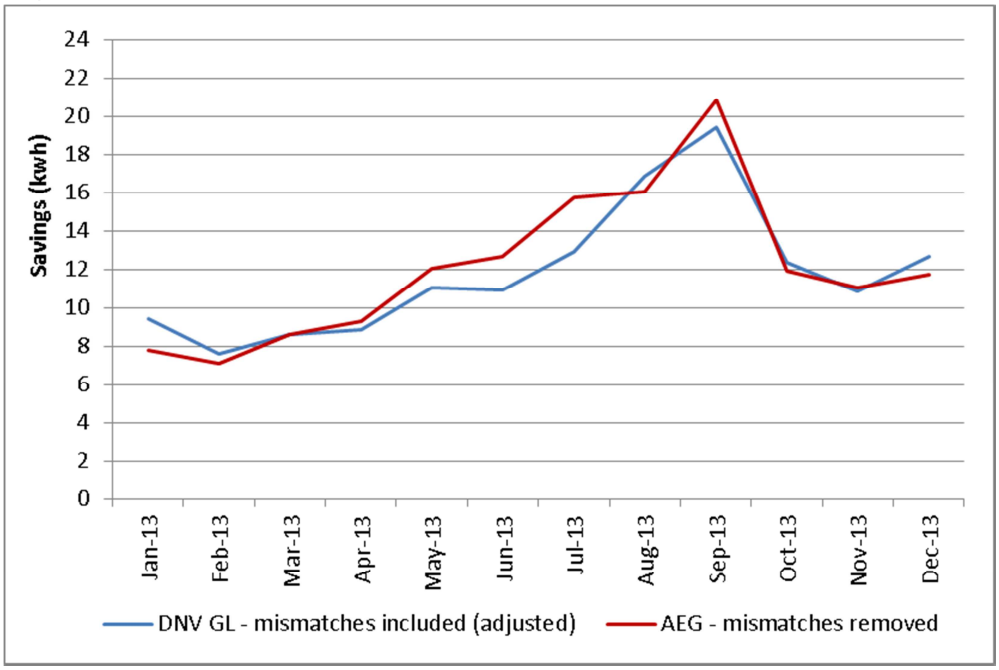
Month	AEG		DNV GL		% DNV / AEG	
	Control[1]	Treatment	Control	Treatment	Control	Treatment
Jan-13	NA	73,569	73,922	73,962	NA	101%
Feb-13	NA	73,101	73,515	73,586	NA	101%
Mar-13	NA	72,734	73,206	73,218	NA	101%
Apr-13	NA	72,335	72,851	72,796	NA	101%
May-13	NA	71,921	72,423	72,356	NA	101%
Jun-13	NA	71,448	71,990	71,935	NA	101%
Jul-13	NA	70,970	71,588	71,522	NA	101%
Aug-13	NA	70,523	71,054	70,991	NA	101%
Sep-13	NA	70,133	70,572	70,505	NA	101%
Oct-13	NA	69,776	70,203	70,137	NA	101%
Nov-13	NA	69,419	69,814	69,760	NA	100%
Dec-13	NA	69,105	69,500	69,474	NA	101%

[1]not available in SCE's report

5.3 Difference-in-differences Estimation

Figure 1 presents a comparison of results from the difference-in-differences approach. AEG estimated an annual consumption reduction of 145 kWh while DNV GL's estimate is 142 kWh. DNV GL's and AEG's monthly savings estimates are based on different HER samples. To allow comparison between the two savings curves, DNV GL's monthly savings estimates were adjusted to represent savings for the households in the treatment group without mismatched addresses or households that actually received the report. The difference between AEG's and DNV GL's savings estimates based on difference-in-differences is only 2%.

