ATTACHMENT B

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Final Report on Southern California Gas Company's 2009 – 2010 High Efficiency Forced-Air Furnace Pilot

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Pilot Overview and Objectives

In its 2009 to 2011 Application SoCalGas proposed a pilot that would offer natural gas high-efficiency (HE) forced-air unit (FAU) furnaces to customers with high winter season space heating needs. The pilot was originally designed to target approximately 250 low-income homes with space heating usage at or above 300 therms during the winter season of November through March (winter season). The goal of the pilot was to replace an existing, inefficient operational natural gas FAU furnace, (defined as units with an Annual Fuel Utilization Efficiency (AFUE) rating of 65 or lower) with a new high-efficiency FAU furnace (with an AFUE rating ≥ 92). The replacement of these high-use inefficient FAU furnaces with the high-efficiency units would produce a lower bill for the customer and also provide long-term energy savings. Expected energy efficiency gains were estimated at 29% per FAU installed,[1] and anticipated energy savings were an average of 88 therms per customer during the 4 month winter season.

Pilot Implementation

Three existing SoCalGas LIEE contractors, Community Action Partnership (CAP) of San Bernardino, Reliable Energy Management Company (REMCO), and The East Los Angeles Community Union (TELACU) were selected for the pilot based on their ability to provide full HVAC services and who were already SoCalGas LIEE program contractors. These contractors had the ability to assess for, finance and install the required equipment on an accelerated timeline. Customers were selected to participate in the pilot based on the following criteria: 1) customers who already had an existing, working furnace; 2) customers who lived in single-family homes and customers who owned their home; 3) customers with space heating usage of 300 therms or above during the 2008-2009 winter season; and, 4) customers with furnaces that had an Annual Fuel Utilization Efficiency (AFUE) rating of 65 or lower.

Customer selection for the pilot followed the following process: First, an initial list of approximately LIEE customers that had received LIEE program services during 2008 was created. Customers were selected from this list in order to minimize the probability that other measures would be installed during the evaluation period. From the initial list of 9,000 customers, SoCalGas used the Customer Information System (CIS) to select customers with natural gas usage of 300 or more therms for the winter period This resulted in approximately 2,000 customers (out of the 9,000 on the initial list). SoCalGas then further analyzed these 2,000 customers to identify those who lived in a single-family home and also owned the property. The analysis produced a list of approximately 500 customers from which the pilot participants were recruited.

[1] In Advice Letter No. 3945 filed on January 5, 2009, SoCalGas stated that an energy efficiency gain of 42% was anticipated. However, it was subsequently realized that this was based on an incorrect calculation and the correct efficiency gain was 29.3%.

SoCalGas LIEE contractors contacted potential HE FAU pilot participants to attain customer approval and confirm their eligibility. Once participants were identified, SoCalGas LIEE contractors installed the higher-efficiency furnaces in accordance with the Commission adopted Statewide LIEE Policies and Procedures Manual and the Weatherization Installation Standards (WIS) manual.

After all installations were completed, SoCalGas LIEE contractor, Richard Heath Associates, inspected the furnaces, to ensure the new furnaces were installed correctly. SoCalGas LIEE contractors began installing the first of the HE FAU furnaces in August of 2009 and completed the last of the installations in December 2009. Of the 2,000 customers targeted for the pilot program, only fifty opted to participate.

Budget Spent vs. Authorized Budget

The average installation and equipment costs for each furnace were $2,680, resulting in total installation costs for the pilot of $109,834 for 50 customers. Table 1 shows the approved and expended pilot budget.

Table 1: Pilot Budget

Task	Approved Budget	Total Expenditures
Equipment cost	$625,000	$106,600
Installation cost	$100,000	$3,234
Total costs	$725,000	$109,834

Final Results of the Pilot

Although 50 installations were completed, only 41 HE FAU installations were used in the analysis. This was due to a lag in invoicing for 9 units related to administrative issues in paperwork and processing. The results of the analysis indicate that customers did see a reduction in gas consumption. Listed below are some of the challenges faced in getting customers to participate in the pilot.

- Customers identified for the pilot received services from a prior program year. Therefore the time between weatherization installation and the offering of furnace resulted in some customers being unwilling to participate in the program (legitimacy of the program was questioned).
- The original customer moved.
- The FAU had already been replaced.
- Phone number disconnected/no new number.
- The home was no longer owned by customer (bank owned).
- The contractor was unable to pull permits for the replacement unit due to existing code violations on the property.
- The FAU had an AFUE rating that was higher than 65 (maximum AFUE rating specified by the pilot guidelines).
- The home needed a new duct system before the FAU could be installed. Duct replacement is not currently an authorized LIEE measure.

