

Review of PG&E Home Energy Reports Initiative Evaluation

CPUC Energy Division

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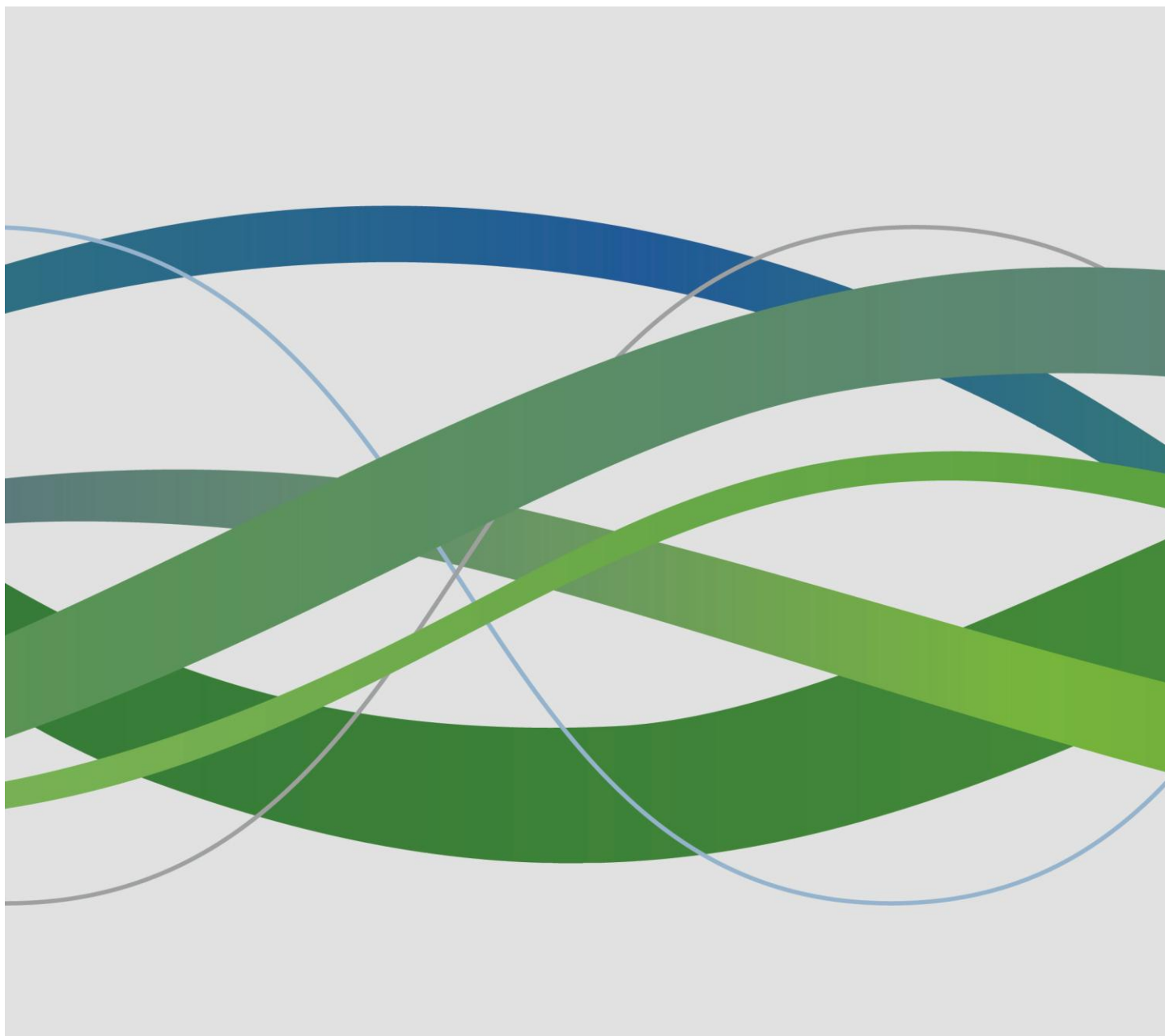


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1. Introduction

The purpose of this report is to summarize DNV KEMA's review of Freeman, Sullivan, Consulting's (FSC) *Evaluation of Pacific Gas and Electric Company's Home Energy Report Initiative for the 2010–2012 Program*¹ hereafter referred to as the FSC Report. This is the final step of DNV KEMA's assigned role to provide oversight to the PG&E Comparative Feedback Initiative evaluation process.

This report reviews the three main components² of the evaluation that, in combination, produce the final savings estimates:

- Consumption reduction estimation
- Downstream/tracked rebate program joint savings estimation
- Upstream/untracked rebate program joint savings estimation

As CPUC evaluators, DNV KEMA has access to a full set of PG&E billing data and program tracking data. This made it feasible for us to go a step beyond reviewing code and methods and produce fully independent estimates of savings and downstream rebate program joint savings with which to compare FSC's results. This replication process goes well beyond the vetting of approach that was considered the minimum review of the FSC results and allows for a more robust validation that savings are occurring under the program³.

After a background section, the report provides the high level findings and then recommendations. Subsequent sections provide more in depth information on the estimation of reduced consumption as well as the downstream rebate joint savings estimate.

¹ Dated April 25, 2013

² DNV KEMA validated the sample design and randomization process at the time they were performed by FSC in 2011.

³ By conducting this level of independent review and replication of the program data (albeit limited in scope to the FSC evaluation that also incorporated AMI data) adds credibility that savings are occurring.



2. Background

PG&E contracted with Opower to provide home energy reports (HERs) to a selection of residential customers. FSC was contracted by PG&E to facilitate the Opower implementation. FSC, working with PG&E and Opower, developed the treatment and control samples to enable evaluation, as well as additional research in support of PG&E’s program plans.

The HERs were sent in three waves: Beta Wave, Gamma Wave, and Wave One. The waves started at different times, were drawn from different populations and received slightly different treatments. Each treatment group was part of a randomly assigned pair of treatment and control groups. For the purpose of this evaluation, the distinctions between the waves were not important beyond start dates, group counts and energy fuel-type (i.e., gas and/or electric).

The summary table, Table 2-1 below, comes from the FSC Report dated April 25, 2013:

Table 2-1: Characteristics of HER Program Participants (Source: FSC Report)

Wave	Total Treatment (Initial #)	Dual-fuel	Electric-only	Gas-only	Frequency (S=Standard, R=Reduced)	Energy Use Quartile(s)
Beta	60,000	Y	N	N	S	4
Gamma	~190,000*	Y	Y	Y*	S, R	1, 2, 3, 4
Wave One	400,000	Y	N	N	S	2, 3, 4

*Because of the removal of SMUD customers from the Gamma Gas-only Wave, the exact number of gas-only customers in Gamma is not known, but is much less than the 15,000 that were initially sampled.

