NYSEG and RG&E

Residential Gas HVAC Program Evaluation Report

Program Years 2009 – 2011

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New York State Electric & Gas (NYSEG) and Rochester Gas and Electric (RG&E) Residential Natural Gas Equipment Rebate Program

Process Evaluation Summary

Evaluation Conducted by: DNV KEMA, 2011-2013

PROGRAM SUMMARY

The NYSEG/RG&E Residential Natural Gas Equipment Rebate Program provides rebates to eligible natural gas customers to encourage the purchase of energy-efficiency equipment. The program provides rebates for high efficiency furnaces and boilers as well as indirect water heaters, boiler reset controls, and programmable thermostats. A network of HVAC trade allies plays a key role in promoting these rebates.

EVALUATION OBJECTIVE AND HIGH LEVEL FINDINGS

The objectives of the process evaluation included:

- Identifying ways to increase participation in the program through improved marketing and outreach efforts;
- Measuring satisfaction with the program from the perspectives of both participating customers and participating HVAC contractors;
- Learning of ways to improve program delivery; and
- Gaining a better understanding of the decision-making process of customers who purchase natural gas equipment and the role of the HVAC contractor in this purchase decision.

The process evaluation covered the 2009-2011 program years and included surveys with 550 program participants and interviews with 36 HVAC contractors and distributors.

Key evaluation findings include:

- *Participant satisfaction with the program was generally very high, with the exception of the program rebate application forms.* Ninety-three percent of the program participants were satisfied with the program as a whole and the levels of satisfaction with the rebate amounts and the timeliness of the rebates were above 80 percent. The lowest level of participant satisfaction (74%) was with the rebate application forms. Participants cited a variety of reasons for their dissatisfaction including the forms being complicated/confusing and too lengthy.
- *Participants were much more likely to suggest advertising as a way to increase program participation than increasing rebate levels.* We asked the participants what RG&E and NYSEG could do to get more people to participate in the rebate program. The most common suggestion, by far, was that the program should do more advertising and building of customer awareness (45% of respondents) followed by increasing program rebate levels (14%). Increasing program marketing was also the most frequent recommendation from the participating HVAC contractors for improving the program.
- *The effectiveness of program marketing channels varied, to a statistically-significant degree, depending on the demographics of the participants.* Radio and television ads were more successful in reaching less

educated customers. Newspapers were more successful in reaching seniors and more educated customers. Utility mailings and the utility website were more successful with higher-income customers.

- *Low-income customers, who could benefit the most from this program, were least aware of its benefits:* Unfortunately the lower-income consumers who could benefit the most from the program rebates and lower heating bills were less likely than their higher-income counterparts to be aware of the program, the rebates or the potential for heating bill savings.

- *HVAC contractors were very important in both building program awareness and influencing the equipment purchase decisions.* About half of the respondents said that their HVAC contractor was their first source of program information and also their most influential source of program information. We asked the program participants a lot of detailed questions about their HVAC equipment purchase experience. Based on their survey responses, we determined that 84 percent of participants were influenced to some degree by their HVAC contractor in their equipment purchase decision.
- *Federal tax credits were a driver of furnace/boiler replacement:* The HVAC distributors estimated, on average, that 79 percent of their high efficiency equipment sales/installations were receiving the federal tax credit. The contactors, on average, estimated that 50 percent of their high efficiency equipment sales/installations were receiving the credit.

- *Most participants are not replacing their furnace/boiler due to breakdown:* The evaluators assumed that since a furnace or a boiler is a very expensive purchase, especially in the context of the current economic downturn, most of the existing furnaces or boilers would have either been completely inoperable or "on their last legs." Yet only 10 percent of the participants said that the furnace/boiler which was replaced was "not operating at all" and only a third said that their furnace/boiler was "operating but with significant performance problems." Over half of the respondents (55%) said that their furnace/boiler was still operating well, although the majority of these said that their furnace/boiler was old enough for replacement. The federal tax credits likely encouraged some of this early equipment replacement.

- *Awareness of and reaction to new federal requirements:* We asked the HVAC trade allies whether they were aware of pending federal requirements that would increase the minimum AFUE of furnaces/boilers and what they thought would be the impact of these new requirements on the HVAC market. Forty-eight percent of the interviewees were aware of the coming federal standards. Some welcomed the new standards as a way to even the playing field with competition which sells less-expensive lower-efficiency equipment. Yet others were concerned about the challenges of installing high-AFUE equipment in the tight spaces frequently found in condominiums, apartments, or townhouses. Still others thought that the greater costs of the higher-efficiency equipment would hurt future sales and burden those with lower incomes.

EVALUATION RECOMMENDATIONS AND PROGRAM ADMINISTRATOR RESPONSE

The following recommendations were made by the evaluators conducting this study. NYSEG's and RG&E's initial response to these recommendations is also summarized below and will be tracked over time.

- **Recommendation 1:** ***The program needs to increase its marketing and outreach efforts including offering funding for co-operative marketing efforts.*** When we asked the program participants for recommendations on how the program might increase participation, the most-cited suggestion, by far (45% of participants) was for the program to do more marketing and build consumer awareness. The second-most-cited suggestion – increasing rebate levels – was only cited by 14 percent of participants. In addition, when we asked the HVAC contractors and distributors how satisfied they were with various aspects of the program, their satisfaction levels were lowest (only 31% satisfied) with the program's marketing efforts. When we asked these trade allies for suggestions on ways to improve the program, doing more marketing and outreach was the most-cited recommendation. The trade allies had some useful suggestions for increase program awareness including:

    - *Funding co-op marketing efforts:* A few of the trade allies mentioned how NYSERDA currently funds 50 percent of the costs of a co-branded effort to promote high efficiency furnaces and boilers and how they wished that the NYSEG/RG&E program offered something similar. Some suggested that equipment manufacturers could also be asked to contribute a share of this marketing funding.

    - *Producing a program fact sheet:* One contractor requested that the program provide contractors with a simple document that contains all the program information (e.g., requirements, eligible equipment, etc.) that they could hand out to customers.

    - *Providing website information on the life-cycle benefits of EE equipment:* One contractor suggested providing information on the program website that explains/compares the life-cycle costs of an energy-efficient furnace/boiler with a standard efficiency model.

    - *Doing more upstream outreach:* A couple of contractors suggested that more should be done to build awareness of the program among HVAC equipment manufacturers and distributors.

Response to Recommendation 1: Agree except *disagree with recommendation for cooperative marketing; budget does not permit.

- **Recommendation 2:** ***The program should continue to use a diversity of marketing channels.*** The participant survey results revealed that different types of program marketing reached different parts of the RG&E/NYSEG customer base. Of the types of marketing methods used by the program:

    - Radio and television ads were more successful in reaching less educated customers, in reaching customers during the 2010-2011 program year (vs. the 2009-2010 program year), and in reaching RG&E customers (vs. NYSEG customers).

    - Newspapers were more successful in reaching seniors and more educated customers vs. their younger and less-educated counterparts.

    - Utility mailings and the utility website were more successful with higher-income customers.

Response to Recommendation 2: RFP being developed to add cross promotion of all EEPS programs.

- **Recommendation 3:** ***The program should develop a customized strategy and marketing collateral for getting greater program penetration in the condominium and multifamily market.*** A couple of contractors claimed that the program was not doing enough to increase its presence in the condominium and multifamily market. At the same time many noted that it can be difficult to install some of the higher AFUE equipment in some condominiums, town houses, and apartments due to tighter spaces and the need for extra venting/piping. We would recommend that the NYSEG/RG&E program develop marketing materials that were customized to this market. The materials would be targeted at owners of condos, townhomes, and apartments (either for direct mail or distribution to contractors) and would not only promote the program but would be upfront about the special structural challenges these types of housing sometimes pose for the installation of higher efficiency furnaces.

Response to Recommendation 3: RFP being developed to cross promote EEPS programs to all residential sectors.

- **Recommendation 4:** ***The program should do more promotion of the rebate reservation system to contractors.*** The rebate reservation system received high satisfaction ratings from those contractors who were familiar with it. These contractors said that the system was very helpful in being able to confirm to customers they would receive their rebate. However, since a number of contractors and distributors indicated unfamiliarity with the system, it would likely benefit the program to do more promotion of this system.

Response to Recommendation 4: Already implemented at time of report.

- **Recommendation 5:** ***The program should consider offering larger rebates for the equipment with higher AFUE ratings.*** Ninety-three percent of the participating HVAC contractors and most of the HVAC distributors reported that the program was either "very effective" or "effective" in encouraging trade allies to sell more energy efficient gas heating equipment. However, when recommending ways to improve the program, the second-most common recommendation was to focus program rebates on the equipment with the highest AFUE ratings. "Rather than offering so many rebates, they should increase the incentives -- quantity vs. quality," said one contractor. "The size has to be substantial enough to motivate." Another contractor recommended that the program offer a "tiered" rebate for 97% AFUE furnaces.

Response to Recommendation 5: Already implemented at time of report.

EVALUATION METHODS AND SAMPLING

The evaluation team designed a sampling plan for the program participants that was broadly representative of the participant population with some oversampling of participants who received the less common measures (duct sealing, boiler reset controls, and indirect water heaters). The purpose of the

oversampling of the less common measures was to provide the evaluators with the necessary diversity of participant types to examine all aspects of program participation.

Table 1shows this sampling plan including a listing of the variables used to differentiate the participant strata, the populations of these strata, and the target number of completed surveys. Table 2 shows the actual number of surveys we completed and how these were distributed among the various participant strata. The table shows that we are able to successfully meet our overall target and almost all of our strata targets.

Table 1
Participant Sample Population as of July 2011
and Target # of Completed Surveys

Stratum	Sampling Measure Type	Billing Analysis Period	Prog. Tstat	Sample Population		Target Completes	
				N	Percent	n	Percent
1	Duct Sealing*	N/A	N/A	23	0%	20	4%
2	Boiler Reset Control*	N/A	N/A	27	0%		
3	Indirect Water Heater*	N/A	N/A	295	3%	50	9%
4	Boiler	Yes	Yes	229	2%	30	5%
5	Boiler	Yes	No	330	3%	40	7%
6	Furnace	Yes	Yes	4,193	39%	190	35%
7	Furnace	Yes	No	1,412	13%	70	13%
8	Boiler	No	Yes	102	1%	5	1%
9	Boiler	No	No	149	1%	5	1%
10	Furnace	No	Yes	2,944	27%	100	18%
11	Furnace	No	No	1,168	11%	40	7%
Total				**10,872**	**100%**	**550**	**100%**

Notes: “Prog. Tstat” is an abbreviation for a programmable thermostat. *Participants in the duct sealing, boiler reset control, and indirect water heater strata also had boilers or furnaces installed.

Table 2
Final Disposition (Completed Surveys vs. Targets)

	Sample Population		Target Completes		Final Disposition	
Stratum	N	Percent	N	Percent	n	Percent
1	23	0%	23	~2%	17	3%
2	27	0%	27	~2%		
3	295	3%	50	9%	50	9%
4	229	2%	30	5%	30	5%
5	330	3%	40	7%	40	7%
6	4,193	39%	190	35%	190	35%
7	1,412	13%	70	13%	70	13%
8	102	1%	5	1%	6	1%
9	149	1%	5	1%	5	1%
10	2,944	27%	100	18%	102	19%
11	1,168	11%	40	7%	40	7%
Total	**10,872**	**100%**	**550**	**100%**	**550**	**100%**

Notes: "Prog. Tstat" is an abbreviation for a programmable thermostat. *Participants in the duct sealing, boiler reset control, and indirect water heater strata also had boilers or furnaces installed.

The evaluators developed the sample frame of participating HVAC contractors from the NYSEG/RG&E tracking database. The sample frame of participating HVAC contractors was 1,193 contractors after removal of HVAC contractors who did not have contact information in the tracking database. The evaluators then stratified this sample frame into small, medium and large strata with each stratum accounting for about a third of the total measures installed in the tracking database.

The evaluators used the following steps to create the sample frame for the distributors and nonparticipating HVAC contractors:

- Review service territories covered by NYSEG and RG&E. The evaluators divided the New York State counties into four categories: 1) the NYSEG service territory and any bordering counties; 2) the RG&E service territory and any bordering counties; 3) Both NYSEG and RG&E territories and bordering counties; and 4) All other counties.
- Develop list of HVAC distributors. The sample frame of HVAC distributors was obtained in two ways: 1) A list of 70 businesses was obtained from Dun and Bradstreet using the relevant SIC codes. 2) An additional list of businesses was obtained from HVAC contractors we interviewed who identified distributors supplying them with HVAC equipment (n=10).
- Develop list of HVAC contractors. The evaluators obtained a list of 3,284 businesses from Dun and Bradstreet using relevant NAICS and SIC codes.
- Identify small, medium and large businesses. The number of employees was used to determine business size categories for contractors and distributors.

New York State Electric & Gas (NYSEG) and Rochester Gas and Electric (RG&E) Residential Natural Gas Equipment Rebate Program

Impact Evaluation Summary

Evaluation Conducted by: DNV KEMA, 2011-2013

PROGRAM SUMMARY

The NYSEG/RG&E Residential Natural Gas Equipment Rebate Program provides rebates to eligible natural gas customers to encourage the purchase of energy-efficiency equipment. The program provides rebates for high efficiency furnaces and boilers as well as indirect water heaters, boiler reset controls, and programmable thermostats. A network of HVAC trade allies plays a key role in promoting these rebates.

EVALUATION OBJECTIVE AND HIGH LEVEL FINDINGS

The objectives of the impact evaluation included:

- Estimating energy savings for the program using a billing analysis methodology;
- Estimating realization rates for the program;
- Estimating net-to-gross ratios for the program;;
- Reviewing program tracking databases to check that the appropriate energy savings assumptions are being applied; and
- Reviewing the algorithms for estimating energy savings for residential natural gas equipment in the New York State Technical Reference Manual (TRM).[1]

The billing analysis used billing data and tracking data from 4,822 participants from the 2009-2010 program years. The net-to-gross analysis used responses from a survey of 550 participants from the 2010-2011 program years as well as interviews with 36 HVAC contractors and distributors who operate in upstate New York. The engineering analysis reviewed program tracking data from the 2009-2011program years.