Energy Savings

In order to isolate the effects of the new furnace, SoCalGas recruited pilot participants from homes that had been treated by the LIEE program in the previous year, and thus in 2009 they receive no other measures other than the furnace.

SoCalGas hired an independent consultant to conduct a billing analysis on the 41 participants to assess the therm savings. Two models were run: one that consisted of customer specific regressions and one that consisted of a fixed effects model. The averaged results are shown in Table 2 below. A complete description of the analysis is provided in Appendix A.

Table 2 : Summary of Billing Analysis Results

Model	Estimated Savings (therms) per Customer	Total Savings (therms)
Customer Specific	145.5	5,964.5
Customer Specific Estimates Used for Winter Months Only	125.4	5,143.2
Fixed Effects Estimates Used for Winter Months Only[2]	104.2	4,272.6

The results of this analysis suggest that significant therm savings resulted from the pilot.

Cost Effectiveness

A cost-effectiveness analysis was done for the pilot. The Modified Participant Test (MPT) with non-energy benefits, the Utility Cost Test (UCT) with non-energy benefits, and the Total Resource Cost Test (TRC) without non-energy benefits were calculated. The resulting benefit cost ratios are presented in Table 3. As shown, the measure passes the Commission-adopted[3] 0.25 threshold for cost effectiveness.

Table 3: Benefit Cost Ratios for SoCalGas Furnace Pilot

MPT	UCT	TRC
0.57	0.37	0.28

Recommendations

Based on the 41 observations, it appears that positive results can be expected for both therm savings and cost effectiveness. However, SoCalGas does not recommend that the HE FAU replacement be added to the LIEE furnace repair and replacement measure. This is due primarily to the recent development of newer and more energy efficient (95 AFUE) forced-air units and the phasing-out of the 92 AFUE units used in the pilot. Uncertainties around the cost of new 95 AFUE

[2] These estimates are based on weather sensitive usage only.

[3] D. 08-11-031, Ordering Paragraph 17.

FAU's and the availability of the units used in the pilot make it difficult if not impossible to determine the feasibility of HE FAU replacement as a full measure. Because high efficiency FAU's continue to increase in efficiency, SoCalGas would also need to continue to conduct cost-effectiveness tests to verify that new models would still be eligible for the LIEE program. Additionally, SoCalGas faced many unexpected obstacles (as outlined above) even though a diligent effort was made to find and provide customers with this service.

The SoCalGas LIEE group found 41 households in the fall of 2009 that had working space heat furnaces and replaced them with new furnaces. The 41 households participated in the 2008 LIEE program that provided building shell and water heating conservation measures. Monthly billing usage history was extracted from October 2008 through September 2010 to investigate the changes in monthly gas use when the new space heat furnace was installed. Using furnace installation date, billing history, and daily weather, several analyses were conducted to measure the therm impact of the new furnace. The results from these analyses revealed significant gas usage savings after the furnace was replaced. The analyses that were performed will be described in the remainder of this summary.

Pre/Post Period Usage Comparison

The first analysis performed was a simple pre/post usage comparison. Annual post installation use was compared to pre installation annual use. The results of this analysis are displayed in Table 1 below. On average, usage decreased by 208 therms per customer (970 therms pre compared to 762 post per customer). Most customers had 12 months of pre and post period usage but some had more pre period months than post period. To address that issue, normalized usage differences appear in the last column of Table 1. The normalized difference takes the total pre/post use divided by the number of months and then multiplied by the use per month by 12. The normalized savings drop to 76 therms per customer.

Table 1 Pre-Post Results Annual

BA_ID	pre_use	pre_hdd	post_use	post_hdd	Usage	HDD	Pre Period	Post Period	Normalized
	Total	Total	Total	Total	Diff	Diff	Months	Months	Diff
1	958	1166	766	1350	-192	184	12	12	-192
2	898	835	1038	865	140	30	12	12	140
3	924	2326	690	2547	-234	221	13	11	-100
4	1227	1298	920	1216	-307	-82	14	10	52
5	951	1165	837	1351	-114	186	12	12	-114
6	792	2283	691	2591	-101	308	12	12	-101
7	626	839	479	864	-147	25	13	11	-55
8	1284	1166	814	1350	-470	184	12	12	-470
9	927	2283	774	2589	-153	306	12	12	-153
10	760	1191	626	1325	-134	134	12	12	-134
11	1231	836	937	865	-294	29	12	12	-294
12	766	2283	585	2590	-181	307	12	12	-181
13	1072	1671	370	843	-702	-828	16	8	-249
14	771	2310	625	2563	-146	253	12	12	-146
15	1300	835	1408	865	108	30	11	13	-118
16	1321	836	1266	863	-55	27	12	12	-55
17	840	2283	815	2591	-25	308	12	12	-25