3. Findings

DNV KEMA reviewed the three main components of the evaluation that, in combination, produce the final savings estimates:

- Consumption reduction estimation
- Downstream/tracked rebate program joint savings estimation
- Upstream/untracked rebate program joint savings estimation

We reviewed FSC's methods both as stated in the evaluation report and as revealed in STATA code that FSC provided. We also produced a set of comparison results using DNV KEMA methods and data that PG&E provided to the CPUC.

Estimating reduced consumption measures the total effect of the HERs on consumption. This is the primary estimate of program-related savings. The subsequent steps will identify what portion of the savings are possibly joint savings with other programs.

FSC's approach to estimating the reduction in consumption is consistent with most of the best practices as delineated in State and Local Energy Efficiency Action Network's *Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations*⁴ (the SEE Action report, hereafter). In particular, they follow the recommended fixed-effects regression approach and estimate standard errors using clustered errors.

FSC diverges from the SEE Action recommended approach in one major way; the SEE Action approach states that move-outs should be removed altogether and not included when aggregating to program level consumption reductions. FSC's approach allows both treatment and control group households to stay in the regression until they close their accounts. DNV KEMA supports FSC's approach in this case as it will capture valid savings in households up until they move. However, given FSC included "move-outs" we would have preferred to see the aggregation conducted with monthly counts. We discuss this issue further in section 3.1.2.

3.1.1 Average Household Consumption Reduction

DNV KEMA independently estimated wave level consumption reductions for the HER Initiative. We performed these estimates using DNV KEMA methods and code, and using PG&E data provided to the CPUC. Our objective was to verify whether FSC's results are consistent with independently produced results, not necessarily to produce identical results.

⁴ 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>.



A comparison of FSC’s and DNV KEMA aggregate electric savings estimates is provided in Table 3-1 below. FSC’s estimates of savings are within 4% of DNV KEMA’s estimates for the wave groupings. In aggregate, the two sets of results are within 2%. Both estimates use FSC’s counts for expanding average household-level savings to program-level savings, making this a comparison of the underlying regression model results.

Table 3-1: Comparison of Summary Results-Electric Savings

Wave	Electric (in GWh)				DNV/FSC %
	FSC		DNV KEMA		
	Savings	(SE)	Savings	SE	
Beta	12.7	(0.9)	12.1	(0.8)	96%
Gamma Dual Fuel Reduced	4.8	(0.6)	5.0	(0.6)	104%
Gamma Dual Fuel Standard	5.8	(0.6)	6.0	(0.6)	104%
Gamma Electric-only Standard	4.4	(0.5)	4.2	(0.5)	96%
Wave One Dual	25.9	(1.6)	25.3	*	98%
Wave One Electric-only	3.1	(0.7)	3.2	*	102%
Total	56.7		55.8		98%

*Wave One results are based February through October data.

Table 3-2 provides the comparison of FSC and DNV KEMA’s aggregate gas savings estimates. Once again, at the wave level, FSC’s results differ somewhat from DNV KEMA’s, but on aggregate they are approximately the same.

Table 3-2: Comparison of Summary Results-Gas Savings

Wave	Gas (in ,000 Therms)				DNV/FSC %
	FSC		DNV KEMA		
	Savings	SE	Savings	SE	
Beta	538	(68)	487	(70)	91%
Gamma Dual Fuel Reduced	232	(42)	222	(41)	96%
Gamma Dual Fuel Standard	224	(42)	219	(41)	98%
Wave One Dual	461	(125)	553	*	120%
Total	1469		1464		100%

*Wave One results are based February through October data.

Despite the differences at the wave level, our results closely mirror FSC’s results. Monthly plots provided in Section 5.2, illustrate the close relationship between the two sets of results. We did not try to exactly replicate FSC’s approach but applied our own methodology and code. The overall similarity in the results despite somewhat different methods and data is a testament to the soundness of FSC’s average household savings estimates.

3.1.2 Population Counts

Population counts are used to expand estimated per-household savings to 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 also complicated by ongoing attrition in both the treatment and control groups.

The FSC report includes sample counts, starting counts, an average attrition rate for each wave and the average population used for aggregating household savings to the program level. The DNV KEMA population counts roughly re-create the initial counts used by FSC. Exact counts depend on details such as how move-out date is assigned, data quality criteria for inclusion in the regression, etc. As a result we did not attempt to recreate the exact average population FSC used to produce the savings estimates. The comparisons we could make are provided in Section 1.

More importantly, FSC's aggregation approach is a simplification that has the potential to inject a small but unnecessary bias into the results. Multiplying the average population with the average savings is only consistently accurate if both savings and population are linear functions. In actuality, natural attrition will decrease the population at a decreasing rate at the same time that saving is variably increasing. Simple simulations using FSC's monthly savings and average attrition cause a consistent upward bias of one half to one percent. While this is a small difference, DNV recommends aggregating monthly savings estimates using monthly active population counts which guarantees proper accounting of monthly attrition.

3.1.3 Downstream Rebate Joint Savings Estimation (Potential Double Counting)

FSC's estimates of joint savings are substantially different from DNV KEMA derived estimates. FSC's measure counts, total treatment and control rebate savings, and treatment versus control differences are substantially different from DNV KEMA's. Additionally, while DNV KEMA closely followed the SEE Action estimation approach, this approach is quite different than the approach FSC used.

Section 5.3 discusses the differences between the downstream rebate findings in depth. The differences are so widespread that we are unable to surmise the possible causes of the differences. FSC indicated in discussions that they might not have used complete rebate data for their calculations. We should note that DNV KEMA's rebate tracking data, while apparently complete through 2012, was provided on a preliminary basis.

Despite the demonstrated differences, DNV KEMA recommends using FSC's estimates of downstream rebate joint savings. FSC's estimate of joint savings only represents 0.3% of total savings and is slightly larger than DNV KEMA's estimate resulting in larger net reductions due to possible double counting.

3.1.4 Upstream Rebate Joint Savings Estimation (Potential Double Counting)

While DNV KEMA reviewed the methodology employed for estimating the upstream joint savings estimates, we did not review the data for this aspect of the evaluation or replicate results. However, based



on what we reviewed, we note the results are at expected levels. The confidence interval on the estimate of increased upstream CFL uptake is twice the magnitude of the estimate itself. This means that upstream joint savings, within the 95% confidence level, could be three times the claimed amount, but they could also be zero. A better approach needs to be developed for measuring this effect that is less expensive and has greater precision and accuracy. Despite the lack of statistical significance, DNV KEMA supports using the estimates for upstream rebate joint savings and their removal from overall savings.



4. Recommendations

Overall, we found no major concerns or faults with the FSC results or methodology for estimating reduction in consumption other than what is noted above. As such, DNV KEMA recommends accepting the findings regarding energy savings for HERs presented in the FSC report.