Key evaluation findings include:

Billing Analysis Results

Table 1 shows our final estimates of savings for the primary measures rebated by the program. These savings estimates include any savings from thermostats that were installed at the same time. The majority of heating units were installed accompanied with a new thermostat installed. This also means that the effective estimate of thermostat savings, separate from these measures, is zero.

[1] The official title of the manual is the *New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs*. Prepared for the New York Department of Public Service by the New York Evaluation Advisory Contractor Team. October 15, 2010.

Table 1
Final, Adjusted, per Measure Savings

Savings Type	Savings Estimate (Annual Therms/ Participant)	Adjustment	Savings
Boilers	225	69%	156
Furnaces without ECM	139	92%	128
Furnaces with ECM	139	94%	131

Table 2combines the measure counts from the tracking data to produce an overall program heating savings estimate for 2009-2010. Energy savings estimates for duct sealing, boiler reset control, and indirect water heaters are not included in these estimates. DNV KEMA was unable to produce savings estimates for these measures. There were too few participants for the first two measures to even include them in the billing models. An indirect water heater estimate was attempted but was not statistically significant. However, these measures were very infrequent in the program and therefore represent only a small fraction of expected savings.

Table 2
Program Savings for Boilers and Furnaces

Measure	Accounts	Installed Measures	Total Savings (1000 Therms)
Boiler	1,124	1,229	191.6
Furnace,	2,061	2,162	276.5
Furnace w/ ECM	7,705	8,058	1,056.3

Table 3 provides Equivalent Full Load Hours (EFLH) estimates which were derived from the post-installation usage. These estimates represent the number of full hours a furnace or boiler would need to run, given the average efficiency, capacity and consumption during the post-installation period.

Table 3
EFLH Estimates

Measure Type	Equivalent Full Load Hours
Boilers	800
Furnaces without ECM	858
Furnaces with ECM	911

It is important to note that a large majority of the participating customers had new programmable thermostats installed in conjunction with the installation of their energy-efficient furnaces or boilers. We were not able to disentangle the separate savings impacts of these programmable thermostats from the energy-efficient furnaces or boilers.

Realization Rates

Table 4 provides the realization rates for the three measures with savings estimates. The TRM savings include thermostat savings for those installations that included thermostats. If thermostats contribute to the measured savings then these realization rates are appropriate if the proportion of thermostat installations remains similar in future program years. Because this analysis does not distinguish thermostat savings from heating measure savings, it is impossible to give separate realization rates for these.

Table 4
Measure-level Realization Rates, Thermostats Included

Savings Type	Estimated Savings	Full TRM savings	Realization Rate
Boilers	156	356	0.44
Furnaces without ECM	128	246	0.52
Furnaces with ECM	131	284	0.46

Net-to-Gross Analysis

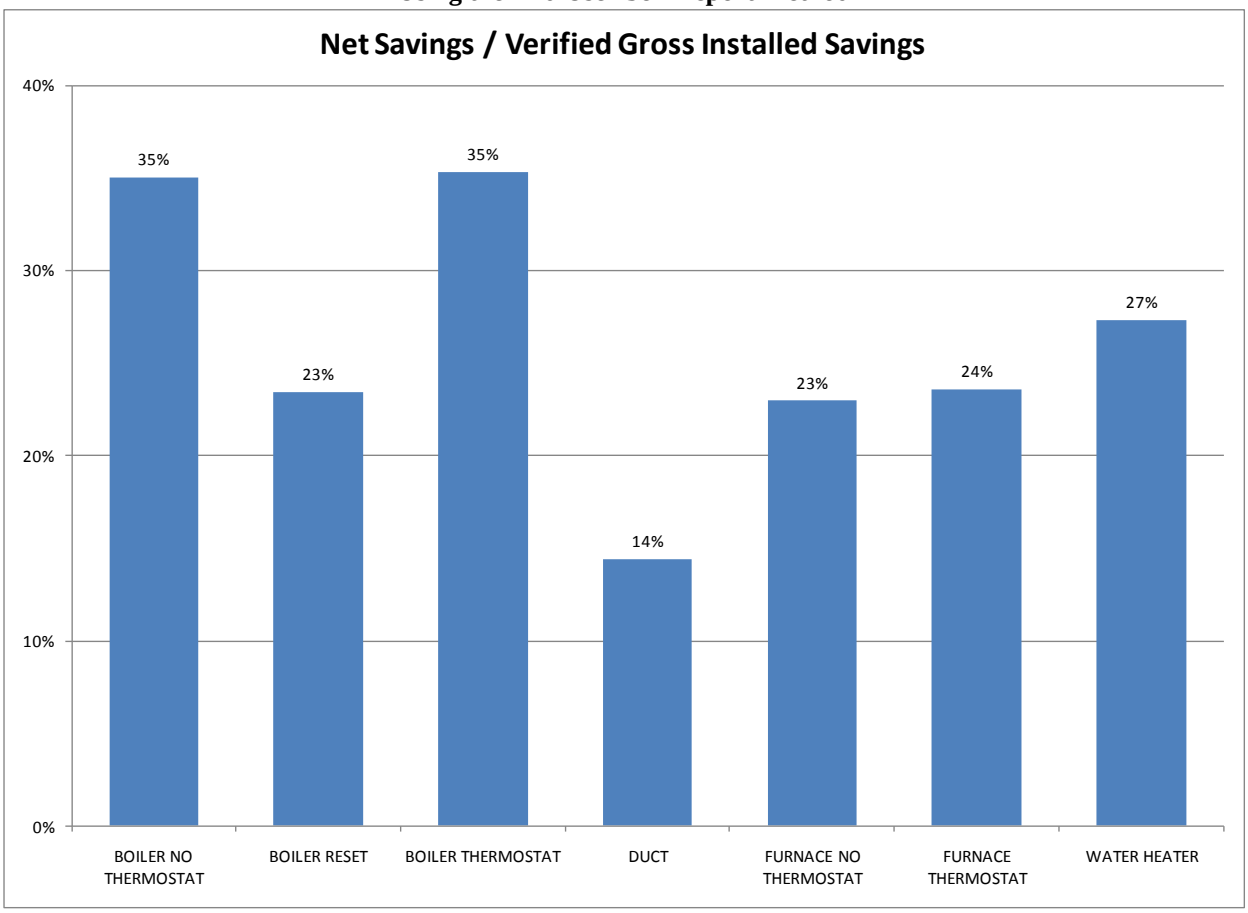
We used two analytical methods to estimate the net-to-gross ratios for this program.

1. *End user self-report method:* This method attempts to measure the direct influence of the program – e.g., the influence of the program rebate and information -- on the energy savings achieved. This method attempts to measure the influence of the rebate on four different attributes of the decision to install energy-efficient measures: 1) the likelihood of installing the energy-efficient measure; 2) the energy efficiency of the measures installed; 3) the timing of the measure installations; and 4) the quantity of measures installed.

2. *Supplier influence method:* This method assumes that the program's influence extends beyond the rebate to the kind of equipment recommendations that the HVAC contractors are making. Therefore participants who said they went with the higher efficiency equipment because their contractors recommended it may be unconsciously experiencing indirect program influence to the extent that these recommendations were program-influenced.

Figure 1 shows the net-to-gross ratios, by equipment type, that we estimated using the end user self report net-to-gross method.

Figure 1
The Net-to-Gross Ratios by Equipment Type
Using the End User Self Report Method



A summary of our findings from the supplier influence net-to-gross method include:

- *There was evidence that a large majority of the program participants were influenced in their equipment purchase decision by their HVAC contractor:* Eighty-four percent of program participants were deemed to be supplier-influenced based on their survey responses.

- *There was evidence that the participating HVAC contractors were more likely to be recommending the high efficiency equipment than the nonparticipating contractors and that this was driven by program rebates*.

- *Yet, on average, the participating HVAC contractors reported no increase in the sales penetration of their sales of 94%+ AFUE furnaces over the last two years. There was evidence that the large federal tax credit for high efficiency furnaces had a significant impact on the market for high efficiency equipment and therefore likely dwarfed and masked normal program influences on high efficiency sales.*

- *On average there was no difference between the participating and nonparticipating HVAC contractors in the sales penetration of their sales of 94%+ AFUE furnaces in the current period. In the past period the participating HVAC contractors had only a slightly higher level of sales penetration of these high efficiency furnaces than their nonparticipating counterparts.* Likely factors that would explain why there was not a bigger difference between the participating and nonparticipating contractors included the impacts of the federal tax credits, evidence that some of the nonparticipating contractors have been using rebates from other programs, and indications of a growth in general consumer demand for energy-efficient products.

- *There was some limited evidence of market effects and program spillover:*

- *While the supplier influence net-to-gross method found evidence that the HVAC contractors were influencing consumer equipment choices and that the program was increasing the frequency with which participating contractors were promoting high efficiency equipment, we could not quantify these program effects due to the distorting effects of the federal tax credit.*

The findings from the engineering analysis are discussed in the recommendations section of this report.

EVALUATION RECOMMENDATIONS AND PROGRAM ADMINISTRATOR RESPONSE

The following recommendations were made by the evaluators conducting this study. NYSEG's and RG&E's initial response to these recommendations is also summarized below and will be tracked over time.

- **Recommendation 1:** ***The program should adopt the results from the DNV KEMA billing analysis as the updated energy savings for furnaces and boilers.*** The engineering analysis observed that the DNV KEMA billing analysis provided energy savings estimates for furnaces that are similar to those estimated by most state/regional Technical Reference Manuals (TRMs) and similar to those found by the HEHE analysis in Massachusetts. The DNV KEMA billing analysis found boiler savings that were higher than most TRMs, though comparable to the HEHE analysis results for high efficiency boilers. The engineering analysis concludes that these higher DNV KEMA boiler savings estimates were reasonable given the high average efficiency of boilers installed under the RG&E/NYSEG program and the fact that in some cases the billing analysis estimates included energy savings from indirect water heaters (which could not be disentangled from the boilers in the analysis).

Response to Recommendation 1: Final decision on changes to the Tec Manual must be made by the IAG.

- **Recommendation 2:** ***The program should stop claiming separate savings for indirect water heaters installed as part of a new boiler system, and use the results of the DNV KEMA billing analysis which roll savings for indirect water heaters in with boiler savings.*** The billing analysis done for this evaluation did not provide enough information to justify a claim for independent savings for indirect water heaters. In addition, from a design perspective, indirect water heaters have the major issue of increased gas usage during the non-heating season. The type of billing analysis used for furnace/boiler replacement, such as DNV KEMA's for this evaluation, or the GasNetworks

analysis, rely on a weather-based model that often misses additional usage or savings from the non-heating season. Without a reputable source that includes summer water heating usage, DNV KEMA cannot recommend a savings estimate for indirect water heaters at this time. The engineering analysis also found that the calculation method outlined in the 2010 New York TRM for indirect water heaters was excessively complicated, contained two errors, and was never put into effect.

Response to Recommendation 2: Final decision on changes to the Tec Manual must be made by the IAG.

- **Recommendation 3:** ***The program should stop claiming separate savings for setback thermostats installed along with a new furnace or boiler, and use the results of the DNV KEMA billing analysis which roll savings for setback thermostats in with furnace /boiler savings.*** The New York TRM and many other state/regional TRMs rely on the same 2007 GasNetworks billing analysis for their savings estimates for setback thermostats. However, several issues call into question the accuracy and applicability of the saving estimates from this 2007 study. First other studies covered by our literature review did not find any savings for this measure. Second the GasNetworks study did not account for possible self selection effects. The GasNetworks study looked at customers who had independently purchased a programmable thermostat (as opposed to having one installed in conjunction with a new furnace or boiler, which is how all the NYSEG/RG&E program participants obtained theirs). It is reasonable to assume that customers who independently purchase a programmable thermostat are likely more energy-conscious to begin with than those who do not seek such thermostats. The GasNetworks analysis also was not accounting for any interactive effects, such as takeback, between the setback thermostats and the new furnace/boiler. However, the NYSEG/RG&E program must account for these interactive effects. Finally, since the 2007 GasNetworks study, setback thermostats have become more commonly installed. For example, the percentage of NYSEG/RG&E participants who reported replacing a setback thermostat with a setback thermostat increased from 49 percent for the 2009-2010 program participants to 59 percent for the 2010-2011 program participants.

  Response to Recommendation 3: Final decision on changes to the Tec Manual must be made by the IAG.

- **Recommendation 4:** ***While the end user self-report net-to-gross method was the only one we used that was able to produce net-to-gross ratios, we do not recommend that these be applied to the program's gross savings because they likely underestimate the influence of the program on the decisions to purchase high efficiency equipment.*** Our survey evidence shows that HVAC contractors exert a great deal of influence in the equipment purchase decision and that there was a link between whether a contractor participated in the NYSEG/RG&E program and the frequency with which they were recommending the high efficiency equipment. However, due to the confounding effects of the federal tax credits, we were unable to quantify these likely program effects..

  Response to Recommendation 4: Final decision on changes to the Tec Manual must be made by the IAG.

EVALUATION METHODS AND SAMPLING

The billing analysis used bimonthly billing data that covered the pre- and post-installation periods. The billing analysis estimated the average change in consumption from the pre- to the post-installation periods. This estimated change in consumption is an unadjusted savings estimate that captures the change from replacing an existing system with a new, high-efficiency unit. The unadjusted savings estimate was adjusted on an aggregate basis to produce a final adjusted savings estimate that reflects the estimated savings relative to a standard-efficiency installation.