18	854	2287	900	2587	46	300	12	12	46
19	1472	1394	937	1120	-535	-274	15	9	72
20	970	2282	856	2589	-114	307	12	12	-114
21	1026	7569	562	5182	-464	-2387	15	9	-71
22	764	1163	690	1350	-74	187	12	12	-74
23	1117	1312	732	1201	-385	-111	16	9	138
24	988	2283	559	2591	-429	308	12	12	-429
25	1753	1490	789	1024	-964	-466	15	9	-350
26	773	836	602	863	-171	27	12	12	-171
27	1068	1177	566	1074	-502	-103	13	5	373
28	1098	1165	1001	1349	-97	184	12	12	-97
29	650	1433	578	1348	-72	-85	12	12	-72
30	962	841	1223	861	261	20	12	12	261
31	727	2336	707	2538	-20	202	13	10	177
32	1131	7709	670	5065	-461	-2644	15	9	-11
33	757	2330	516	2542	-241	212	13	11	-136
34	970	840	883	860	-87	20	13	11	68
35	729	840	529	860	-200	20	13	11	-96
36	996	1189	704	1324	-292	135	13	11	-151
37	814	835	779	864	-35	29	12	12	-35
38	737	1177	603	1336	-134	159	13	11	-22
39	886	1163	657	1348	-229	185	12	12	-229
40	1082	1202	803	1308	-279	106	14	10	36
41	791	2283	748	2590	-43	307	12	12	-43
Total	39,763	72,742	31,235	71,002	-8528	-1,740			-3,128
Per Customer	970	1,774	762	1,732	-208	-42			-76

The simple pre/post usage comparison was also conducted for just the winter months (November through March). Winter post installation use was compared to pre installation winter usage. The results of this analysis are shown in Table 2 below. On average, winter usage decreased by 144 therms per customer (660 therms pre compared to 512 post per customer). Most customers had 5 months of pre and post period winter month usage but some had more pre period months than post period. To address that issue, normalized usage differences appear in the last column of Table 2. The normalized difference takes the total pre/post use divided by the number of months and then multiplied by the use per month by 5. The normalized savings drop to 113 therms per customer.

Table 2 Pre-Post Results Winter Months

BA_ID	pre_use	pre_hdd	post_use	post_hdd	Usage	Hdd	Pre Period	Post Period	Normalized
	Winter	Winter	Winter	Winter	Diff	Diff	Months	Months	Diff
1	595	1081	464	1169	-131	88	5	5	-131
2	712	785	759	772	47	-13	5	5	47
3	560	2065	439	2205	-121	140	5	5	-121
4	754	963	699	1005	-55	42	4	4	-69
5	659	976	512	1019	-147	43	4	4	-184
6	528	1839	388	1877	-140	38	4	4	-175
7	521	766	359	751	-162	-15	5	5	-162
8	657	1081	434	1165	-223	84	5	5	-223
9	653	2034	536	2272	-117	238	5	5	-117
10	521	976	397	995	-124	19	4	4	-155
11	856	791	388	787	-468	-4	5	5	-468
12	612	2110	421	2212	-191	102	5	5	-191
13	700	1532	225	709	-475	-823	7	3	-125
14	636	2093	497	2289	-139	196	5	5	-139
15	667	705	624	670	-43	-35	4	4	-54
16	997	777	869	768	-128	-9	5	5	-128
17	637	2070	597	2210	-40	140	5	5	-40
18	522	1811	638	2252	116	441	4	5	-15
19	867	1257	593	968	-274	-289	6	4	19
20	771	2108	637	2272	-134	164	5	5	-134
21	749	5206	419	3857	-330	-1349	6	4	-100
22	627	1100	484	1164	-143	64	5	5	-143
23	632	967	565	1023	-67	56	4	4	-84
24	645	2105	410	2289	-235	184	5	5	-235
25	1127	1324	532	929	-595	-395	6	4	-274
26	619	777	463	768	-156	-9	5	5	-156
27	699	1074	505	1043	-194	-31	5	4	-68
28	763	1082	696	1165	-67	83	5	5	-67
29	523	1351	406	1177	-117	-174	5	5	-117
30	569	779	763	769	194	-10	5	5	194
31	502	2041	541	2237	39	196	5	5	39
32	856	5204	547	3738	-309	-1466	6	4	-30
33	493	2058	394	2194	-99	136	5	5	-99
34	606	790	619	766	13	-24	5	5	13
35	461	717	309	676	-152	-41	4	4	-190
36	780	1100	519	1166	-261	66	5	5	-261
37	590	789	533	773	-57	-16	5	5	-57
38	523	1074	459	1164	-64	90	5	5	-64