DNV KEMA has the following recommendations regarding reporting and calculating downstream savings going forward.

- Graphical representation of monthly savings estimates will provide a more convincing illustration of savings to the reader than the tabular results provided. Graphs could include average savings on both a monthly and overall basis.
- Figure 3-1, in the FSC report, is a useful illustration of the post-treatment effect of the HER Initiative on consumption. A related figure showing the calendarized savings in comparison to the model estimates, for one wave as an example, might also be useful for overcoming concerns related to the black box nature of the fixed effects approach.
- Because downstream savings will continue to accumulate through the tenure of the program, DNV KEMA recommends adopting a methodology that captures downstream rebate effects on a rational, ongoing fashion from the point of installation. The SEE Action report discusses DNV KEMA's general approach as a best practice.

5. Addendum

5.1 Population Counts

Because of the importance of population counts in the overall calculation of savings, DNV KEMA re-created starting counts and average attrition rate for comparison with FSC's values. We used PG&E customer information files to establish move-out dates.⁵ The results are presented in the following tables. For the first two waves, (Beta and Gamma), our counts are consistently higher than FSC, and the attrition rates are extremely close. For Wave One, our counts are consistently below FSC counts, and our attrition rate for the large dual fuel group is significantly greater than the FSC rate.

DNV KEMA recommends that overall savings estimates be calculated by aggregating the monthly savings estimates using monthly customer counts. FSC did not provide monthly counts for each wave, so we were not able to compare FSC's reported aggregate savings to an estimate generated using this alternate method.

Table 5-1: Beta Wave Comparison of Counts and Attrition

		Beta	
		FSC	DNV KEMA
# of Customers at Launch of Wave	Control	58,528	59,995
	Treatment	58,493	59,992
# of Months of HERs		17	17
Monthly Rate of Attrition	Control	0.8%	0.75%
	Treatment	0.8%	0.73%

⁵ The customer information files provide the exact date of the close of the customer account. The billing data can also be used to establish a move-out date. One would expect them to be consistent, but there are sometimes slight differences. DNV KEMA opted to use the customer information files to establish move-outs.



Table 5-2: Beta Wave Comparison of Counts and Attrition

		Gamma					
		Dual (Electric and Gas)				Electric-only	
		Standard		Reduced		Standard	
		FSC	DNV KEMA	FSC	DNV KEMA	FSC	DNV KEMA
# of Customers at Launch of Wave	Control	70,529	72,832	70,529	72,832	43,396	44,603
	Treatment	70,518	72,827	70,547	72,277	43,363	44,581
# of Months of HERs		14	14	14	14	14	14
Monthly Rate of Attrition	Control	0.9%	0.90%	0.9%	0.90%	1.4%	1.28%
	Treatment	0.9%	0.90%	0.9%	0.88%	1.4%	1.25%

Table 5-3: Beta Wave Comparison of Counts and Attrition

		Wave One			
		Dual		Electric-only	
		Standard		Standard	
		FSC	DNV KEMA	FSC	DNV KEMA
# of Customers at Launch of Wave	Control	89,026	88,592	9,825	9,676
	Treatment	356,419	354,640	39,124	38,533
# of Months of HERs		11	11	11	11
Monthly Rate of Attrition	Control	0.9%	1.06%	1.4%	1.42%
	Treatment	0.9%	1.05%	1.4%	1.41%



5.2 Monthly Consumption Reduction Plots

The following figures display the monthly estimates of savings reported by FSC and reproduced by DNV KEMA. The plots include plots of electric and gas savings for the three waves (Beta, Gamma and Wave One), separated by dual fuel and electric-only households and for two different report mailing schedules.⁶

In general, the monthly savings are similar across the two sets of estimates. The results are not exactly identical because we used independent methods and data for our estimates versus the methods and data FSC used. In particular, we are puzzled by the results of the Wave One dual fuel model in November. However, since the results are so consistent other than the November result, it appears the issue is clearly in our data or analysis. Given that the bulk of our analysis of monthly savings is consistent with FSC's results it is probably not worth the additional expense to completely understand why the result is so different.

⁶ PG&E tested a “standard frequency” cadence of three initial monthly reports followed by bi-monthly reports and a “reduced frequency” cadence of three initial monthly reports followed by quarterly reports.