DNV KEMA used a fixed-effects model to perform the billing analysis. The primary advantage of the fixed effects model approach is that it controls for all unmeasured characteristics of the program participants, so long as those characteristics do not change over time. For the characteristics that change over time, time-effects intercepts account for time trends not explained by other variables. Compared to the common site-level, PRISM-type approach, the fixed effect approach avoids the necessity of a control group while still controlling general trends affecting consumption levels. The fixed effects model also provides greater model degrees of freedom for a more robust model.

DNV KEMA received billing data for 10,766 households. Among these households, 3,930 households that had the measures installed after June 30, 2010 were removed because it was not possible for those households to have 12 months of consumption data in the post period. Additionally, 553 households had insufficient billing data in either the pre- or post-installation periods for other reasons and were removed from the billing regressions.

We also removed fuel-switching households from the analysis dataset. It is standard practice to assume that fuel switching is not motivated by the program incentives. Instead, the program incentive motivates the installation of the higher efficiency gas measure. The change in gas consumption for non-fuel switching households is a good proxy for the marginal savings produced by fuel switchers. Because the tracking data identifies fuel switchers, they were simply removed from the analysis.

DNV KEMA also included only actual measured bill consumptions. If a bill with an estimated meter reading was encountered, it was combined with one or more subsequent bills so that the result was based only on actual meter readings. The readings before move-in date and after move-out date were removed. In the final dataset that was used for billing analysis for an average participant there were 17.7 readings. Our final analysis population had 4,822 participants.

The methods used for the net-to-gross analyses have already been described above.

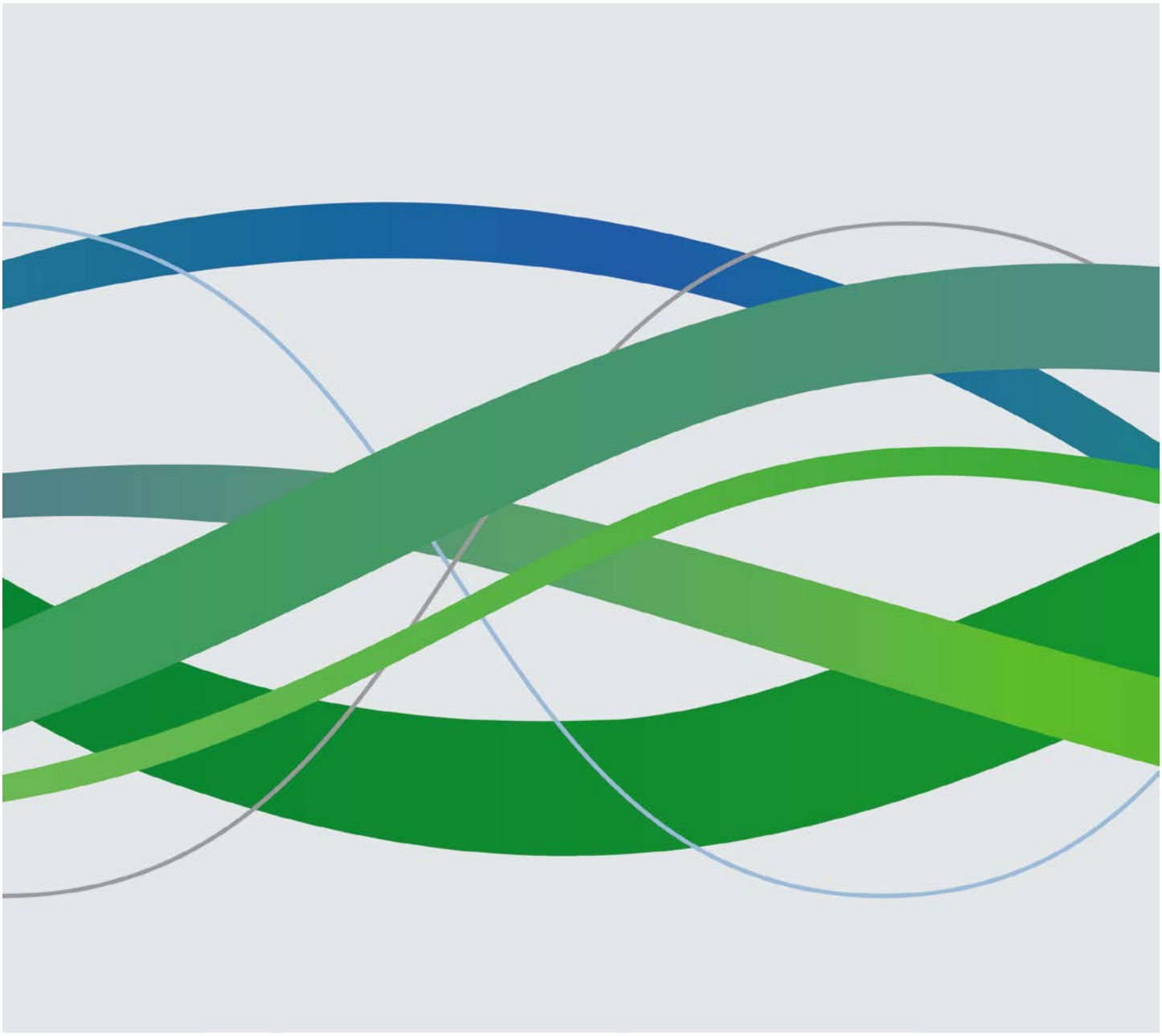
NYSEG/RG&E Residential Gas

Process and Impact Evaluation

NYSEG/RG&E

Prepared by KEMA, Inc.

April 2013



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1. Executive Summary

This section contains a summary of more detailed findings found elsewhere in this report.

1.1 Introduction and Scope

This report contains findings from our process and impact evaluation of the New York State Electric & Gas (NYSEG) and Rochester Gas and Electric (RG&E) Natural Gas Equipment Rebate program. The evaluation covers the 2009-2011 program period.

The key data collection and analytical activities of this evaluation included:

1. *Participant survey:* In December 2011 DNV KEMA completed a survey with 550 program participants who had participated in the program during the 2009-2011 period. The evaluators used this survey for much of the information used to inform the process evaluation of this program. The participant survey responses were also the main inputs for the net-to-gross (NTG) analysis.

2. *Trade ally interviews:* In January 2012 DNV KEMA completed in-depth interviews with 36 HVAC contractors and distributors who operate in upstate New York. This included both contractors/distributors who had participated in the program and those who had not.

3. *Billing analysis:* DNV KEMA conducted a billing analysis to estimate the average energy savings of program participants. Because the analysis required billing data for a year before and a year after participation, this analysis could only include customers who participated in the program from July 2009 to June 2010 (the billing data came from RG&E/NYSEG in August 2011). After removing other participants for various reasons (e.g. they had incomplete billing data, their previous heating fuel was not gas, etc.), we ended up with a final billing analysis population of 4,822 customers.

4. *Engineering analysis:* DNV KEMA conducted an engineering analysis to 1) check whether the reported savings estimates in the program tracking database match the calculation methods recommended by the New York Technical Reference Manual (TRM); 2) assess the reasonableness of TRM calculation methods for the energy-efficient measures rebated by the program based on the DNV KEMA billing analysis as well as a review of recent secondary sources of information; and 3) make recommendations for improving the calculation methods

.

1.2 Findings from the Participating Customer Surveys

This section contains a summary of findings from the participating customer surveys. More detailed findings can be found in Chapter 2 of this report.

1.2.1 Characteristics of Equipment Purchase and Replacement

We asked the program participants a number of questions about the purchase and replacement of their equipment (mostly furnaces and boilers). Some of our more interesting findings included:

- *Most participants are not replacing their furnace/boiler due to breakdown:* One of the most interesting findings from the participant survey concerned what the participants said about the condition of the heating equipment they had replaced. The evaluators assumed that since a furnace or a boiler is a very expensive purchase, especially in the context of the current economic downturn, most of the existing furnaces or boilers would have either been completely inoperable or "on their last legs." Yet the survey responses indicated that these assumptions were not true. For example, only 10 percent of the participants said that the furnace/boiler which was replaced was "not operating at all" and only a third said that their furnace/boiler was "operating but with significant performance problems." Over half of the respondents (55%) said that their furnace/boiler was still operating well, although the majority of these said that their furnace/boiler was old enough for replacement.

- *Participants reported that the heating capacities of their new furnaces/ boilers were, on average, lower than the equipment they replaced:* Twenty-eight percent of participants said that their previous furnace/boiler had a larger heating capacity than the new one while only 13 percent said that their previous furnace/boiler had a smaller heating capacity than the new one. Half the participants said that there was no difference in heating capacity between the previous furnace/boiler and the new one. The billing analysis also found evidence that the heating capacities of the new furnaces or boilers that contractors were installing were, on average, lower than the equipment they replaced.

- *Fuel switching was very limited:* Only five percent of the respondents reported to be fuel switchers. The majority of the fuel switchers were either using heating oil (42%) or wood (28%) as their primary heating fuel before switching to gas.

1.2.2 Marketing and Recruitment

This subsection summarizes some of the key findings concerning the program's marketing and recruitment.

1.2.2.1 Participant Awareness and Motivations

- *Participant awareness of receiving the rebate was nearly universal:* Ninety-five percent of the participants we surveyed were aware that they received a rebate from program. This high percentage was not surprising because the program has many features that encourage participant awareness of the rebates. For example, participants receive their rebates in the form of a check from RG&E/NYSEG rather than a utility bill reduction or point-of-sale discount. In addition HVAC contractors are not allowed to receive the rebate checks unless they installed some eligible equipment in their own houses.

- *Participants were much more likely to suggest advertising as a way to increase program participation vs. increasing rebate levels.* We asked the participants what RG&E and NYSEG could do to get more people to participate in the rebate program. The most common suggestion, by far, was that the program should do more advertising and building of customer awareness (45% of respondents) followed by a suggestion that the program increase the rebates levels (14%).

- *Sources of program awareness:* Half the participants cited their HVAC contractor as their first source of rebate awareness. The remainder cited a wide variety of first sources – such as newspapers, radio/TV, word-of-mouth, utility mailings, and the utility website – with no one source being cited by more than nine percent of participants. In terms of secondary sources of information, thirty-five percent did not have one. The remainder named a wide variety of secondary sources with radio/TV, newspaper, and their HVAC contractor being the most-cited.

- *Different types of program marketing reached different parts of the RG&E/NYSEG customer base:* Of the types of marketing methods used by the program:

  - Radio and television ads were more successful in reaching less educated customers, in reaching customers during the 2010-2011 program year (vs. the 2009-2010 program year), and in reaching RG&E customers (vs. NYSEG customers).

  - Newspapers were more successful in reaching seniors and more educated customers vs. their younger and less-educated counterparts.

  - Utility mailings and the utility website were more successful with higher-income customers.

  - Unfortunately the lower-income consumers who could benefit the most from the program rebates and lower heating bills were less likely than their higher-income counterparts to be aware of the program, the rebates or the potential for heating bill savings.

- *HVAC contractors were the most influential sources of program information:* About half (49%) of the respondents said that their HVAC contractor was the most influential information source and the other half cited a wide variety of sources with no particular information source being predominant.

- *Federal tax credits were also a driver of furnace/boiler replacement:* The HVAC distributors estimated, on average, that 79 percent of their high efficiency equipment sales/installations were receiving the federal tax credit. In contrast, the contactors, on average, estimated that 50 percent of their high efficiency equipment sales/installations were receiving the credit. Since the contractors are closer to the actual furnace/boiler purchase we believe that their estimate is more reliable.

- *Over half (58%) of the participants claimed awareness of the program rebates before calling their HVAC contractor.*

- *Why participants had their furnace/boiler replaced:* The top three reasons why participants said they had their furnace/boiler replaced included wanting to replace a furnace boiler with significant maintenance or performance issues (39%), finding their existing furnace/boiler too expensive to operate (36%), and wanting to replace an old furnace/boiler before it totally broke down (27%). Fifteen percent said that they did it to get the rebate.

- *Only ten percent of participants said they had a high-efficiency furnace in mind before speaking with their HVAC contractor:* The participants who were most likely to have the energy-efficient furnace in mind were male, highly-educated, and in the higher-income groups.

- *Why they chose the high efficiency furnace/boiler:* About three quarters (73%) of the participants said they chose the high efficiency furnace/boiler because they wanted to reduce their energy bills. Participants gave other reasons, like wanting to get a rebate or helping the environment, much less often.

1.2.2.2 The Role of the HVAC Contractor in the Equipment Purchase Decision

- *The role of the HVAC contractor in helping select the furnace/boiler:* Nearly half (49%) of the participants said that their HVAC contractor recommended a specific type of brand/equipment with about a quarter (27%) saying that their contractor recommended a high efficiency model. Other less-common roles of the contractor included providing cost estimates, providing information on system reliability, and providing information on system comfort.

- *Over two thirds (68%) of the participants said their HVAC contractor emphasized energy efficiency when discussing furnace/boiler features:* The new furnace/boiler having a good

warranty/reliability was a distant second with 27 percent of participants citing this as a contractor emphasis.

- *The energy efficiency of their furnace/boiler was the most important feature for participants:* We asked the participants which two or three features of the furnace/boiler made the most difference in what they selected. For the furnace/boiler to be energy efficient was by far the most important feature with nearly two-thirds (64%) of the participants citing it. The next most-cited features were low price (19%) and having a good warranty or reliability (11%).

- *Two thirds of the participants said that their contractor presented them with multiple models of furnaces/boilers to choose from.*

- *Yet only 24 percent of participants said that they knew the average cost difference between the high efficiency furnace/boiler they had installed and a standard efficiency model.* Participant groups who were more likely to say they knew the cost difference included males, non-seniors, the highly-educated, those with higher incomes, and those who said they heard about the RG&E/NYSEG program before contacting their HVAC contractor.