39	639	1081	427	1177	-212	96	5	5	-212
40	612	1073	532	1130	-80	57	5	5	-80
41	630	2065	568	2205	-62	140	5	5	-62
Total	27,070	61,577	21,167	59,777	-5903	-1,800			-4,617
Per Customer	660	1,502	516	1,458	144	-44			-113

Individual Customer Regression Models

The second analysis performed was estimating customer specific regression models. The dependent variable was monthly gas consumption (in therms). The independent variables included an intercept term, monthly heating degree days (Hdd) based on the starting and ending meter read dates, and an interaction with monthly Hdd and a post furnace installation indicator. It is expected that the intercept and monthly Hdd have positive coefficient values while the interaction with monthly Hdd and a post furnace installation indicator term have a negative value for each customer. Using 20 year average monthly Hdd values, pre and post installation annual consumption can be estimated using the regression coefficients. The results of this analysis are provided in Table 3 below. On average, usage decreased by 146 therms per customer (970 therms pre compared to 825 post per customer). These numbers are similar to the simple pre/post analysis where the savings per customer is between the simple and normalized savings. Besides the model coefficients, the f-statistic and the R-Squared value are included in the table. An R-Squared value close to 1 and an f-statistic value over 4 indicate that the model performed well. The coefficients have the expected signs for almost all the customers (seven customers did not have negative Hdd interacted with post installation indicator).

Table 3 Customer Specific Model Results Annual

BA_ID	f-Statistic	R-Squared	Intercept	post * hdd	Hdd	Est Pre Use	Est Post Use	post-pre
1	110.69	0.91336	41.3826	-0.14974	0.36885	1026.57	811.42	-215.149
2	219.18	0.95428	27.7061	0.09638	0.69375	991.59	1083.15	91.564
3	74.53	0.87651	38.3332	-0.06184	0.17466	878.35	730.24	-148.116
4	317.09	0.96795	22.0439	-0.06337	0.67192	1229.97	1138.91	-91.054
5	208.62	0.95208	26.1946	-0.14794	0.53939	1089.35	876.78	-212.563
6	298.55	0.96602	22.5269	-0.0726	0.23207	826.2	652.29	-173.905
7	100.61	0.9055	13.0901	-0.16447	0.54329	673.25	516.99	-156.26
8	13.06	0.55432	71.2182	-0.20288	0.2607	1229.21	937.71	-291.501
9	217.9	0.95403	28.9341	-0.07788	0.25005	946.14	759.61	-186.538
10	99.29	0.90436	18.9297	-0.12453	0.43335	849.81	670.88	-178.932
11	5.23	0.33269	57.9551	-0.67886	0.80544	1460.69	815.72	-644.967
12	1008.83	0.9897	14.8939	-0.09545	0.25354	786.02	557.4	-228.629
13	43.35	0.80501	31.7377	-0.12363	0.31518	833.71	656.07	-177.64
14	697.27	0.98516	10.9707	-0.08231	0.27638	793.65	596.48	-197.166
15	102.94	0.90744	82.3219	-0.05219	0.45427	1419.46	1369.87	-49.586