Monthly Electric Consumption Reduction

Figure 5-1: Beta Wave Electric Savings, Dual Fuel HH, Standard-Frequency Reports

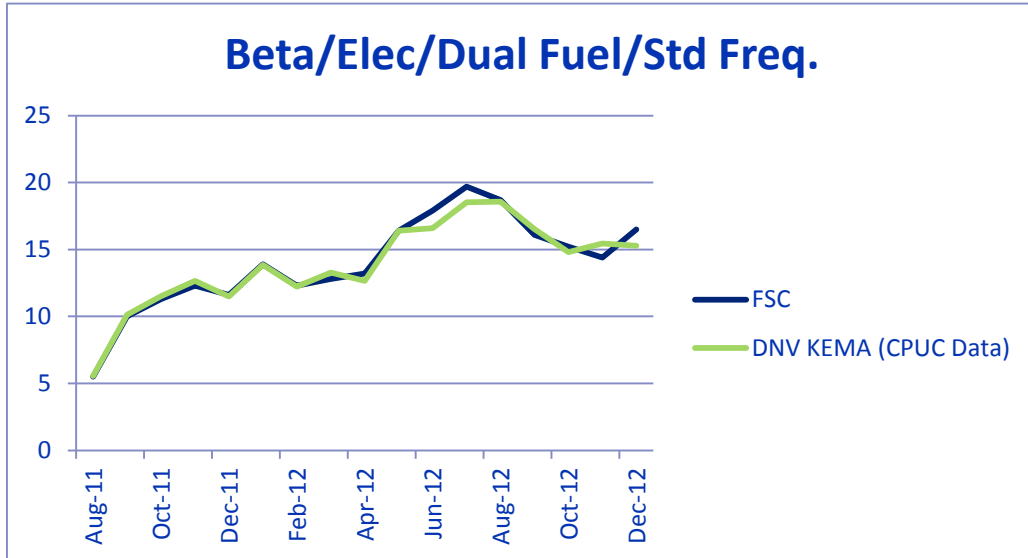


Figure 5-2: Gamma Wave Electric Savings, Dual Fuel HH, Reduced-Frequency Reports

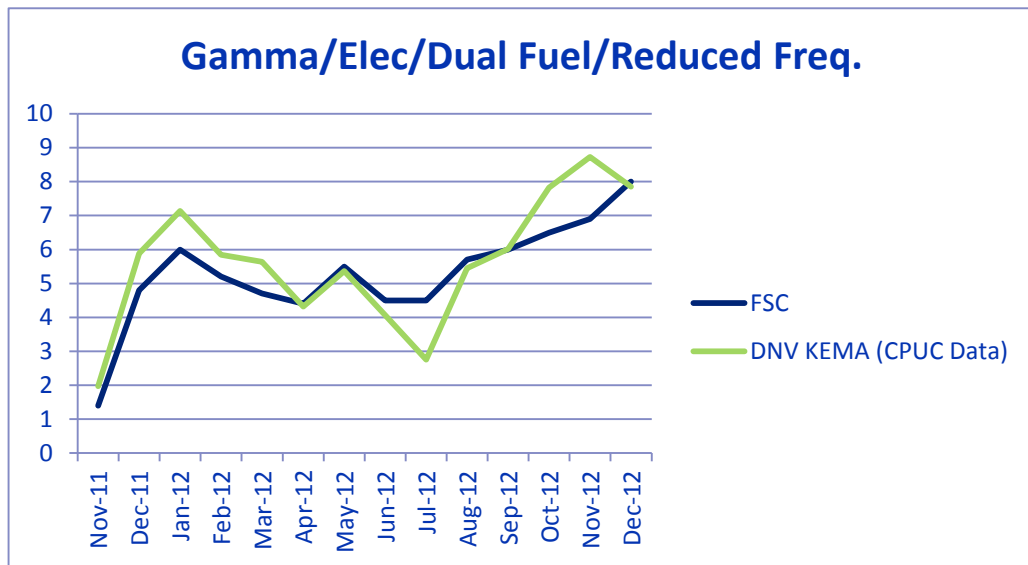


Figure 5-3: Gamma Wave Electric Savings, Dual Fuel HH, Standard-Frequency Reports

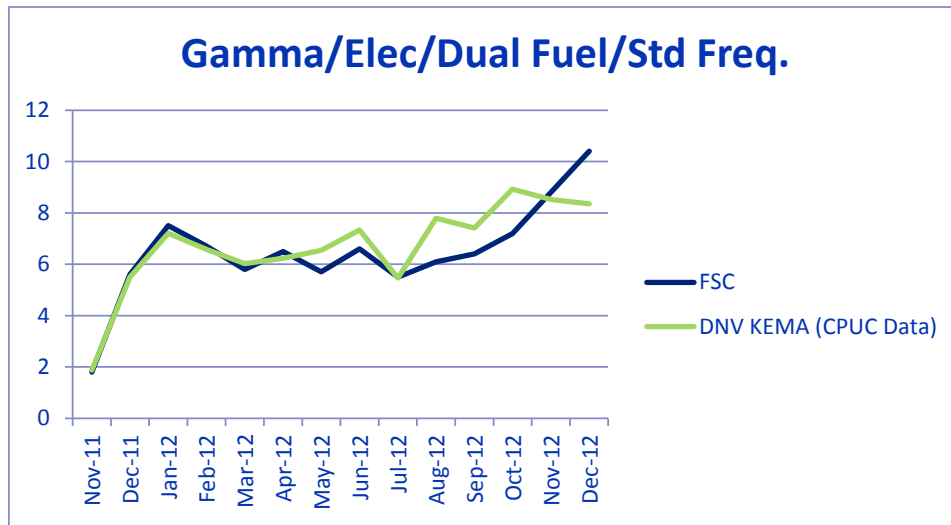


Figure 5-4: Gamma Wave Electric Savings, Electric Only HH, Standard Frequency Reports