- *Ninety-five percent of the 53 participants in our survey sample who received rebates for indirect water heaters said it was "very easy" to find a contractor or store that carried the indirect water heater they had installed.*

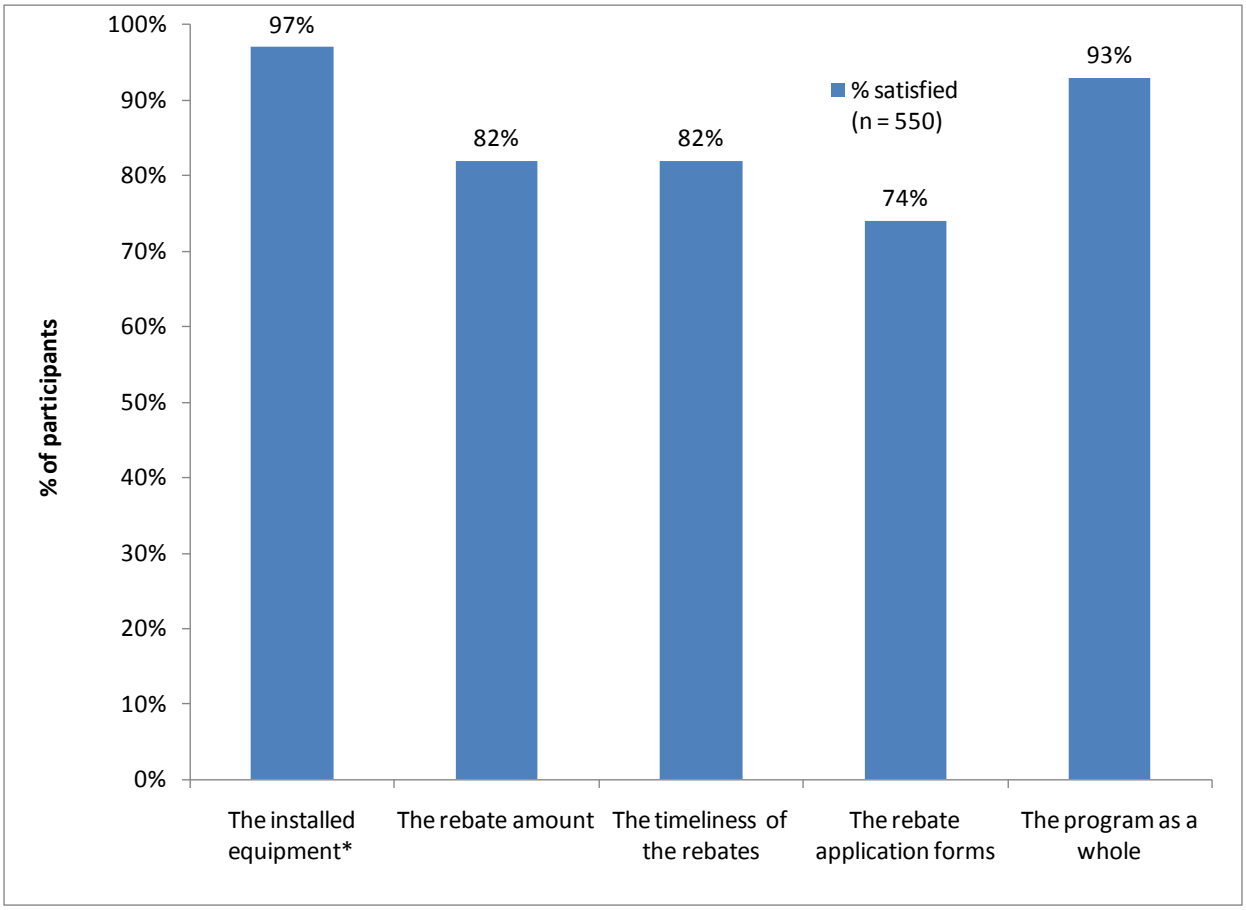
1.2.3 Participant Satisfaction and Recommendations for Increasing Program Participation

We asked the program participants how satisfied they were with the installed equipment, with a range of program activities, and with the program as a whole. Respondents were asked to use a five-point satisfaction scale where five equaled "very satisfied" and one equaled "very dissatisfied." Figure 1-1 shows that the satisfaction ratings for the program as a whole and the installed equipment were very high while the satisfaction ratings for the rebate levels and rebate timeliness were somewhat lower but still in the "good" range.[1] Only in the area of the rebate application forms did the program's level of satisfaction decrease to a level where it might suggest a need for program improvement. Of course, rebate application forms are never a popular aspect of such programs, so this 74 percent satisfaction rating must be understood in that context.[2]

[1] Based on our experience evaluating many such programs, we consider satisfaction ratings about 90% to be "very good", those above 80% to be "good," and those below 80% to be "a need for program improvement."

[2] For example, our recent evaluation of a residential HVAC program in Michigan found participant satisfaction levels for the rebate application forms to be 70% in 2010 and 64% in 2011.

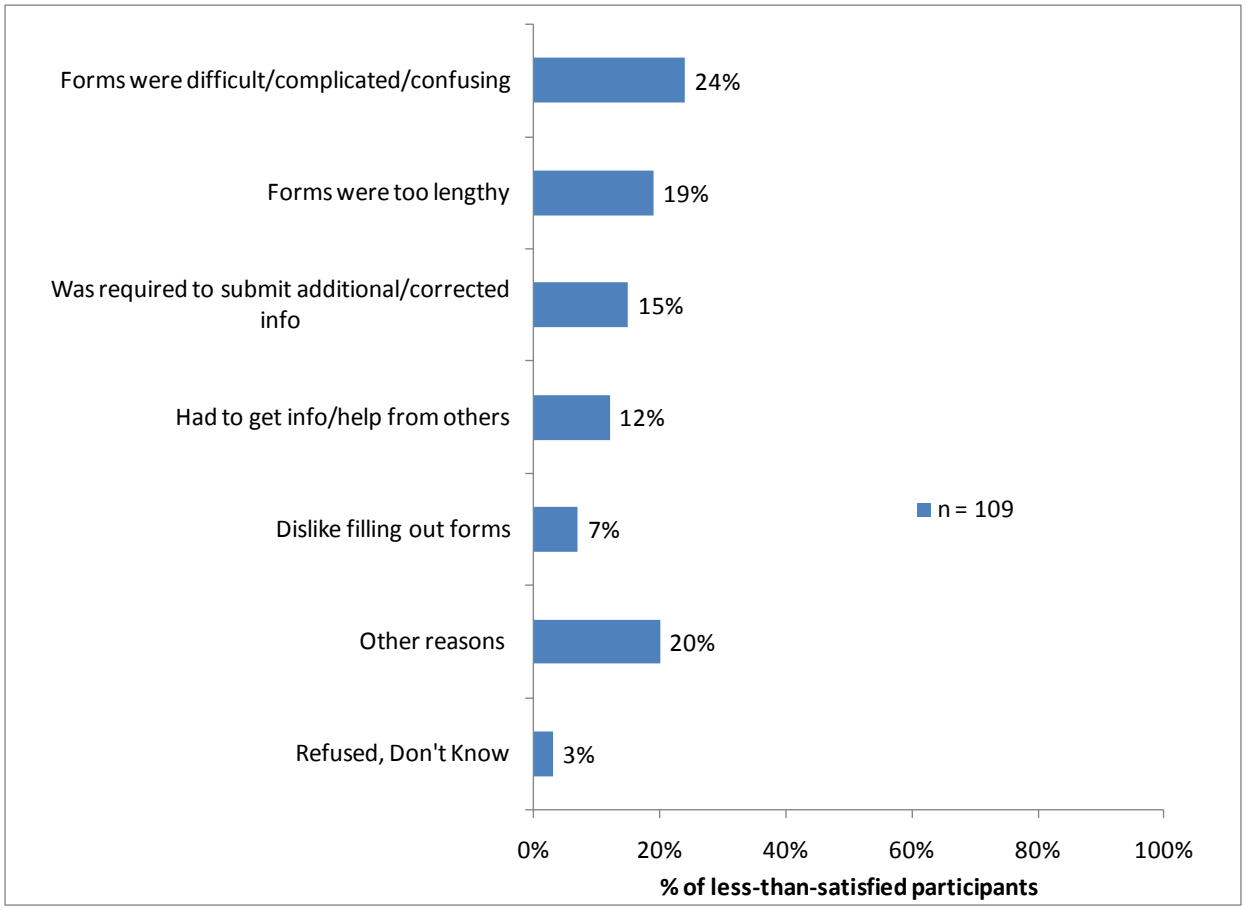
Figure 1-1
Participant Satisfaction with
Program Attributes and Program as a Whole



Note: *This is an average satisfaction rating for all the equipment installed through the program.

We asked the program participants who reported being less than satisfied with the rebate applications forms about their reasons for dissatisfaction. Figure 1-2 shows that participants cited a variety of reasons for their dissatisfaction including the forms being complicated/ confusing, the forms being too lengthy, and requirements that the participants submit additional, corrected information.

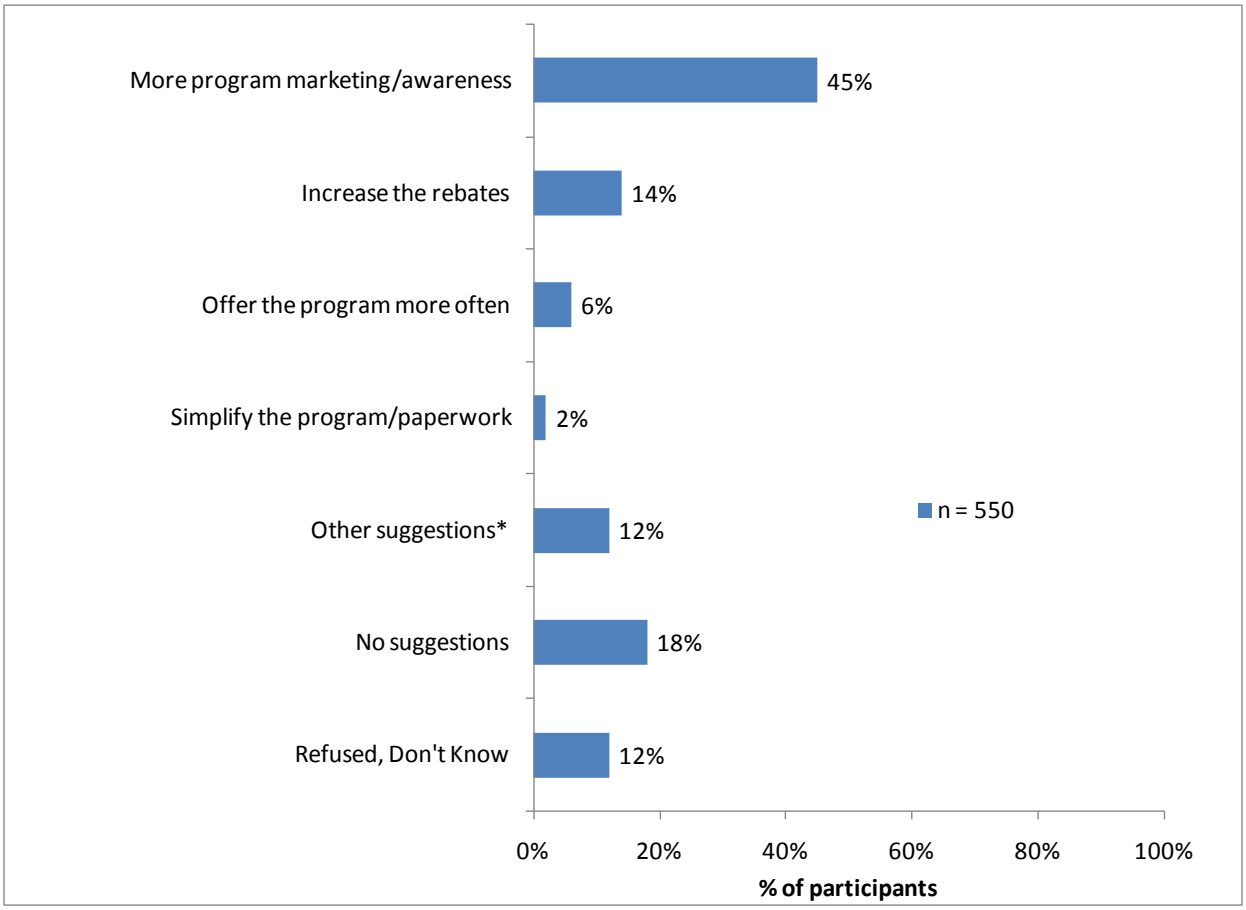
Figure 1-2
Why Participants Were Less-Than-Satisfied with the Rebate Application Forms



Note: *This is an average satisfaction rating across equipment types.

We also asked the program participants for recommendations on how the program might increase participation. The most-cited suggestion, by far (45% of participants) was for the program to do more marketing and build consumer awareness. Figure 1-3 and the note that accompanies the chart list the suggestions that were provided by multiple respondents. There were also many other suggestions that were provided by only a single respondent and which appear in the main body of the report.

Figure 1-3
Participant Suggestions for
Program to Increase Participation in Program



Notes: The total percentages exceed 100% because respondents were allowed to give multiple responses. *The full list of other suggestions appears in the main body of the report. Suggestions in the "other suggestions" category that were mentioned by multiple respondents include: making a local contact or utility representative available to better explain the program; allowing RG&E/NYSEG to recommend good or "green" HVAC contractors, reducing the amount of time it takes to pay rebates, extending the time period for which program rebates are available, making the program more available to landlords and rental properties, offering a "needs-based" rebate program where rebates would be larger for lower-income participants, coordinating the program rebates with government tax credits, allowing customers to fill out rebate applications online, lowering utility gas rates, RG&E/NYSEG inspecting furnaces to see if they are wasting energy, offering a payment/financing plan to help reduce the upfront cost burden of the energy-efficient furnace/boiler, making furnaces less expensive, and offering home energy audits.