16	82.02	0.88651	50.3198	-0.07116	0.84143	1403.26	1335.65	-67.605
17	109.85	0.91276	18.351	-0.03265	0.26466	854.14	775.94	-78.205
18	285.44	0.96452	27.6464	0.00193	0.22341	866.89	871.5	4.614
19	228.21	0.95601	61.7489	-0.06349	0.39739	1311.98	1220.75	-91.223
20	192.19	0.9482	21.2397	-0.08036	0.31346	1005.7	813.21	-192.485
21	96.12	0.90152	-5.3416	-0.03883	0.15169	724.61	522.72	-201.889
22	179.7	0.94479	16.1039	-0.1395	0.49712	907.54	707.1	-200.435
23	175.22	0.94093	23.7235	-0.10282	0.5652	1096.79	949.05	-147.739
24	86.22	0.89144	31.6583	-0.11947	0.2252	919.31	633.14	-286.171
25	405.58	0.97476	53.325	-0.31526	0.64861	1571.85	1118.88	-452.973
26	122.81	0.92124	19.4597	-0.14918	0.60631	809.55	667.82	-141.736
27	148.91	0.95205	45.2621	-0.1249	0.4178	1143.46	964	-179.456
28	64.39	0.8598	40.4209	-0.07994	0.48546	1182.58	1067.71	-114.864
29	16.21	0.60695	15.1958	0.0112	0.27144	572.37	588.46	16.093
30	125.55	0.92282	57.1505	0.288	0.32575	995.29	1268.92	273.622
31	212.61	0.95508	24.4504	-0.00962	0.17803	719.83	696.8	-23.035
32	106.77	0.91047	-14.3553	-0.01689	0.17537	739.59	651.75	-87.843
33	84.44	0.88941	20.7548	-0.05855	0.18887	701.45	561.2	-140.25
34	88.32	0.89375	41.4951	0.03077	0.48645	960.1	989.33	29.234
35	208.8	0.95212	23.524	-0.16698	0.48865	746.54	587.9	-158.64
36	17.74	0.62822	20.7519	-0.22488	0.59034	1097.25	774.13	-323.115
37	129.5	0.925	30.5216	-0.05038	0.52914	868.98	821.12	-47.866
38	9.41	0.47251	30.0952	0.01372	0.23459	698.21	717.92	19.714
39	105.51	0.90949	26.1435	-0.2234	0.47929	1002.39	681.41	-320.985
40	151.23	0.93508	48.8809	-0.05795	0.31231	1035.31	952.04	-83.27
41	596.9	0.98271	11.8227	-0.04492	0.28104	815.04	707.44	-107.602
Total						39783.98	33819.41	-5964.552
Per Customer						970.3409	824.8636	-145.4768

As the case with the simple pre/post usage comparison, the coefficients estimated in the individual customer specific regression models were used to examine just the winter months (November through March). Winter post installation estimated use was compared to pre installation winter estimated usage. Results of this analysis are depicted in Table 4 below. On average, winter usage decreased by 125 therms per customer (672 therms pre compared to 547 post per customer). This value is between the estimates derived in the winter month pre/post usage analysis.

Table 4 Customer Specific Model Results Winter Months

BA_ID	f-Statistic	R-Squared	Intercep	post * hdd	hdd	Est Pre Use Winter	Est Post Use Winter	post-pre Winter
1	110.69	0.91336	41.3826	-0.14974	0.36885	660.82	476.553	-184.269