Figure 1. Results from Difference-in-differences



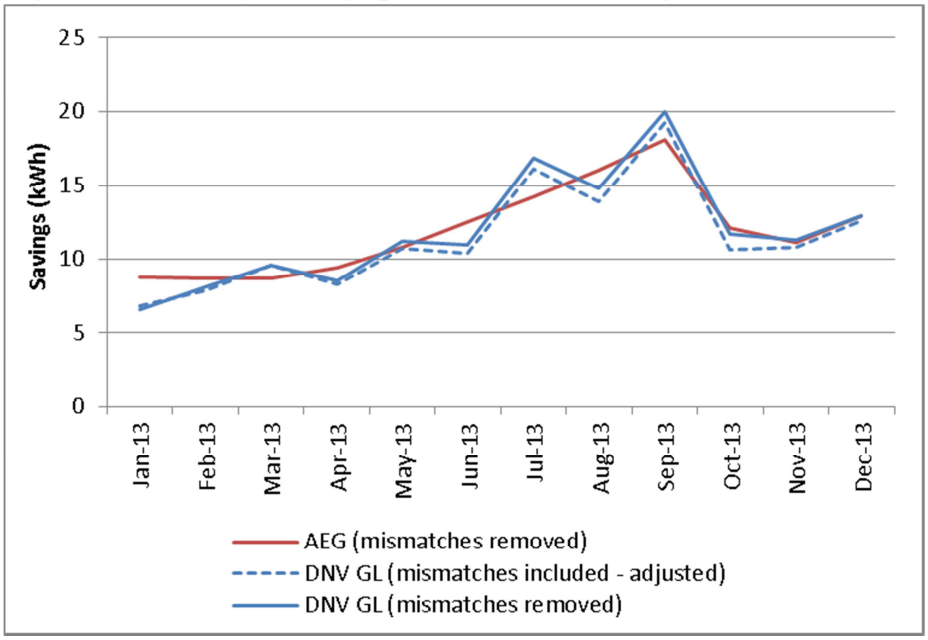
Note: AEG used Jan 2012 in the difference-in-differences as proxy for Dec 2011 when estimating savings for the month of Dec 2013

DNV GL found some inconsistencies in the tables and graphs in SCE report. Specifically, DNV GL recommends that AEG reviews the results from the difference-in-differences approach in Chapter 4 because the reported values for savings in Table 6 of SCE's report do not match the graph presented in Figure 4 of SCE's report.

5.4 Savings from the Fixed Effects Model

Figure 2 shows a comparison of the monthly savings estimates due to HER based on the fixed effects model. Savings trends show an increase in savings from January to September 2013 and then a drop in savings during the latter months of 2013. AEG's and DNV GL's average per household savings are 143 kWh (1.4%) and 137 kWh (1.3%), respectively.

Figure 2. Monthly Savings per Household using a Fixed Effects Model



DNV GL and AEG used slightly different approaches in billing analysis and data preparation. Table 12 provides a list of dependent variables used by DNV GL and AEG in the regression. In particular, AEG included cooling degree days and its interaction with an overall post-program indicator. AEG's approach separates the effect of weather on consumption (the CDD term) and the effect of weather during the pre and post periods (CDD*post). The inclusion of these terms should improve the overall model performance, but will not, on average affect the savings estimate as CDD is not interacted with the post*treatment variable that captures savings.

Table 12.Dependent variables used by AEG and DNV GL in the Regression Model

Variables	Description	AEG	DNV GL
Customer fixed effects	Fixed effects for each customer	X	X
Monthly effects	Indicator for each month in the pre and post period	X	X[1]
CDD	Cooling degree days	X	
Post*CDD	Cooling degree days and post indicator interaction term	X	
Postmonth1*treat	Treatment effect during the 1st month in the post period	X	X
Postmonth2*treat	Treatment effect during the 2nd month in the post period	X	X
Postmonth3*treat	Treatment effect during the 3rd month in the post period	X	X
Postmonth4*treat	Treatment effect during the 4th month in the post period	X	X
Postmonth5*treat	Treatment effect during the 5th month in the post period	X	X
Postmonth6*treat	Treatment effect during the 6th month in the post period	X	X
Postmonth7*treat	Treatment effect during the 7th month in the post period	X	X
Postmonth8*treat	Treatment effect during the 8th month in the post period	X	X
Postmonth9*treat	Treatment effect during the 9th month in the post period	X	X
Postmonth10*treat	Treatment effect during the 10th month in the post period	X	X
Postmonth11*treat	Treatment effect during the 11th month in the post period	X	X
Postmonth12*treat	Treatment effect during the 12th month in the post period	X	X

[1] AEG's specification did not use 12 months of data during the pre-period.