1.2.4 Changes in Energy Consumption after Participation

We asked the program participants a number of questions about their energy consumption observations and behaviors after the installation of their furnace. Some of our survey findings on these topics included:

- *Seventy-percent of the participants noticed some reduction in their heating bills since participating in the program.*

- *Twenty-six percent of the participants said that they made major renovations/additions to their home since the installation of the new furnace/boiler*. The most common renovations included new windows and new insulation or siding.

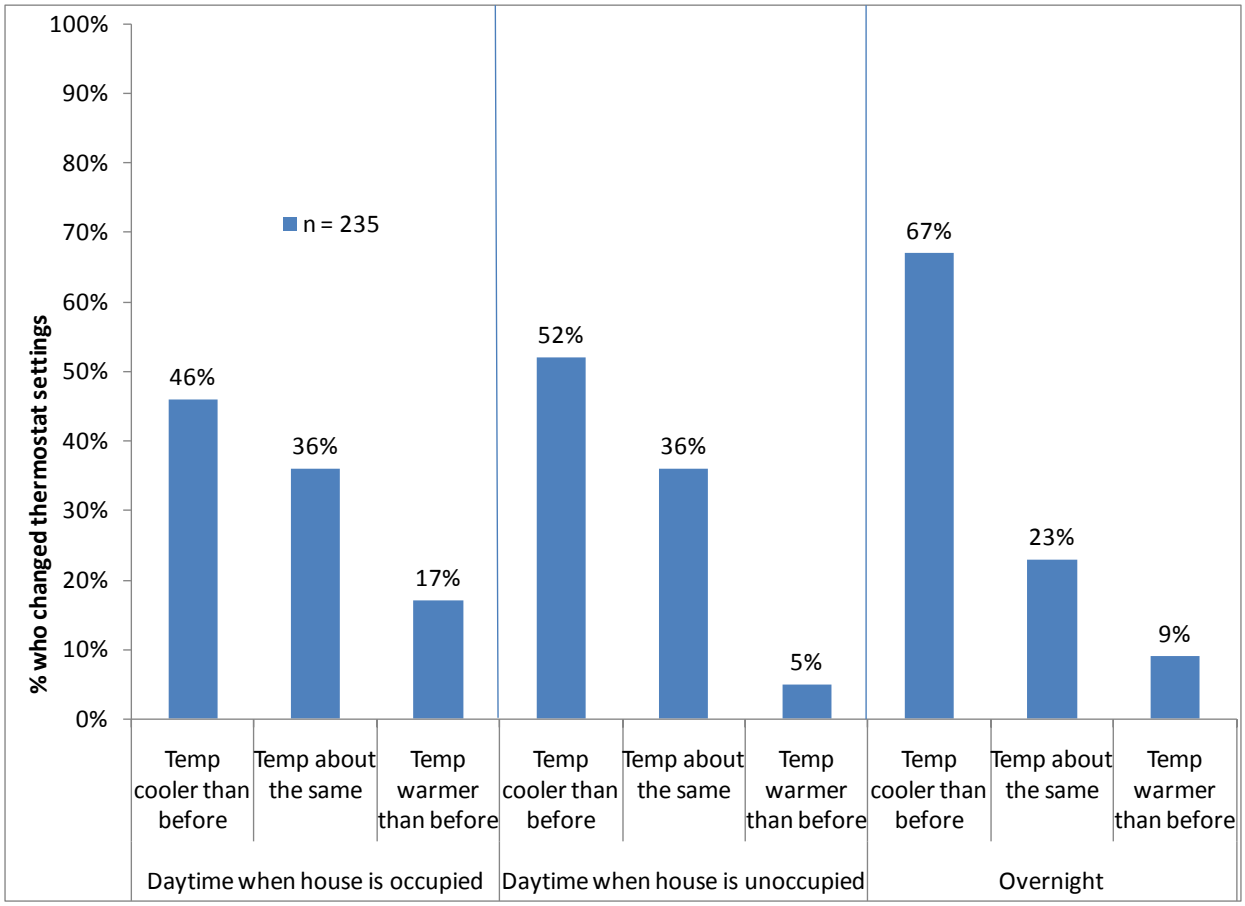
- *Forty-three percent of the participants said that they had changed the way that they set thermostat settings for heating since joining the program.* When we asked these participants why they changed their thermostat settings, the two most common responses were that they had a programmable thermostat and that the new temperature settings felt the same as the old ones.

- *The majority of participants who changed their thermostat settings for heating changed them in an energy-efficient manner.* Figure 1-4 shows what the participants who reported changing their thermostat settings said was their new heating settings for different time periods since having their new furnace/boiler installed. For all three time periods the percentage of participants who reported keeping their homes cooler than they had before was much greater than the percentage who said they now keep their homes warmer.

- *Fifty-three percent of the participants who received programmable thermostats through the program previously had a programmable thermostat.* The fact that over half of the recipients of the program-rebated programmable thermostats previously had a programmable thermostat raises some questions about the energy savings attributed to this measure in the New York Technical Reference Manual. This issue is discussed in more detail in the engineering analysis section of this report.

- *Program participants who had a furnace installed through the program were more likely (40% of respondents) to be running their fans all the time with their current furnaces than they had been with their previous furnaces.*

Figure 1-4
How Participants Changed Their Thermostat Settings for Heating Since Getting the New Furnace/Boiler Installed



1.3 Findings from the HVAC Trade Ally Interviews

This section contains a summary of findings from the in-depth interviews with HVAC trade allies. More detailed findings can be found in Chapter 3 of this report.

1.3.1 Trade Ally Awareness of the NYSEG/RG&E Program and Other Programs Encouraging EE Gas Equipment

- *HVAC contractor/distributor awareness/knowledge of the NYSEG/RG&E program:* All the participating HVAC contractors and 91 percent of the HVAC distributors said they were aware of the NYSEG/RG&E Natural Gas Equipment program. Half of the nonparticipating HVAC

contractors also said they were aware of the program. In terms of program knowledge, all participating HVAC contractors reported knowing what types of energy efficient equipment the program rebates. Almost half (45%) of the distributors and a fifth of the nonparticipating contractors also said they were familiar with the equipment the program rebates.

- *Sources of program awareness:* We asked the HVAC contractors and distributors who were aware of the NYSEG/RG&E program how they heard about it. Distributors tended to learn about the program from contractors. Contractors often indicated becoming familiar with the program via contact with the utility – usually through direct mail or emails.

- *Awareness of the 2010 suspension of the program:* The NYSEG/ RG&E program was suspended from July to October in 2010 and the utilities were interested in knowing whether HVAC trade allies were aware of this suspension and how they reacted to this suspension. None of the nonparticipating contractors were aware of this suspension but over half (58%) of the participating contractors and distributors indicated being aware of this program suspension.

- *Impacts of the 2010 suspension of the program:* We asked the trade allies who were aware of the 2010 program suspension whether the break in program service affected their ability to market and sell eligible equipment. Sixty percent of these HVAC contractors and distributors said that the suspension negatively affected them by causing their sales of high efficiency equipment to slow down. The other 40 percent said that the availability of federal tax credits for energy-efficient furnaces/boilers and growing natural demand for these energy-efficient products essentially offset the impacts of the program suspension.

- *Awareness of other EE programs for residential gas:* We asked the trade allies whether they were aware of other programs, besides the NYSEG/RG&E program, that encouraged the purchase of energy-efficient gas equipment. A quarter of the distributors and participating contractors and over half (60%) of nonparticipating contractors indicated being aware of other such programs. These programs included those run by National Fuel, NYSERDA, National Grid, Orange and Rockland, Central Hudson Gas & Electric and FEMA (for flood victims). While some trade allies said that the other programs were similar to NYSEG/RG&E regarding incentive levels, a few claimed that the other programs offered more substantial rebates for energy efficient equipment. A couple trade allies indicated that the process for obtaining rebates was more complicated at NYSERDA compared to NYSEG/RG&E.

- *Awareness of and reaction to new federal requirements:* We asked the HVAC trade allies whether they were aware of pending federal requirements that would increase the minimum AFUE of furnaces/boilers and what they thought would be the impact of these new requirements on the HVAC market. Forty-eight percent of the interviewees were aware of the coming federal standards. The contractors had a mixed reaction to the impacts of these requirements. Some

welcomed the new standards as a way to even the playing field with competition which sells less-expensive lower-efficiency equipment. Yet others were concerned about the challenges of installing high-AFUE equipment in the tight spaces frequently found in condominiums, apartments, or townhouses. Still others thought that the greater costs of the higher-efficiency equipment would hurt future sales and burden those with lower incomes.

1.3.2 Marketing and Sales Trends

- *Trade ally marketing channels:* We asked the HVAC trade allies how they advertise their services. Table 1-1 shows that there was some variation in marketing practices across the trade ally categories with distributors and participating contractors relying on a wide variety of marketing channels while the nonparticipating contractors used primarily phone listings, word-of-mouth, and newspaper ads.

- *Whether trade allies feature energy efficiency in their promotional activities:* Almost three quarters (73%) of participating contractors said that they featured energy efficiency in some of their advertising. In contrast less than half (45%) of distributors and nonparticipating contractors did. However, almost half of the distributors said that they mention the NYSEG/RG&E Natural Gas Equipment Rebate program when recommending ENERGY STAR qualifying equipment to residential contractors. Two thirds of the distributors have helped contractors participate in the program.

Table 1-1
How Trade Allies Advertise Services

Method of Advertising Services	Distributors (n=11)	Participating Contractors (n=15)	Nonparticipating Contractors (n=10)	Total (n=36)
Word of mouth	45%	47%	80%	56%
Phone book	9%	53%	70%	44%
Newspaper	18%	33%	50%	33%
Website	18%	47%	10%	28%
Flier/Postcard/Mailer	27%	33%	10%	25%
TV	27%	27%	0%	19%
Radio	27%	20%	10%	19%
Ad in Penny Saver	9%	20%	0%	11%
Newsletter	0%	20%	0%	8%
Trade Publication	27%	0%	0%	8%
Company truck/ Sign outside installation location	9%	7%	10%	8%
Billboard	18%	0%	0%	6%
Sales calls	9%	0%	0%	3%

- *Promoting energy efficiency products:* Most (73%) participating contractors and about half (45%) of distributors and nonparticipating contractors said that they including information about energy efficiency in their marketing efforts. Trade allies frequently mention increased sales and customer satisfaction as benefits to promoting energy efficient equipment. Trade allies most often indicate downsides to endorsing high efficiency technologies includes having to spend extra time with customers to explain the program and that some residents want to have less expensive systems installed (regardless of savings offered by energy efficient equipment and/or program rebates).

- *Promoting the NYSEG/RG&E Natural Gas Equipment Rebate program:* Almost half (45%) of the distributors said that they mention the NYSEG/RG&E Natural Gas Equipment Rebate Program when recommending ENERGY STAR qualifying equipment to residential contractors. Two thirds of the distributors also said that they have helped contractors participate in the program.

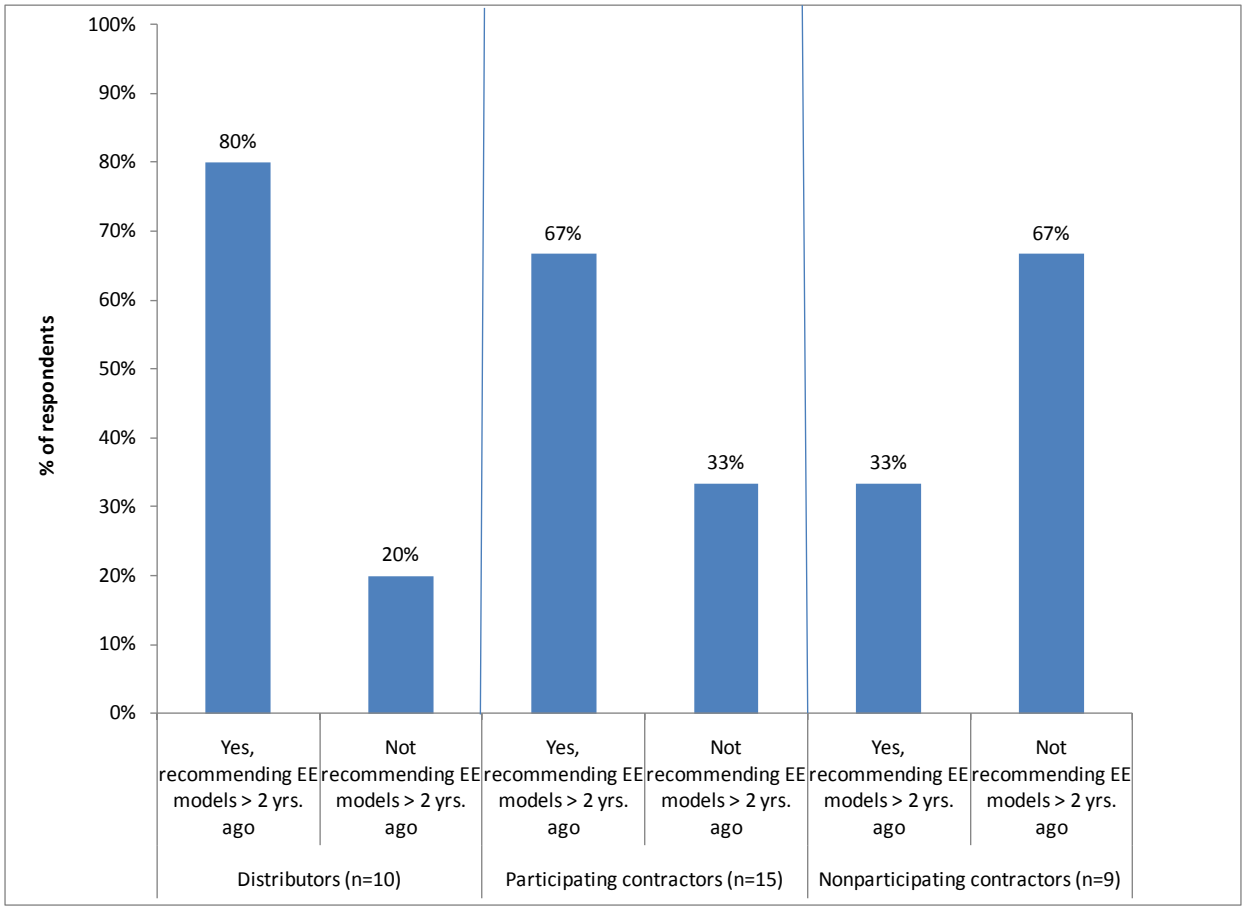
- *The pros and cons of promoting energy efficiency:* We asked the trade allies what they saw as the advantages and disadvantages of promoting energy-efficient technologies in residential applications. HVAC contractors and distributors often cited increased sales and customer satisfaction as benefits. In terms of disadvantages they mentioned having to spend additional time with customers explaining the program and the simple fact that some households wish to have less expensive systems installed.