2	219.18	0.95428	27.7061	0.09638	0.69375	709.99	789.383	79.388
3	74.53	0.87651	38.3332	-0.06184	0.17466	564.79	432.689	-132.104
4	317.09	0.96795	22.0439	-0.06337	0.67192	937.09	859.106	-77.985
5	208.62	0.95208	26.1946	-0.14794	0.53939	794.75	612.694	-182.053
6	298.55	0.96602	22.5269	-0.0726	0.23207	608.42	453.311	-155.104
7	100.61	0.9055	13.0901	-0.16447	0.54329	512.98	377.497	-135.481
8	13.06	0.55432	71.2182	-0.20288	0.2607	676.92	427.254	-249.662
9	217.9	0.95403	28.9341	-0.07788	0.25005	678.85	512.483	-166.372
10	99.29	0.90436	18.9297	-0.12453	0.43335	627.94	474.687	-153.25
11	5.23	0.33269	57.9551	-0.67886	0.80544	953.24	394.044	-559.2
12	1008.83	0.9897	14.8939	-0.09545	0.25354	616.11	412.2	-203.912
13	43.35	0.80501	31.7377	-0.12363	0.31518	546.55	394.405	-152.144
14	697.27	0.98516	10.9707	-0.08231	0.27638	645.29	469.435	-175.85
15	102.94	0.90744	82.3219	-0.05219	0.45427	785.81	742.819	-42.992
16	82.02	0.88651	50.3198	-0.07116	0.84143	944.71	886.098	-58.615
17	109.85	0.91276	18.351	-0.03265	0.26466	657.15	587.399	-69.75
18	285.44	0.96452	27.6464	0.00193	0.22341	615.51	619.623	4.115
19	228.21	0.95601	61.7489	-0.06349	0.39739	797.78	719.65	-78.13
20	192.19	0.9482	21.2397	-0.08036	0.31346	775.85	604.172	-171.676
21	96.12	0.90152	-5.3416	-0.03883	0.15169	548.72	401.423	-147.295
22	179.7	0.94479	16.1039	-0.1395	0.49712	692.29	520.62	-171.667
23	175.22	0.94093	23.7235	-0.10282	0.5652	814.16	687.63	-126.534
24	86.22	0.89144	31.6583	-0.11947	0.2252	639.39	384.154	-255.233
25	405.58	0.97476	53.325	-0.31526	0.64861	1064.81	676.854	-387.957
26	122.81	0.92124	19.4597	-0.14918	0.60631	596.73	473.845	-122.888
27	148.91	0.95205	45.2621	-0.1249	0.4178	740.46	586.764	-153.698
28	64.39	0.8598	40.4209	-0.07994	0.48546	799.52	701.139	-98.378
29	16.21	0.60695	15.1958	0.0112	0.27144	410.02	423.801	13.783
30	125.55	0.92282	57.1505	0.288	0.32575	554.08	791.321	237.236
31	212.61	0.95508	24.4504	-0.00962	0.17803	502.58	482.035	-20.545
32	106.77	0.91047	-14.3553	-0.01689	0.17537	593.5	529.411	-64.088
33	84.44	0.88941	20.7548	-0.05855	0.18887	507.26	382.169	-125.087
34	88.32	0.89375	41.4951	0.03077	0.48645	608.18	633.524	25.346
35	208.8	0.95212	23.524	-0.16698	0.48865	520.13	382.59	-137.545
36	17.74	0.62822	20.7519	-0.22488	0.59034	830.24	553.501	-276.738
37	129.5	0.925	30.5216	-0.05038	0.52914	588.48	546.978	-41.501
38	9.41	0.47251	30.0952	0.01372	0.23459	439.16	456.045	16.884
39	105.51	0.90949	26.1435	-0.2234	0.47929	720.54	445.629	-274.914
40	151.23	0.93508	48.8809	-0.05795	0.31231	628.74	557.42	-71.318
41	596.9	0.98271	11.8227	-0.04492	0.28104	659.51	563.535	-95.97
Total						27569.05	22425.89	-5143.153
Per Customer						672.4158	546.9729	-125.4427

Fixed-Effects Regression Model

The final analysis performed was estimating a single regression model for all customers. The dependent variable was monthly gas consumption (in therms). The independent variables included customer specific intercept terms, monthly heating degree days (Hdd) based on the starting and ending meter read dates, and an interaction with monthly Hdd and a post furnace installation indicator. Estimating customer specific intercepts is known as a fixed-effects model. This technique is useful in examining post implementation usage when detailed information regarding the characteristics of each customer is unknown. The regression results provide just an overall f-statistic for the individual intercept terms. It is expected that the monthly Hdd term will have a positive coefficient values while the interaction with monthly Hdd and a post furnace installation indicator term have a negative value. The model R-Square is .69457 and the F-Statistic is 50.62. The overall F-Statistic for the individual customer intercept terms is 7.67. The Hdd and Hdd interacted with the post installation indicator both have the expected signs and significant (38.75 t-statistic for Hdd and –8.43 t-statistic for the interaction of Hdd with post installation). The resulting coefficient on the Hdd term was 0.284884 and the resulting coefficient on the interaction term was -0.068492. The post installation interaction with Hdd term coefficient value indicates that 24 percent of the Hdd related usage is saved with the new furnace.

Using 20 year average monthly Hdd values, pre and post installation winter months consumption based on just the weather terms can be estimated using the regression coefficients. This gives an estimate of savings based on weather sensitive usage only. Total savings using this method was 4,272.6 therms and average per customer savings was 104.2 therms. On average, usage decreased by 104 therms in the winter months per customer (433 therms pre compared to 329 post per customer). This number is a little smaller than the individual customer model winter number.

All three analyses showed savings from installing a new furnace to these 41 LIEE customers. The regression model approaches seem to produce the most robust results from a statistical standpoint. Policy makers can be assured when working furnaces are replaced in the LIEE program, significant savings will result.