Other sources of variations include the billing data used and billing cycle assignments. AEG used only 11 months of billing data in the pre-period (January 2012 to November 2012) while DNV GL used 12 months of data the in pre-period (December 2011 to November 2012). DNV GL used the month of the billing cycle end date as the billing month while AEG uses the same approach only of the day in in the billing cycle end date is greater than 15. Otherwise, AEG uses the previous month as the billing cycle.

5.5 Joint Savings Analysis - Downstream

Initial review of SCE joint savings analysis for downstream rebate programs showed substantial differences in the program tracking database used by AEG and DNV GL. DNV GL found more rebate measures in the tracking data from CPUC than in the tracking data initially provided by SCE to AEG. Efforts were made to reconcile the differences in the tracking data which resulted to a comparable joint savings analysis between AEG and DNV GL.

Table 13 presents the number of HER customers participating in SCE's downstream rebate programs while Table 14 quantifies the kWh savings by measure group jointly attributed to the HER program and the SCE downstream rebate program. Based on AEG's and DNV GL's analysis, the HER program increases participation of other energy efficiency programs. In particular, more than 85% of the joint savings are attributed to both HER program and rebate programs for lighting, refrigerator and pool pump measure groups.

Table 13. No. of HER Participants from Downstream Rebate Programs

Measure	Control (No. of Customers)		Treatment (No. of Customers)		Difference		
	AEG	DNV GL	AEG	DNV GL	AEG	DNV GL	%DNV GL / AEG
Evaporative Cooler	1	-	-	-	(1)	-	
Lighting	54	-	64	4	10	4	40%
Refrigerator / Freezer	819	804	961	928	142	124	87%
Air Conditioners	60	59	80	80	20	21	105%
Whole House Retrofit	31	29	36	32	5	3	60%
Dishwasher	-	1	-	-	-	(1)	
Pool Pump	185	182	265	262	80	80	100%
Whole House Fan	18	18	18	18	-	-	
Clothes Washer	2	2	-	-	(2)	(2)	100%
Home Shell Improvement	-	1	-	1	-	-	
Surveys	1,005	996	1,135	1,114	130	118	91%
Total	2,175	2,092	2,559	2,439	384	347	90%

Table 14. Total Savings of HER customers from Downstream Rebate Programs

Measure	Control (kWh)		Treatment (kWh)		Difference		
	AEG	DNV GL	AEG	DNV GL	AEG kWh	DNV GL kWh	%DNV GL / AEG
Evaporative Cooler	528	-	-	-	(528)	-	
Lighting	3,960	-	25,149	26,473	21,189	26,473	125%
Refrigerator / Freezer	224,814	216,359	251,261	236,953	26,447	20,593	78%
Air Conditioners	13,343	12,200	16,408	15,624	3,065	3,425	112%
Whole House Retrofit	13,654	33,112	15,481	33,213	1,827	101	6%
Dishwasher	-	26	-	-	-	(26)	
Pool Pump	55,559	54,377	82,676	81,524	27,117	27,147	100%
Whole House Fan	113	113	60	60	(53)	(53)	101%
Clothes Washer	79	79	-	-	(79)	(79)	100%
Home Shell Improvement	-	153	-	845	-	692	
Surveys	61,286	60,583	69,622	67,483	8,336	6,899	83%
Total	373,336	377,004	460,657	462,174	87,319	85,171	98%