- *Operating status of previous furnaces/boilers:* Contractors reported that the new furnace/boiler is usually replacing equipment that was not functioning at all (49% of the time) or with considerable problems (35% of the time). However, contractors also reported replacing furnace/boiler systems that were still functioning well somewhat frequently (17% of the time). Participating contractors reported replacing furnaces/boilers that were still operating well twice as often as nonparticipating contractors did (20% vs. 10% of the time).

- *Topics brought up by contractors with their customers when replacing a furnace or boiler:* We asked the HVAC contractors what options or factors they discuss with the customers when replacing a furnace or boiler. The two most-cited topics of conversation were energy efficiency/energy savings (62%) and the cost of the system/affordability (39%).

- *Trends in recommending energy-efficient gas equipment:* We asked the trade allies: "Do you more frequently recommend high efficiency furnaces or boilers than you did two years ago?" Figure 1-5 shows that 80 percent of the distributors and two thirds of the participating contractors reported an increasing frequency in recommending energy-efficient models. However, only a third of the nonparticipating contractors reported the same. When we asked trade allies why they were encouraging energy efficiency products more recently than they had in the past, their two most-cited reasons included the potential to reduce energy costs and the ability to take advantage of the rebates.

Figure 1-5
Whether HVAC Trade Allies Are Recommending EE Equipment More Frequently Than They Did Two Years Ago



- *Trends in stocking practices:* We asked both distributors and contractors whether the percentage of energy-efficient equipment they have in stock is different now than it was two years ago. Eighty-two percent of the distributors reported a change in their stocking practices compared to less than a third of the contractors. The responses of the participating and nonparticipating contractors were very similar. The distributors and contractors mentioned a number of factors that were either encouraging or discouraging their stocking of energy-efficient equipment including increasing demand for and baseline presence of energy-efficient models, the disappearance of federal tax credits, and reduced rebates.

- *Estimation of high efficiency furnaces/boilers receiving federal tax credits:* NYSEG and RG&E expressed interest in knowing about the impacts of the federal tax credit on sales of energy-efficient gas equipment. So we asked the trade allies to estimate what percentage of the high efficiency furnaces/boilers they sold had received federal tax credits. The distributors estimated, on average, that 79 percent of their high efficiency equipment sales/installations were receiving the federal tax credit. In contrast, the contactors, on average, estimated that 50 percent of their high efficiency equipment sales/installations were receiving the credit. Since the contractors are closer to the actual furnace/boiler purchase we believe that their estimate is more reliable.

- *Duct sealing:* While a number of distributors (64%) and contractors (56%) indicated offering duct-sealing services, many trade allies (42%) do not offer duct-sealing equipment.[3] The most frequently stated reason for not providing duct sealing was that trade allies have no interest in offering this service because they do not think there is much of a market for duct sealing.

- *Electronically commutated motors (ECMs):* All participating contractors and the majority (80%) of distributors and nonparticipating contractors said that they sold or installed gas furnaces with ECMs. Most (81%) distributors and participating contractors (and half of nonparticipating contractors) considered gas furnaces with ECMs to be a good value for their residential customers because it cuts down on electricity costs/consumption. However, some trade allies (including 40% of nonparticipating contractors) did not think highly of ECMs, citing the high repair cost and increased potential for the system to break down.

- *Where contractors obtain their HVAC equipment:* The majority of contractors (80%) said they purchase their residential systems from distributors (with just one contractor indicating obtaining their equipment from a manufacturer.) There was a lot of diversity in the supply with the contractors reporting the use of 25 different distributors to obtain their equipment.

1.3.3 Effectiveness of Program on Increasing Sales of High Efficiency HVAC Equipment

- *Impact of program on sales/installations of high efficiency equipment:* Trade allies were asked to use a five-point effectiveness scale where five equaled “very effective” and one equaled “not at all effective” to indicate how effective the program has been in encouraging sales of residential high efficiency gas heating equipment. Most (93%) participating contractors and over half (55%)

[3] An example of duct-sealing equipment would be equipment that monitors airflow to stop blowing in sealant when the static pressure gets to an appropriate amount.

of the distributors reported the program was "very effective" or "effective" in encouraging contractors and distributors to sell more efficient gas heating equipment, with no participating contractor or distributor indicating the program was ineffective. Nonparticipating contractors provide mixed ratings about the effectiveness of the program, with some (20%) indicating the program was at least somewhat effective and others (20%) reporting the program was ineffective.

1.3.4 Trade Ally Satisfaction with NYSEG/RG&E Program

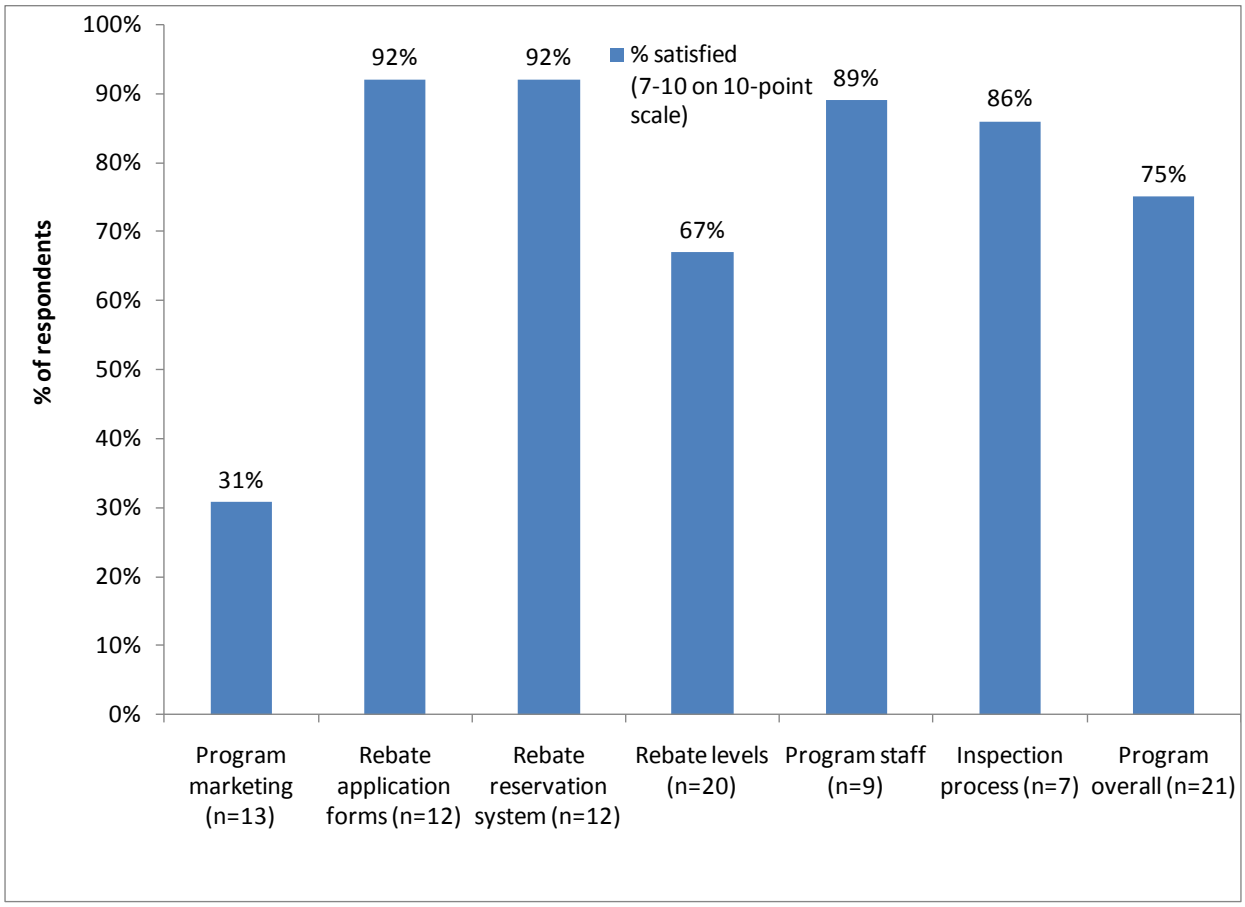
We asked the participating HVAC contractors and the distributors who seemed familiar with the program about their satisfaction with various aspects of the program as well as with the program as a whole. We asked them to use a ten-point satisfaction scale where ten equaled "very satisfied" and one equaled "very dissatisfied." We considered satisfaction ratings in the 7-10 range to indicate satisfaction with the program or program activity.

Figure 1-6 shows that the HVAC trade allies were generally satisfied with the program with two exceptions.[4] Less than a third (31%) of the respondents who indicated some familiarity with the program marketing efforts were satisfied with it. As discussed in the body of the report, many distributors and contractors did not think NYSEG and RG&E were doing enough advertising to build awareness of the customer rebates and pointed to other HVAC programs such as NYSERDA's which provides funding to HVAC contractors for co-op advertising. Some of these trade allies also said that the program could be doing more to build awareness of the rebates among equipment manufacturers and distributors.

In addition only 61 percent of the trade allies were satisfied with the rebate levels. Some of the less than satisfied respondents said that the program had higher rebate levels in the past and that for furnaces at the 95% AFUE level and above the program needed to provide much higher rebates. Table 1-2 shows the average satisfaction ratings broken out by type of trade ally.

[4] We also asked the HVAC contractors and distributors about their satisfaction with the timeliness of the rebate payments. However, the design of the program is such that almost all rebate payments go to end users rather than contractors. Therefore only five participating contractors and one distributor provided satisfaction ratings for this program attribute. Because of this small sample size, and the consideration that some of these satisfaction ratings may be based on secondary information (e.g., customer complaints) rather than direct experience in receiving a rebate (which program staff indicate would be fairly rare for contractors) we chose not to include this satisfaction rating in Figure 1-6, but do show the average satisfaction ratings in Table 1-2 and in the body of the report.

Figure 1-6
Trade Ally Program Satisfaction Levels



When we asked the trade allies to recommend improvements to the program, many offered suggestions that corresponded with the areas of dissatisfaction noted above. They recommended that the program do more marketing and increase rebate levels for the higher efficiency furnaces. A couple of them specifically recommended that the program offer fewer rebates but more rebates of larger size that are focused on the higher AFUE furnaces. Other recommendations for program improvements included:

- Having the program make greater inroads with owners of condominiums and multifamily buildings,
- Offering co-op advertising;
- Making more direct contact with HVAC equipment manufacturers and distributors;
- Allocating the incentive dollars at a more measured pace so the funds last longer;

- Simplifying the program paperwork (e.g., not requiring labor and material costs to be broken out);
- Providing contractors with a simple document that contains all the program information (e.g., requirements, eligible equipment, etc.) that they can hand out to customers; and
- Providing information on the program website that explains/compares the life-cycle costs of an energy-efficient furnace/boiler with a standard efficiency model.

Table 1-2
Average Satisfaction Ratings for
NYSEG/RG&E Natural Gas Equipment Rebate Program

Satisfaction Topic (Scale of 1 to 10 where 10 means 'Very Satisfied' and 1 means 'Not at all Satisfied')	**Distributors (n=11)**	**Participating Contractors (n=15)**	**Overall (n=10)**
Satisfaction with marketing support provided by the program	4.4 (n=8)	6.4 (n=5)	5.2 (n=13)
Satisfaction with program's rebate application forms	10.0 (n=1)	8.5 (n=11)	8.7 (n=12)
Satisfaction with the rebate reservation system	8.0 (n=3)	9.0 (n=9)	8.8 (n=12)
Satisfaction with the amount of the rebates offered by the program	6.1 (n=7)	8.0 (n=14)	7.4 (n=21)
Satisfaction with the time it takes to receive the rebate	1.0 (n=1)	8.5 (n=4)	7.0 (n=5)
Satisfaction with customer service received from program staff	10.0 (n=1)	9.0 (n=8)	9.1 (n=9)
Satisfaction with quality control inspection process	1.0 (n=1)	9.7 (n=6)	8.4 (n=7)
Satisfaction with the program as a whole	6.7 (n=6)	9.2 (n=14)	8.5 (n=20)

1.4 The Impact Evaluation Findings

This section of the report summarizes the methods and results of a billing analysis that DNV KEMA undertook to estimate energy savings associated with installation of high-efficiency equipment according to Residential Natural Gas Equipment Rebate Program requirements. This section of the Executive Summary provides a brief overview of the more detailed methodological description and model results that appear in the main body of the report.

1.4.1 Methods

The billing analysis used bimonthly billing data that covered the pre- and post-installation periods. The billing analysis estimated the average change in consumption from the pre- to the post-installation periods. This estimated change in consumption is an unadjusted savings estimate that captures the change from replacing an existing system with a new, high-efficiency unit. The unadjusted savings estimate was adjusted on an aggregate basis to produce a final adjusted savings estimate that reflects the estimated savings relative to a standard-efficiency installation.