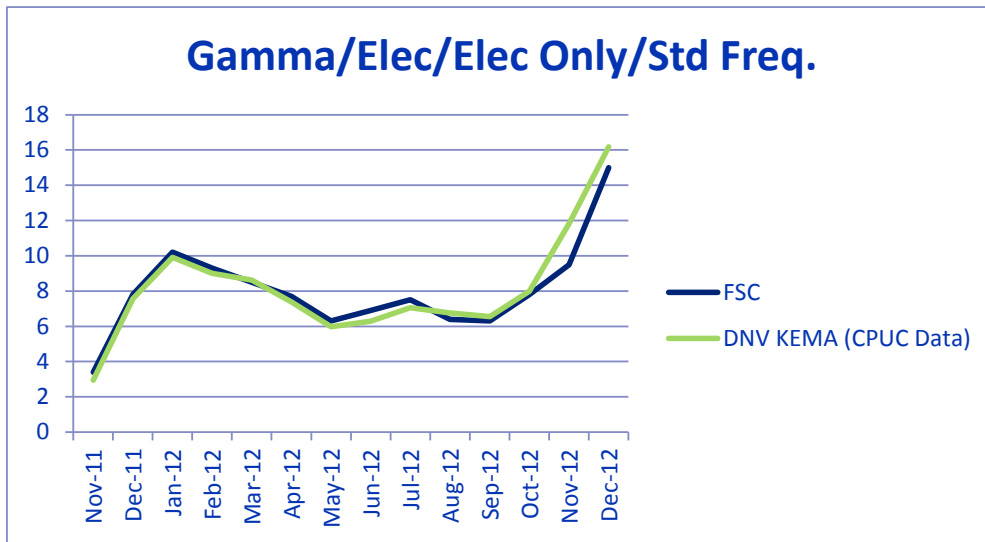


Figure 5-5: Wave One Electric Savings, Dual-Fuel HH, Standard-Frequency Reports

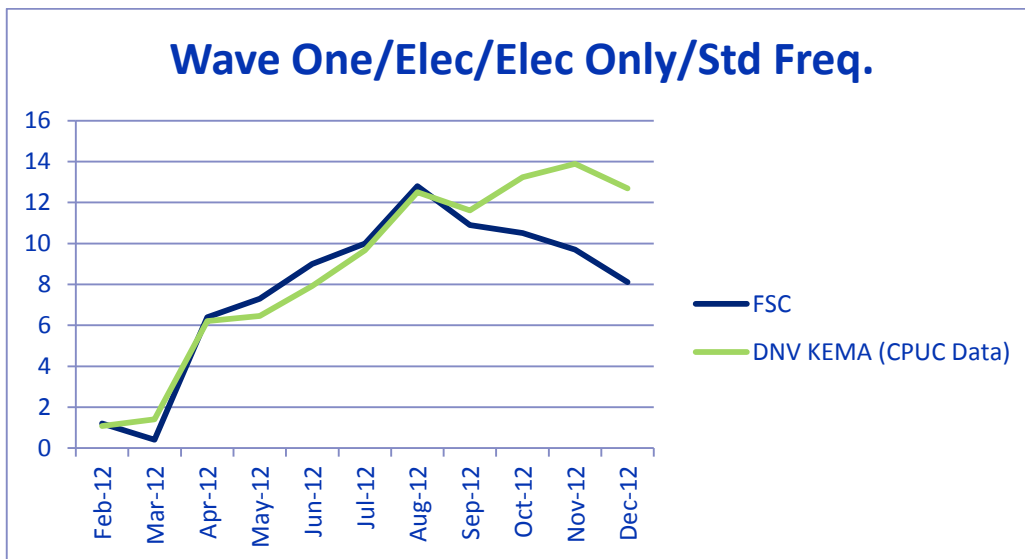
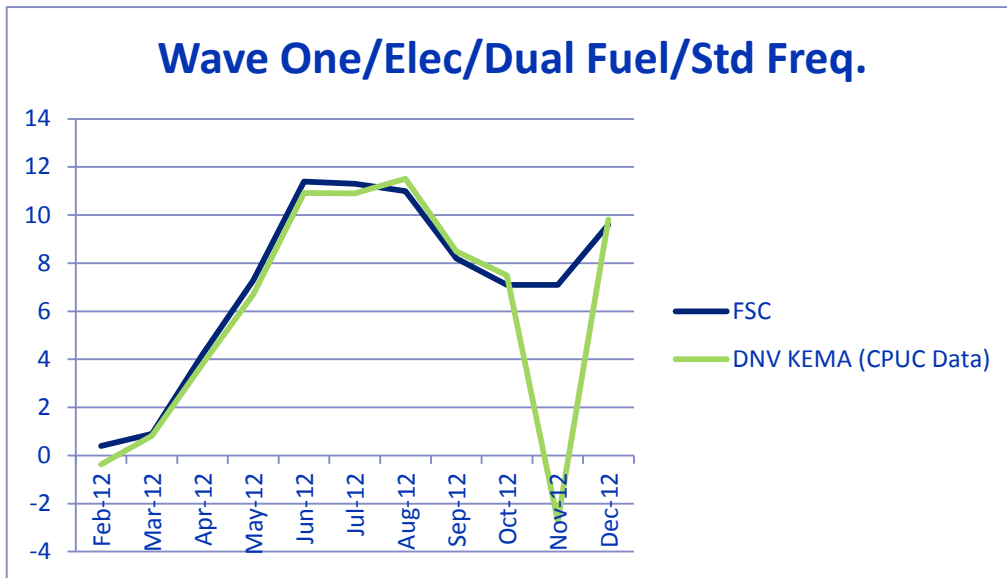


