Central Hudson Gas & Electric Corporation

Residential Electric HVAC: Impact Evaluation Summary

Evaluation Conducted by: Applied Energy Group (AEG), DATE: November 2015

PROGRAM SUMMARY

The objective of the Residential Electric HVAC Program is to replace residential electric heating and cooling systems with energy efficient systems. The program offers residential electric customers rebate incentives to purchase energy efficient HVAC systems, including central air conditioners and air-source heat pumps. The program also offers incentives for additional HVAC measures including electronically commutated motor (ECM) furnace fans, water heaters, and programmable thermostats. Per program rules, other measures such as ECM furnace fans must be installed with another qualifying HVAC system. The table below shows the rebate levels for each measure offered through the program.

Measure	Rebate
Central Air Conditioners	
Tier 1, SEER ≥ 15; EER ≥ 12.5	$100
Tier 2, SEER ≥ 16; EER ≥ 13	$300
Air-Source Heat Pumps	
Tier 1, SEER ≥ 15; EER ≥ 12; HSPF ≥ 8.5	$350
Tier 2, SEER ≥ 16; EER ≥ 13; HSPF ≥ 9	$500
Other Measures	
ECM Fan	$200
Heat Pump Water Heater	$400
Programmable Thermostat	$25
Air Sealing	$100/hour, Up to 6 hours

EVALUATION OBJECTIVE AND HIGH LEVEL FINDINGS

Applied Energy Group (AEG), an independent evaluation contractor, designed the 2010-2011 impact evaluation to estimate the electric savings attributable to the program. AEG performed the following tasks to determine the impacts of the program:

- Reviewed program tracking database to verify ex post savings with an engineering analysis.
- Surveyed participants to verify program participation and assess the influences of free ridership and spillover.
- Conducted a statistical billing analysis to identify changes in billed energy usage with a fixed effects regression analysis.

Overall a total of 2,338 eligible measures were installed in 1,325 customer households from 2010 through 2011. AEG determined that the program resulted in a total net savings of 1,305,306 kWh and 443 kW for the ex post analysis.

In July 2012, AEG conducted a survey of 69 randomly selected program participants to evaluate the effects of free ridership and spillover at a 90/10 level of confidence and precision. AEG determined that the NTG factor for the program was 87 percent, which includes both free ridership and spillover estimates.

DETAILED IMPACT EVALUATION FINDINGS

AEG performed an ex post engineering analysis using program tracking data obtained from Central Hudson. Savings were estimated using algorithms from the *2010 New York Standard Approach Manual for Estimating Energy Savings from Energy Efficiency Programs*. The program tracking data formed the basis of engineering algorithm inputs. The table below shows the net energy and demand savings for each measure along with the overall program.

Measure	Measures	kWh/Unit	kW/Unit	Total kWh	Total kW
Central Air Conditioning Tier 1	43	215	0.29	9,251	12
Central Air Conditioning Tier 2	610	224	0.34	136,786	204
Central Air Source Heat Pump Tier 1	356	630	0.23	224,107	81
Central Air Source Heat Pump Tier 2	207	1,001	0.33	207,283	68
Air Sealing	30	61	0.03	1,830	1
ECM Furnace Fan	208	640	-	133,194	-
Heat Pump Water Heater	173	2,775	0.44	480,012	76
Programmable Thermostat*	637	177	-	112,844	-
Total Program				1,305,306	443

* Thermostat savings are shown per account not per measure according to Tech Manual guidance. As a result, the table total does not match the total eligible measures.

Heat pump water heaters account for a significant portion of overall energy savings (37%), followed by heat pump HVAC systems (33%) and central air conditioners (11%).

AEG compared the results of the ex post engineering analysis to the year-end monthly Scorecards submitted to DPS. AEG determined that the program resulted in a net realization rate of 97 percent, provided in the table below.

Savings Type	Gross kWh	Net kWh
Scorecard Savings	1,489,829	1,340,846
Ex Post	1,494,155	1,305,306
RR	100%	97%

In addition to the engineering analysis, AEG performed a separate billing analysis using a fixed effects regression model for various measure combinations based on the program tracking data. Measures were grouped according to the customer rebates identified in the program tracking data. Results of the billing analysis show that four measure combinations have positive savings

values, including: Central AC with a Fan, Central AC with a Thermostat and a Furnace Fan, Furnace Fan, and Water Heater. The table below shows the billing analysis results for single measures as well as the measures groups.

Measure Group	Annual Savings (kWh)
CAC	-577
CAC Fan	2,105
CAC Therm.	-143
CAC Therm. Fan	256
Heat Pump	-490
HP Fan	-2681
HP Therm.	-751
HP Therm. Fan	-71
Air Seal	-5
Furnace Fan	542
Water Heater	179

Many factors may have contributed to the negative savings for the remaining seven measure groups. Investigation into the rebate applications revealed that fuel-switching to electric from natural gas or fuel oil offers a likely explanation for the negative savings. Other possible explanations include first-time buyers of HVAC systems and an increase in energy consumption from replacing an older system with a new, fully functional system. Overall, however, AEG was unable to conclusively explain the occurrence of negative savings for these measure groups. As a result it was decided not to rely on the billing analysis for claimed program savings.

EVALUATION METHODS AND SAMPLING

In July 2012, AEG conducted a survey of 69 randomly selected program participants to evaluate the effects of free ridership and spillover. Results of the survey are statistically significant at the 90 percent confidence level and a margin of error of +/- 10 percent.

Free ridership refers to those participants who would have installed the efficient measures without the program influence. Responses to the free ridership questions were assigned a probability suggesting that the respondent was a free rider. Spillover refers to additional savings achieved as a result of the program, but that were not directly incentivized through the program. The spillover factor is calculated as the ratio of net spillover savings to gross savings of the participant sample.

Using this methodology, AEG estimated that 30% of savings achieved by the program were attributable to free ridership. However, survey responses showed that participants also engaged in energy efficient actions beyond those that were incentivized through the program. As a result, AEG estimated that an additional 17% of savings can be attributed to spillover. Taken together, AEG determined that the overall NTG factor for the program was 87%.