DNV KEMA used a fixed-effects model to perform the billing analysis. The primary advantage of the fixed effects model approach is that it controls for all unmeasured characteristics of the program participants, so long as those characteristics do not change over time. For the characteristics that change over time, time-effects intercepts account for time trends not explained by other variables. Compared to the common site-level, PRISM-type approach, the fixed effect approach avoids the necessity of a control group while still controlling general trends affecting consumption levels. The fixed effects model also provides greater model degrees of freedom for a more robust model.

1.4.2 Results

Table 1-3 shows our final estimates of savings for the primary measures rebated by the program. These savings estimates include any savings from thermostats that were installed at the same time. The majority of heating units were installed along with a new thermostat. This means that the effective estimate of thermostat savings, separate from these measures, is zero.

Table 1-3
Final, Adjusted, per Measure Savings

Savings Type	Savings Estimate (Annual Therms/ Participant)	Adjustment	Savings
Boilers	225	69%	156
Furnaces without ECM	139	92%	128
Furnaces with ECM	139	94%	131

Table 1-4 combines the measure counts from the tracking data to produce an overall program heating savings estimate for 2009-2010. Energy savings estimates for duct sealing, boiler reset control, and indirect water heaters are not included in these estimates. DNV KEMA was unable to produce savings estimates for these measures. There were too few participants for the first two measures to even include them in the billing models. An indirect water heater estimate was attempted but was not statistically significant. However, these measures were very infrequent in the program and therefore represent only a small fraction of expected savings.

Table 1-4
Program Savings for Boilers and Furnaces

Measure	Accounts	Installed Measures	Total Savings (1000 Therms)
Boiler	1,124	1,229	191.6
Furnace,	2,061	2,162	276.5
Furnace w/ ECM	7,705	8,058	1,056.3

Table 1-5 provides Equivalent Full Load Hours (EFLH) estimates which were derived from the post-installation usage. These estimates represent the number of full hours a furnace or boiler would need to run, given the average efficiency, capacity and consumption during the post-installation period.

Table 1-5
EFLH Estimates

Measure Type	Equivalent Full Load Hours
Boilers	800
Furnaces without ECM	858
Furnaces with ECM	911

It is important to note that a large majority of the participating customers had new programmable thermostats installed in conjunction with the installation of their energy-efficient furnaces or boilers. We were not able to disentangle the separate savings impacts of these programmable thermostats from the energy-efficient furnaces or boilers.

1.4.3 Realization Rates and Net-to-Gross Ratios

We also produced estimates for realization rates and net-to-gross ratios for this program.

1.4.3.1 Realization Rates

The New York Evaluation Plan Guidance for EEPS Program Administrators defines the realization rate as "the ratio of project tracking system savings data (i.e., initial estimates of project savings) to savings adjusted for data errors and incorporating the evaluated or verified results of the tracked savings." Using this definition, Table 1-6 and Table 1-7 provide the realization rates for the three measures with savings estimates (one table shows the savings on a per unit basis and the other shows a program total based on the analysis dataset). The TRM savings include thermostat savings for those installations that included thermostats. If thermostats contribute to the measured savings then these realization rates are appropriate if the proportion of thermostat installations remains similar in future program years. Because this analysis does not distinguish thermostat savings from heating measure savings, it is impossible to give separate realization rates.

Table 1-6
Measure-level Realization Rates, Thermostats Included, Per Unit Estimates

Savings Type	Estimated Savings	Full TRM savings	Realization Rate
Boilers	156	356	0.44
Furnaces without ECM	128	246	0.52
Furnaces with ECM	131	284	0.46

Table 1-7
Measure-level Realization Rates, Thermostats Included, Program Totals

Savings Type	Ex Ante Tracked Savings (MMBTU/yr)	Ex Post Net Impact (MMBTU/yr)	Realization Rate
Boilers	438,061	191,600	0.44
Furnaces without ECM	532,254	276,500	0.52
Furnaces with ECM	2,285,162	1,056,300	0.46

Table 1-8 shows the total program savings for the furnaces and boilers. Since all thermostats installed through the program were installed with a furnace or boiler and since the billing analysis could not separate out the thermostat savings, any savings from the thermostats are also included here. As discussed elsewhere in the report, there was no evidence for energy savings from the indirect water heaters. The only other measures not represented here, because their sample size was too insignificant to include in the billing analysis, were the duct sealing and the boiler reset controls.

Table 1-8
Program Savings for Boilers and Furnaces

Measure	Accounts	Installed Measures	Total Savings (1000 Therms)
Boiler	1,124	1,229	191.6
Furnace w/o ECM	2,061	2,162	276.5
Furnace w/ ECM	7,705	8,058	1,056.3
Total			1,524.3

1.4.3.2 Net-to-Gross Ratios

We used two analytical methods to estimate the net-to-gross ratios for this program.

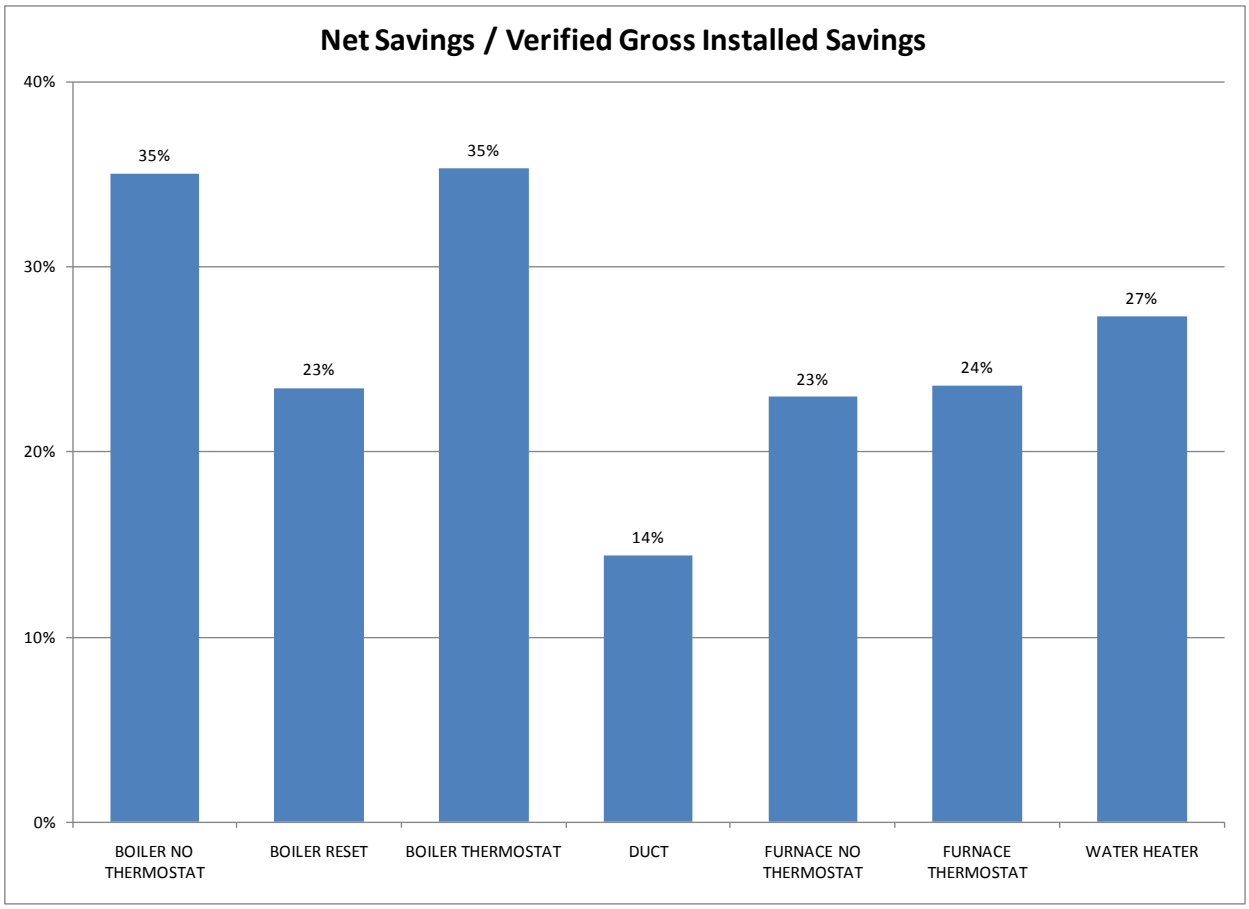
1. *End user self-report method:* This method attempts to measure the direct influence of the program – e.g., the influence of the program rebate and information -- on the energy savings achieved. This method attempts to measure the influence of the rebate on four different attributes of the decision to install energy-efficient measures: 1) the likelihood of installing the energy-efficient measure; 2) the energy efficiency of the measures installed; 3) the timing of the measure installations; and 4) the quantity of measures installed.

2. *Supplier influence method:* This method assumes that the program's influence extends beyond the rebate to the kind of equipment recommendations that the HVAC contractors are making. Therefore participants who said they went with the higher efficiency equipment because their contractors recommended it may be unconsciously experiencing indirect program influence to the extent that these recommendations were program-influenced.

1.4.4 Results from the End User Self-Report Net-to-Gross Method

Figure 1-7 shows the net-to-gross ratios, by equipment type, that we estimated using the end user self report net-to-gross method. The description of the method and additional findings from the net-to-gross-related survey questions appear in the main body of the report.

Figure 1-7
the Net-to-Gross Ratios by Equipment Type
Using the End User Self Report Method



1.4.4.1.1 Results from the Supplier Influence Report Net-to-Gross Method

A summary of our findings from the supplier influence net-to-gross method include:

- *There was evidence that a large majority of the program participants were influenced in their equipment purchase decision by their HVAC contractor.* Eighty-four percent of program participants were deemed to be supplier-influenced based on their survey responses.

- *There was evidence that the participating HVAC contractors were more likely to be recommending the high efficiency equipment than the nonparticipating contractors and that this was driven by program rebates.* The participating HVAC contractors were twice as likely as the nonparticipating contractors to say they were recommending more high efficiency models than they were two years ago. We asked those who said they were recommending the high efficiency

equipment more than two years ago why this was so. The existence of program rebates was the second-most-cited reason among participating contractors.

- *Impact of program on sales/installations of high efficiency equipment:* Trade allies were asked to use a five-point effectiveness scale where five equaled "very effective" and one equaled "not at all effective" to indicate how effective the program has been in encouraging sales of residential high efficiency gas heating equipment. Most (93%) participating contractors and over half (55%) of the distributors reported the program was "very effective" or "effective" in encouraging contractors and distributors to sell more efficient gas heating equipment, with no participating contractor or distributor indicating the program was ineffective.

- *Yet, on average, the participating HVAC contractors reported no increase in the sales penetration of their sales of 94%+ AFUE furnaces over the last two years.* There was evidence that the large federal tax credit for high efficiency furnaces had a significant impact on the market for high efficiency equipment and therefore likely dwarfed and masked normal program influences on high efficiency sales. Both the HVAC wholesalers and the participating HVAC contractors cited the federal tax credits as the number one factor in their sales of the 94%+ AFUE over this two year period. The tax credits likely had two effects which would explain why five of the eight HVAC distributors and three of the 12 participating HVAC contractors reported a decline in the sales penetration of these high-efficiency furnaces over the two year period. One likely effect was that the $1,500 federal tax credit, which was much larger than the NYSEG/RG&E rebates, created an enhanced demand for these high-efficiency furnaces which went away when these tax credits disappeared. This difference in the levels of demand for these high-efficiency furnaces between the current period and the past period was likely exacerbated by the impacts of the tax credits on early equipment replacement. The availability of the tax credit likely encouraged owners of such suboptimal furnaces to replace the equipment sooner than they had originally planned to. This boost in early replacement rates likely had the double impact of increasing the high efficiency furnaces sales in the earlier period and decreasing them in the later period because many decrepit furnaces had been removed from the market thereby reducing early replacement sales opportunities in this later period.

- *On average there was no difference between the participating and nonparticipating HVAC contractors in the sales penetration of their sales of 94%+ AFUE furnaces in the current period.* In the past period the participating HVAC contractors had only a slightly higher level of sales penetration of these high efficiency furnaces than their nonparticipating counterparts. Likely factors that would explain why there was not a bigger difference between the participating and nonparticipating contractors included the impacts of the federal tax credits, evidence that some of the nonparticipating contractors have been using rebates from other programs, and indications of a growth in consumer demand for energy-efficient products.

- *There was some limited evidence of market effects and program spillover.* When asked to explain why he reported an increase in sales of the high efficiency equipment over the two-year period, one nonparticipating contractor said it was "probably from sales pressure. Other places are selling it and pitching it to the customer, so it's being more requested from customers." This might be an indication of program spillover. There were also a number of HVAC contractors and distributors who reported consumers becoming more knowledgeable about high efficiency equipment and asking for it, which would be an indicator of market effects.

- *While the supplier influence net-to-growth method found evidence that the HVAC contractors were influencing consumer equipment choices and that the program was increasing the frequency with which participating contractors were promoting high efficiency equipment, we could not quantify these program effects due to the distorting effects of the federal tax credit.* Our normal method for estimating the net-to-gross ratios using the supplier methods is to look at the increase in sales of energy-efficient equipment by participating HVAC contractors over time or by comparing their level of energy-efficient sales to those of the nonparticipating contractors. However, neither of these indicators showed evidence of program influence. As discussed above, we believe that this was due to a significant impact on the market for high efficiency equipment which likely dwarfed and masked normal program influences on high efficiency sales.