Figure 5-6: Wave One Electric Savings, Dual-Fuel HH, Standard-Frequency Reports



Monthly Gas Consumption Reduction

Figure 5-7: Beta Wave Gas Savings, Dual Fuel HH, Standard Frequency Reports

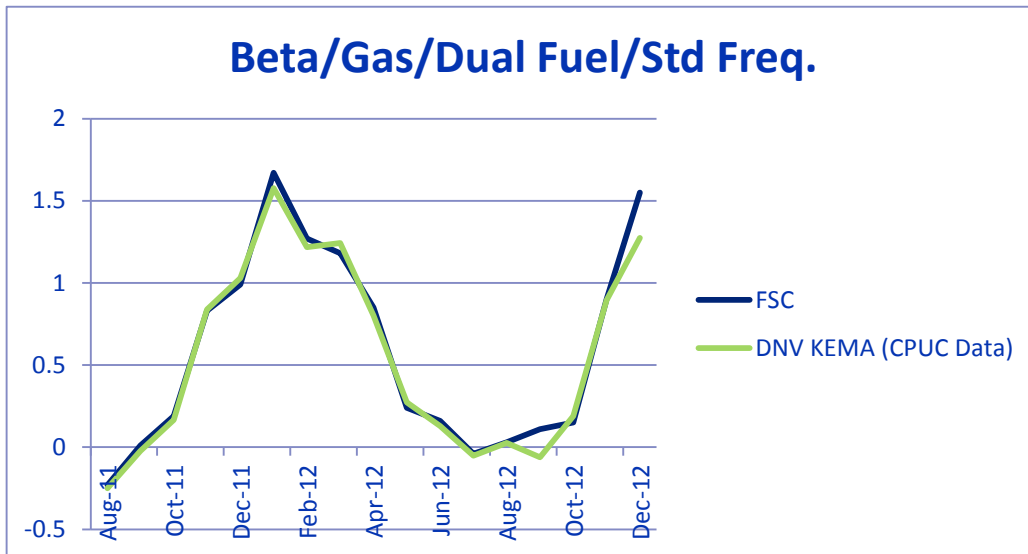


Figure 5-8: Gamma Wave Gas Savings, Dual Fuel HH, Standard Frequency Reports

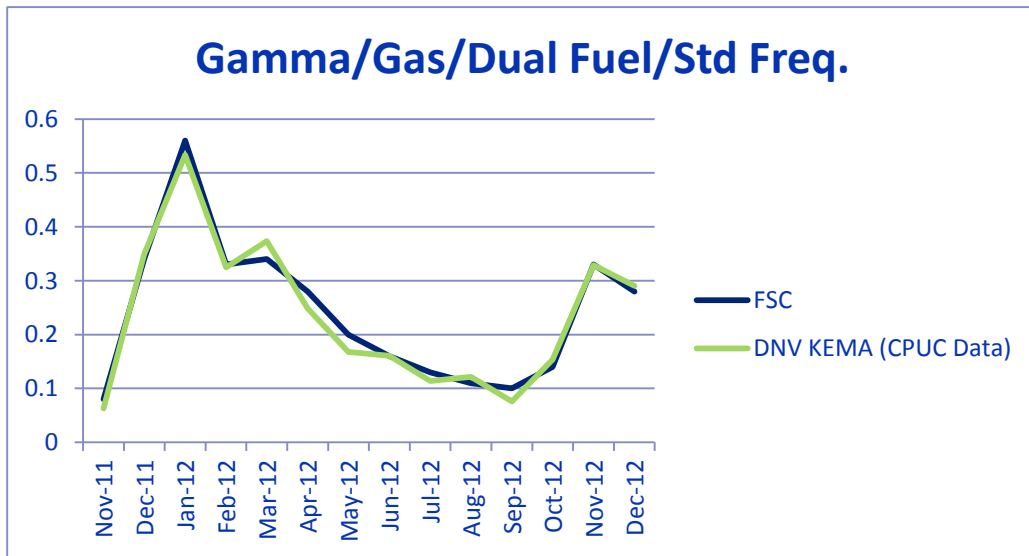


Figure 5-9: Gamma Wave Gas Savings, Dual Fuel HH, Reduced Frequency Reports

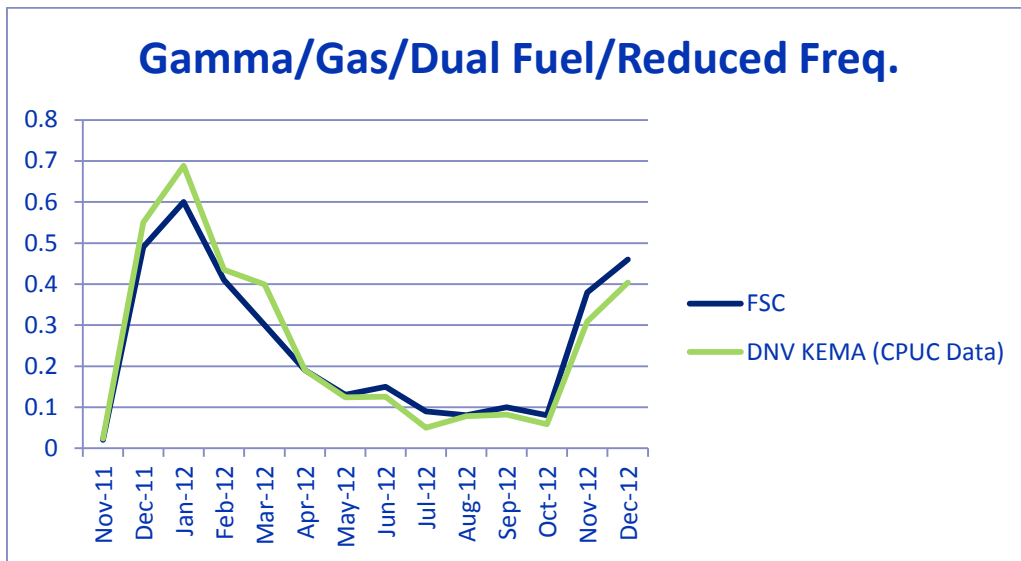
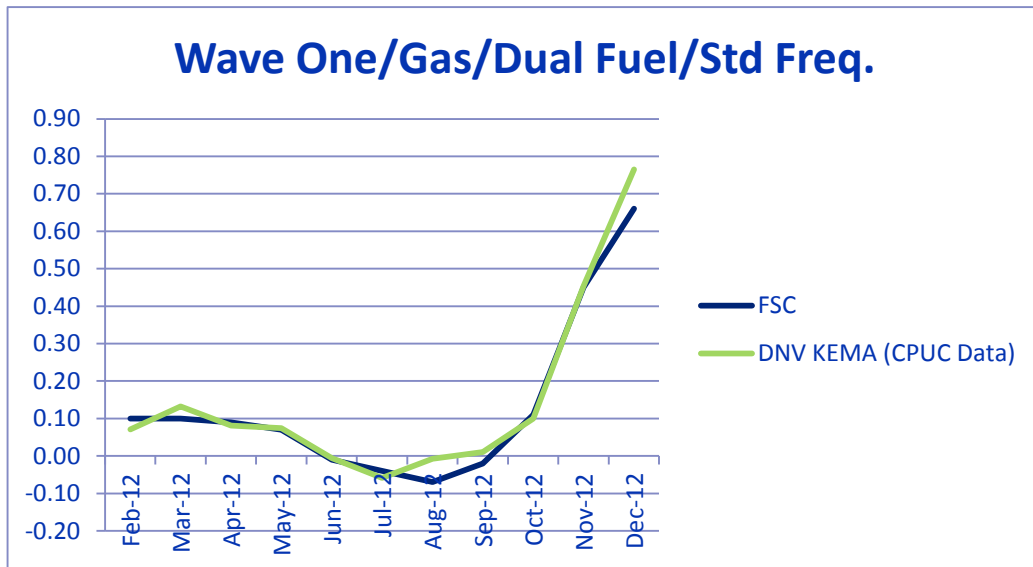


Figure 5-10: Wave One, Dual-Fuel HH, Standard-Frequency Reports





5.3 Downstream Rebate Joint Savings Comparison

This section provides a more in depth discussion of the downstream rebate joint savings process. We include this section to introduce a better approach to estimating the downstream joint savings for future consideration by FSC. In addition, the set of measures identified by FSC is quite different than those identified in our analysis. Because the estimated downstream joint savings are so small, and FSC's estimate is larger than DNV KEMA's estimate, it may not be necessary to change this result for this evaluation.⁷

The downstream joint savings estimation seeks to identify an increase in downstream rebate program activity as a result of the HER Initiative reports. This increase in rebate program activity is one possible source of the measured difference in consumption between the treatment and control groups. Because the savings from these programs are already tracked and claimed by the rebate programs, it is essential to segregate these savings and make sure they are only claimed as savings once. We refer to the additional downstream rebate savings caused by the reports as joint savings because they are jointly caused by the HER reports and the rebate programs.

The basic process for measuring joint savings takes advantage of the experimental design. Control group rebate savings represent rebate savings for the treatment group in the absence of the program. Any difference between treatment and control savings is attributable to the reports. DNV KEMA has developed an approach that measures rebate savings and joint savings approximately as they would affect consumption levels in the billing data or system load. This approach is described and supported in the SEE Action report.

DNV KEMA develops streams of savings for each customer in each wave. Daily savings are calculated

- Starting from the installation date
- Projecting forward on a load shape-weighted basis, and
- Continuing for the life of the measure.

Treatment and control savings are aggregated up to the month. The difference represents the estimate of joint savings. This approach estimates joint savings accurately, 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.

FSC discusses joint savings in Chapter 5 "Attribution of Savings to HERs and Downstream Programs." FSC aggregates rebate program annual claimed savings from the start of the program and without

⁷ Joint savings are removed from the overall estimate of reduced consumption. The larger FSC estimate of joint savings will actually produce a slightly smaller final estimate of programs savings.



consideration of when savings would occur. This approach may be cautious but it generally front-weights joint savings and assigns savings when they could not realistically occur.

Table 5-4 compares FSC’s results to DNV KEMA’s results.

Table 5-4: Total Downstream Rebate kWh Associated with each HER Wave

Wave	DNV KEMA			FSC		
	Control	Treatment	Difference	Control	Treatment	Difference
Beta	883,593	928,401	44,808	751,156	861,126	109,970
Gamma Standard Dual	389,994	441,282	51,288	223,698	266,658	42,960
Gamma Reduced Dual	389,994	434,900	44,906	223,698	257,330	33,632
Gamma Electric Only	249,264	327,297	78,033	98,210	138,089	39,879
Wave One	1,162,126 ⁸	1,138,940	-23,186	843,764	847,641	3,877
Total Difference in Rebated Savings (kWh)			195,849			230,318
Total Difference in Rebated Savings (GWh)			0.20			0.23

DNV KEMA identified substantial more electric rebate savings in the treatment and control groups than FSC despite the fact that FSC’s results artificially front-weight their rebate savings estimates. Even with this increase in activity, DNV KEMA’s joint savings estimate, the difference between treatment and control rebate savings, was 20% less than FSC’s.

5.4 Differences between FSC’s Tracking Data and DNV KEMA’s Tracking Data

The difference in aggregate joint savings is even more surprising after a look at the underlying tracking data measure counts. Significant differences exist between the rebate counts provided in FSC’s report and those found in the CPUC system tracking data. In general, DNV KEMA found fewer rebate measures than what FSC reported but those measures had greater savings.

Table 5-5 through Table 5-9 report these differences. The rebate measures category counts are so different that it appears there is a data issue. Given the extremely small magnitude of both estimates of joint savings, the differences in the estimates may not need to be resolved for this evaluation. For future reference, we should resolve any differences in tracking data source and timeframes.

⁸ Wave One control group savings were scaled for comparison with the treatment group.



Table 5-5: Post Period Beta Wave Measures found by DNV KEMA and FSC.

Rebated Activity	DNV KEMA			FSC		
	Control	Treatment	Difference	Control	Treatment	Difference
A/C Improvements	43	53	10	13	10	-3
AFUE Gas Furnace	110	119	9	171	197	26
Cool Roof	3	1	-2	3	1	-2
Efficient Clothes Washer	868	820	-48	2924	2816	-108
Efficient Dishwasher	888	959	71	766	836	70
Efficient Fridge	0	0	0	47	53	6
Efficient Water Heater	56	53	-3	34	42	8
Improve Insulation	138	156	18	100	122	22
Low Flow Shower Head	22	12	-10	0	0	0
Lighting Indoor	355	288	-67	0	0	0
Lighting Outdoor	85	62	-23	0	0	0
Other	16	18	2	0	0	0
Remove and Recycle Freezer	47	63	16	59	87	28
Remove and Recycle Second Fridge	362	426	64	882	1196	314
Replace and Recycle Freezer	68	65	-3	102	111	9
Test Ducts / Seals	0	0	0	0	0	0
Replace and Recycle Second Fridge	0	0	0	0	0	0
Variable Speed Pool Pump	293	332	39	367	419	52
Whole House Retrofit	85	84	-1	258	263	5
Total	3439	3511	72	5726	6153	427



Table 5-6: Post Period Gamma Standard Dual Measures found by DNV KEMA and FSC.

Rebated Activity	DNV KEMA			FSC		
	Control	Treatment	Difference	Control	Treatment	Difference
A/C Improvements	236	287	51	11	13	2
AFUE Gas Furnace	33	36	3	62	70	8
Air Flow Correction	0	0	0	28	16	-12
Cool Roof	0	2	2	0	1	1
Efficient Clothes Washer	286	293	7	942	909	-33
Efficient Dishwasher	409	397	-12	276	288	12
Efficient Fridge	0	0	0	58	46	-12
Efficient Water Heater	55	65	10	22	23	1
Efficient Windows	0	0	0	0	0	0
Improve Insulation	93	89	-4	58	47	-11
Lighting Indoor	313	336	23	0	0	0
Lighting Outdoor	95	113	18	0	0	0
Low Flow Shower Head	18	15	-3	4	5	1
Other	21	16	-5	83	49	-34
QM Service Agreement	0	0	0	42	24	-18
Remove and Recycle Freezer	24	28	4	24	28	4
Remove and Recycle Second Fridge	153	165	12	308	340	32
Replace and Recycle Freezer	9	4	-5	10	6	-4
Replace and Recycle Second Fridge	106	120	14	0	0	0
Test Ducts/Seals	30	27	-3	0	0	0
Variable Speed Pool Pump	74	71	-3	79	70	-9
Whole House Retrofit	65	70	5	56	82	26
Total	2020	2134	114	2063⁹	2017	-46

⁹ FSC reports the total rebates to be 2,167 for control and 2,135 for treatment. However, the summation of measures by type does not equate to these totals.

Table 5-7: Post Period Gamma Reduced Wave Measures found by DNV KEMA and FSC.

Rebated Activity	DNV KEMA			FSC		
	Control	Treatment	Difference	Control	Treatment	Difference
A/C Improvements	236	256	20	11	16	5
AFUE Gas Furnace	33	33	0	62	71	9
Air Flow Correction		0	0	28	20	-8
Cool Roof	0	3	3	0	3	3
Efficient Clothes Washer	286	284	-2	942	886	-56
Efficient Dishwasher	409	373	-36	276	258	-18
Efficient Fridge		0	0	58	60	2
Efficient Water Heater	55	49	-6	22	18	-4
Improve Insulation	93	105	12	58	62	4
Lighting Indoor	313	301	-12	0	0	0
Lighting Outdoor	95	109	14	0	0	0
Low Flow Shower Head	18	18	0	4	1	-3
Other	21	6	-15	83	56	-27
QM Service Agreement		0	0	42	37	-5
Remove and Recycle Freezer	24	20	-4	24	22	-2
Remove and Recycle Second Fridge	153	160	7	308	378	70
Replace and Recycle Freezer	9	7	-2	10	2	-8
Replace and Recycle Second Fridge	106	135	29	0	0	0
Test Ducts/Seals	30	27	-3	0	0	0
Variable Speed Pool Pump	74	86	12	79	68	-11
Whole House Retrofit	65	68	3	160	195	35
Total	2020	2040	20	2167	2153	-14



Table 5-8: Post Period Gamma Electric Only Measures found by DNV KEMA and FSC.

Rebated Activity	DNV KEMA			FSC		
	Control	Treatment	Difference	Control	Treatment	Difference
A/C Improvements	201	198	-3	21	8	-13
AFUE Gas Furnace	0	0	0	1	0	-1
Air Flow Correction	0	0	0	10	7	-3
Cool Roof	0	0	0	0	0	0
Efficient Clothes Washer	69	73	4	190	220	30
Efficient Dishwasher	148	143	-5	129	126	-3
Efficient Fridge	0	0	0	25	11	-14
Efficient Water Heater	2	2	0	1	2	1
Improve Insulation	11	25	14	8	17	9
Lighting Indoor	184	220	36	0	0	0
Lighting Outdoor	79	80	1	0	0	0
Low Flow Shower Head	0	0	0	1	0	-1
Other	0	0	0	29	9	-20
QM Service Agreement	0	0	0	10	6	-4
Remove and Recycle Freezer	12	7	-5	20	10	-10
Remove and Recycle Second Fridge	51	51	0	134	154	20
Replace and Recycle Freezer	3	4	1	2	2	0
Replace and Recycle Second Fridge	43	54	11	0	0	0
Test Ducts/Seals	35	33	-2	0	0	0
Variable Speed Pool Pump	18	19	1	30	25	-5
Whole House Retrofit	16	34	18	56	82	26
Total	872	943	71	667	679	12



Table 5-9: Post Period Wave One Measures found by DNV KEMA and FSC.

Rebated Activity	DNV KEMA			FSC		
	Control	Treatment	Difference	Control	Treatment	Difference
A/C Improvements	0.32%	0.34%	0.02%	0.01%	0.01%	0.00%
AFUE Gas Furnace	0.04%	0.05%	0.01%	0.05%	0.07%	0.02%
Air Flow Correction	0.00%	0.00%	0.00%	0.03%	0.03%	0.00%
Cool Roof	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Efficient Clothes Washer	0.04%	0.05%	0.01%	1.34%	1.38%	0.04%
Efficient Dishwasher	0.42%	0.37%	-0.05%	0.30%	0.25%	-0.05%
Efficient Fridge	0.00%	0.00%	0.00%	0.08%	0.09%	0.01%
Efficient Water Heater	0.03%	0.04%	0.01%	0.02%	0.02%	0.00%
Efficient Windows	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Improve Insulation	0.11%	0.12%	0.01%	0.06%	0.07%	0.01%
Lighting Indoor	0.19%	0.22%	0.02%	0.00%	0.00%	0.00%
Lighting Outdoor	0.05%	0.06%	0.00%	0.00%	0.00%	0.00%
Low Flow Shower Head	0.01%	0.02%	0.01%	0.00%	0.00%	0.00%
Other	0.01%	0.01%	0.00%	0.07%	0.09%	0.02%
QM Service Agreement	0.00%	0.00%	0.00%	0.05%	0.06%	0.01%
Remove and Recycle Freezer	0.04%	0.04%	-0.01%	0.03%	0.04%	0.01%
Remove and Recycle Second Fridge	0.28%	0.25%	-0.03%	0.46%	0.45%	-0.01%
Replace and Recycle Freezer	0.02%	0.02%	0.00%	0.02%	0.03%	0.01%
Replace and Recycle Second Fridge	0.21%	0.21%	0.00%	0.00%	0.00%	0.00%
Test Ducts/Seals	0.00%	0.01%	0.01%	0.00%	0.00%	0.00%
Variable Speed Pool Pump	0.08%	0.10%	0.03%	0.08%	0.09%	0.01%
Whole House Retrofit	0.09%	0.07%	-0.02%	0.23%	0.20%	-0.03%
Total	1.96%	1.98%	0.02%	2.83%	2.88%	0.05%



A. Pacific Gas and Electric Comments

Thank you for the opportunity to provide these comments to the draft *Review of PG&E Home Energy Reports Initiative Evaluation* prepared by DNV Kema, Inc., dated May 31, 2013. We believe that the similarity of the estimates of electric and natural gas savings found by DNV Kema and Freeman, Sullivan and Company (FSC) are similar (that is, within 2% in aggregate for electricity savings estimates and virtually identical for natural gas savings) is attributable to the close collaboration between the staff and consultants of the Energy Division of the California Public Utilities Commission, DNV Kema, FSC, and PG&E throughout the design, execution, and analysis of the experiments. DNV Kema “found no major concerns or faults with the FSC results or methodology for estimating reduction in consumption” (section 4, page 4.1).

Given that there are no significant differences in savings estimates found by DNV Kema and FSC, this commentary focuses on identifying possible sources for the minor discrepancies found between the DNV Kema and FSC findings with the objective of refining the savings estimation methodology to improve savings estimates for the ongoing evaluations of this initiative in future program cycles. In the comments that follow, the section numbers provided as section headings refer to those used in the DNV Kema report.

3.1.2: Population Counts. DNV Kema’s report recommends aggregating monthly savings estimates using monthly active population counts to guarantee proper accounting of monthly attrition. FSC’s criteria for including a customer in any given month in the treatment population is slightly different: when a customer assigned to treatment condition had billing data for any given month, that customer was considered to have been “treated” with the reports and was therefore included in the treatment group. We believe that DNV KEMA’s use of “customer information files” (see footnote on page 5-1), rather than sampling requiring billing data to be present for a customer to be included in the treatment condition for any given month resulted in DNV KEMA’s customer counts to be slightly higher (as is shown in tables 5-1, 5-2, and 5-3). The criteria for including any given customer in the treatment population for any given month should be mutually agreed upon moving forward.

Additionally, DNV KEMA is aggregating results using each month’s savings impact multiplied by the customer count for that month, and suggests that FSC’s approach introduces bias by using the average monthly impact multiplied by the average number of customers present in a given experimental wave. Given that there is so little difference between the two methods, we believe that the methodology difference isn’t material. That said, PG&E will suggest to FSC that, going forward, FSC should aggregate monthly savings estimates using monthly active population counts to account for monthly attrition on an ongoing basis in its savings estimates (for the 2013-2014 cycle and beyond).

3.1.3: Downstream Rebate Joint Savings Estimation (Potential Double-Counting). Even though estimates of joint savings attributable to both Home Energy Reports and PG&E’s downstream rebates are



not substantially different (probably principally because the overall incidence of downstream rebates in the PG&E residential customer population is quite low), there are substantial differences between DNV Kema and FSC in the customer counts of households receiving specific downstream rebates. We believe that one factor driving these differences is the fact that the two firms received different lists of downstream rebates that were generated at different times with no attempt to reconcile the differences. That said, the specific counts that DNV Kema provides in tables 5-5 through 5-9 suggest that there is a data issue that goes beyond the time of generation of the rebate counts. For example, DNV Kema found that, for the Gamma wave, post-period counts for efficient clothes washers for treatment and control households were 293 and 286, respectively. FSC found counts of 909 and 942, respectively. A second factor influencing these differences in rebate redemption is the methodology used by FSC that is “maximally cautious about eliminating all possible double-counting” (footnote 13 in the FSC report). Specifically, FSC’s assumption was that all rebated products were installed at the beginning of the experimental wave in which a household participated.

We suggest the following changes for future evaluations to address discrepancies:

- Both firms should be working from identical datasets so that the source of any differences in rebate counts can be identified prior to beginning the analysis.
- FSC should adopt the “streams of savings” approach for each customer in each wave to estimate joint savings estimates accurately in terms of magnitude and timing, rather than the approach used that front-weighted savings estimates when they could not realistically occur (for example, so that AC rebates installed among Gamma wave households that began receiving reports in November 2011 are not credited with energy savings until the 2012 cooling season, rather than immediately using FSC’s front-weighted approach).

3.1.4: Upstream Rebate Joint Savings Estimation (Potential Double Counting). We agree with the assessment by DNV Kema that the confidence interval on the data collected via the home inventory task is very wide and that zero (that is, no differences between treatment and control households) is in the confidence interval. We note that this problem is partially attributable to the fact that FSC was unable to achieve the target number of home inventories given time and budget constraints. We agree with DNV Kema’s suggestion that it would be beneficial to identify a methodology to estimate the differences with greater precision and accuracy, and a methodology with lower costs. Two methodologies that may be worth exploring in the future are:

1. Using interval data disaggregation to identify whether there is a discernible difference between the appliance signatures identified between treatment and control households.
2. Comparing energy demand between treatment and control households to identify the time of day that the energy savings observed in treatment households occurs.