1.4.4.2 Conclusions and Recommendations Concerning the Interpretation of these Net-to-Gross Results

As discussed above and elsewhere in the report, there was a lot of evidence from the participant surveys and trade ally interviews that:

- The participating HVAC contractors influenced the decision of customers participating in the program to purchase the higher efficiency equipment; and

- The program was influencing the participating HVAC contractors to recommend the higher efficiency more frequently than they otherwise might have.

Therefore the full measure of program attribution – the portion of the energy savings that should be attributable to the program -- should include not only the portion of the energy savings attributable to the program rebates (which is captured by the end user self report NTG methodology), but also the portion of the energy savings attributable to the program influencing the behavior of the contractors.

Usually we estimate the energy savings attributable to the program's influence over the contractor in two ways:

1) Looking at the difference between the frequency with which the participating contractors are selling the high-efficiency equipment and the frequency with which nonparticipating contractors – which serve as a de facto control group – are selling the high efficiency equipment; and

2) Looking at the difference between the frequency with which the participating contractors are selling the high-efficiency equipment before, or at the very beginning of, their program involvement and this frequency after a few years of their program involvement. If there is a set of nonparticipant interviews, then these can be used to control for any non-program effects that could be contributing to the differences over this time period.

However, this evaluation could not find any differences for both these comparisons.

As we discussed above and elsewhere in this report, we do not think the absence of these differences is evidence that the program was not influencing the behavior of these contractors. We think the absences of these differences was due to the temporary distorting effect of the $1,500 federal tax credit, which was cited by HVAC distributors as a major market driver, which was available to participating and nonparticipating contractors alike, which likely engendered some end user-driven consumer demand for higher efficiency equipment (which would increase nonparticipating contractor sales of the high efficiency equipment even when they were not recommending this equipment more frequently than their participating counterparts), and which was about five times larger than the NYSEG/RG&E program rebates available at the time. This tax credit likely had the confounding effect of temporarily negating the expected differences between the frequency with which participating contractors sold the high efficiency equipment and the frequency with which the nonparticipating contractors sold this equipment.[5]

Of course it could be argued that if the $1,500 federal tax credit was indeed producing this "swamping" effect on the upstate New York HVAC market, then the NYSEG/RG&E program should not get credit for the sales of energy-efficient furnaces and boilers that were significantly influenced by this tax credit. Therefore one approach would be to give the program for the 2009-2011 evaluation period only the energy savings attribution produced by the end user self report methodology, since this would represent the incremental impact of the program rebates over any endogenous factors such as the federal tax credit.

One concern we would have about this approach, however, is that based on our experience doing many net-to-gross estimations, net-to-gross ratios are often re-used for other purposes such as adjustments to *ex ante* gross energy savings estimates for the purpose of setting program savings goals, forecasting energy savings for planning purposes, and even decisions as to whether or not certain energy-efficient

[5] We say "temporarily" because while federal tax credits for efficient furnaces/boilers are still available, they are a fraction of the value of what they used to be and the eligible equipment has also been more narrowly defined than it was in the past.

technologies should continue to receive incentives. Therefore while giving the NYSEG/RG&E program only "partial credit" (e.g., only credit for the rebate effects and not for the contractor effects) might be justified for the 2009-2011 evaluation period due to the federal tax credit effects, we would not want such a ratio to be used for any planning or forecasting purposes because it would represent an anomalous "snapshot" of the program's normal impacts.

In March 2013 we discussed this issue with the New York DPS staff and their consultant team during a presentation of the findings from the evaluation. The DPS staff and their consultant team generally agreed with our analysis of the confounding effects of the federal tax credits and our concerns that the program's net-to-gross ratio based on this anomalous 2009-2011 "snapshot" should not be used for future decision-making about the value or effectiveness of the NYSEG/RG&E program. However, they insisted that the evaluators still needed to provide a net-to-gross ratio for the program for this 2010-2011 evaluation period.

Therefore we decided to use the results from the end user self-report method to calculate the net-to-gross ratio for this evaluation period. Table 1-9 shows these estimates. We weighted the overall program net-to-gross ratio based on the number of participating customers.

Table 1-9
Program Net-to-Gross Ratios
for the 2009-2011 Evaluation Period

Measure	Accounts	End User Self Report Method Net-to-Gross Ratios
Boiler	1,124	0.35
Furnace	9,766	0.24
Total	**10,890**	**0.25**

1.4.5 Other Findings

The impact evaluation found that the NYSEG and RG&E Residential Gas program did an exceptional job of collecting unit information in its program tracking database, especially concerning the AFUE ratings of the furnaces/boilers which were removed. The availability of this baseline information was a great aid to the billing analysis.

1.5 Engineering Analysis Findings

This subsection summarizes the findings from the engineering analysis of this program. The engineering analysis reviewed the energy savings calculations used in the NYSEG/RG&E Residential Natural Gas Equipment Rebate Program tracking database for the program years 2009-2011. It also conducted a review of New York's Technical Reference Manual (TRM) calculation methods for residential gas measures. This included not only a review of the calculations and assumptions used in the New York TRM but also a literature review to see whether these calculations and assumptions were reasonable based on recent studies or on TRMs from other states and regions.

The key findings and recommendations of the engineering analysis included:

- *The program should adopt the results from the DNV KEMA billing analysis as the updated energy savings for furnaces and boilers.* The engineering analysis observed that the DNV KEMA billing analysis provided energy savings estimates for furnaces that are similar to those estimated by most state/regional Technical Reference Manuals (TRMs) and similar to those found by the HEHE analysis in Massachusetts. The DNV KEMA billing analysis found boiler savings that were higher than most TRMs, though comparable to the HEHE analysis results for high efficiency boilers. The engineering analysis conclude that these higher DNV KEMA boiler savings estimates were reasonable given the high average efficiency of boilers installed under the RG&E/NYSEG program and the fact that in some cases the billing analysis estimates included energy savings from indirect water heaters (which could not be disentangled from the boilers in the analysis).

- *The program should stop claiming separate savings for indirect water heaters installed as part of a new boiler system, and use the results of the DNV KEMA billing analysis which roll savings for indirect water heaters in with boiler savings.* The billing analysis done for this evaluation did not provide enough information to justify a claim for independent savings for indirect water heaters. In addition, from a design perspective, indirect water heaters have the major issue of increased gas usage during the non-heating season. This calls into question the magnitude of savings claimed by the GasNetworks analysis. The type of billing analysis used for furnace/boiler replacement, such as DNV KEMA's for this evaluation, or GasNetworks analysis cited above, relies on a weather-based model that often misses additional usage or savings from the non-heating season. Without a reputable source that includes summer water heating usage, DNV KEMA cannot recommend a savings estimate for indirect water heaters at this time. The engineering analysis also found that the calculation method outlined in the 2010 New York TRM for indirect water heaters was excessively complicated, contained two errors, and was never put into effect.

- *The program should stop claiming separate savings for setback thermostats installed along with a new furnace or boiler, and use the results of the DNV KEMA billing analysis which roll savings for setback thermostats in with furnace /boiler savings.* The New York TRM and many other state/regional TRMs rely on the same 2007 GasNetworks billing analysis for their savings estimates for setback thermostats. However, several issues call into question the accuracy and applicability of the saving estimates from this 2007 study. First other studies covered by our literature review did not find any savings for this measure. Second the GasNetworks study did not account for possible self-selection effects. The GasNetworks study looked at customers who had independently purchased a programmable thermostat (as opposed to having one installed in conjunction with a new furnace or boiler, which is how all the NYSEG/RG&E program participants obtained theirs). It is reasonable to assume that customers who independently purchase a programmable thermostat are likely more energy-conscious to begin with than those who do not seek such thermostats. The GasNetworks analysis also was not accounting for any interactive effects, such as takeback, between the setback thermostats and the new furnace/boiler. However, the NYSEG/RG&E program must account for these interactive effects. Finally, since the 2007 GasNetworks study, setback thermostats have become more commonly installed. For example, the percentage of NYSEG/RG&E participants who reported replacing a setback thermostat with a setback thermostat increased from 49 percent for the 2009-2010 program participants to 59 percent for the 2010-2011 program participants.

1.6 Recommendations for Program Improvements

The following recommendations are based on findings from both the participant surveys and the trade ally interviews:

- *The program needs to increase its marketing and outreach efforts including offering funding for co-operative marketing efforts.* When we asked the program participants for recommendations on how the program might increase participation, the most-cited suggestion, by far (45% of participants) was for the program to do more marketing and build consumer awareness. The second-most-cited suggestion – increasing rebate levels – was only cited by 14 percent of participants. In addition, when we asked the HVAC contractors and distributors how satisfied they were with various aspects of the program, their satisfaction levels were lowest (only 31% satisfied) with the program's marketing efforts. When we asked these trade allies for suggestions on ways to improve the program, doing more marketing and outreach was the most-cited recommendation. The trade allies had some useful suggestions for increase program awareness including:

  - *Funding co-op marketing efforts:* A few of the trade allies mentioned how NYSERDA currently funds 50 percent of the costs of a co-branded effort to promote high efficiency

furnaces and boilers and how they wished that the NYSEG/RG&E program offered something similar. Some suggested that equipment manufacturers could also be asked to contribute a share of this marketing funding.

- *Producing a program fact sheet:* One contractor requested that the program provide contractors with a simple document that contains all the program information (e.g., requirements, eligible equipment, etc.) that they could hand out to customers.

- *Providing website information on the life-cycle benefits of EE equipment:* One contractor suggested providing information on the program website that explains/compares the life-cycle costs of an energy-efficient furnace/boiler with a standard efficiency model.

- *Doing more upstream outreach:* A couple of contractors suggested that more should be done to build awareness of the program among HVAC equipment manufacturers and distributors.

- *The program should continue to use a diversity of marketing channels.* The participant survey results revealed that different types of program marketing reached different parts of the RG&E/NYSEG customer base. Of the types of marketing methods used by the program:

  - Radio and television ads were more successful in reaching less educated customers, in reaching customers during the 2010-2011 program year (vs. the 2009-2010 program year), and in reaching RG&E customers (vs. NYSEG customers).

  - Newspapers were more successful in reaching seniors and more educated customers vs. their younger and less-educated counterparts.

  - Utility mailings and the utility website were more successful with higher-income customers.

- *The program should develop a customized strategy and marketing collateral for getting greater program penetration in the condominium and multifamily market.* A couple of contractors claimed that the program was not doing enough to increase its presence in the condominium and multifamily market. At the same time many noted that it can be difficult to install some of the higher AFUE equipment in some condominiums, town houses, and apartments due to tighter spaces and the need for extra venting/piping. We would recommend that the NYSEG/RG&E program develop marketing materials that were customized to this market. The materials would be targeted at owners of condos, townhomes, and apartments (either for direct mail or distribution to contractors) and would not only promote the program but would be upfront about the special structural challenges these types of housing sometimes pose for the installation of higher efficiency furnaces.

- *The program should do more promotion of the rebate reservation system to contractors. The rebate reservation system received high satisfaction ratings from those contractors who were familiar with it.* These contractors said that the system was very helpful in being able to confirm to customers they would receive their rebate. However, since a number of contractors and distributors indicated unfamiliarity with the system, it would likely benefit the program to do more promotion of this system.

- *The program should consider offering larger rebates for the equipment with higher AFUE ratings.* Ninety-three percent of the participating HVAC contractors and most of the HVAC distributors reported that the program was either "very effective" or "effective" in encouraging trade allies to sell more energy efficient gas heating equipment. However, when recommending ways to improve the program, the second-most common recommendation was to focus program rebates on the equipment with the highest AFUE ratings. "Rather than offering so many rebates, they should increase the incentives -- quantity vs. quality," said one contractor. "The size has to be substantial enough to motivate." Another contractor recommended that the program offer a "tiered" rebate for 97% AFUE furnaces.

- *The New York Technical Reference Manual should reconsider offering rebates for programmable thermostats.* Fifty-three percent of the participants who received programmable thermostats through the program previously had a programmable thermostat: The fact that over half of the recipients of the program-rebated programmable thermostats previously had a programmable thermostat raises some questions about the energy savings attributed to this measure in the New York Technical Reference Manual. This issue is discussed in more detail in the engineering analysis section of this report.

2. Findings from the Participating Customer Surveys

This section contains our findings from surveys we conducted with 550 program participants.

2.1 Background

The evaluation team designed a sampling plan for the program participants that was broadly representative of the participant population with some oversampling of participants who received the less common measures (duct sealing, boiler reset controls, and indirect water heaters). Table 2-1 shows this sampling plan including a listing of the variables used to differentiate the participant strata, the populations of these strata, and the target number of completed surveys. The purpose of the oversampling of the less common measures was to provide the evaluators with the necessary diversity of participant types to examine all aspects of program participation.

Table 2-2 shows the actual number of surveys we completed and how these were distributed among the various participant strata. The table shows that we are able to successfully meet our overall target and almost all of our strata targets.

Table 2-1
Participant Sample Population as of July 2011
and Target # of Completed Surveys

Stratum	Sampling Measure Type	Billing Analysis Period	Prog. Tstat	Sample Population		Target Completes	
				n	Percent	n	Percent
1	Duct Sealing*	N/A	N/A	23	0%	20	4%
2	Boiler Reset Control*	N/A	N/A	27	0%		
3	Indirect Water Heater*	N/A	N/A	295	3%	50	9%
4	Boiler	Yes	Yes	229	2%	30	5%
5	Boiler	Yes	No	330	3%	40	7%
6	Furnace	Yes	Yes	4,193	39%	190	35%
7	Furnace	Yes	No	1,412	13%	70	13%
8	Boiler	No	Yes	102	1%	5	1%
9	Boiler	No	No	149	1%	5	1%
10	Furnace	No	Yes	2,944	27%	100	18%
11	Furnace	No	No	1,168	11%	40	7%
Total				**10,872**	**100%**	**550**	**100%**

Notes: "Prog. Tstat" is an abbreviation for a programmable thermostat. *Participants in the duct sealing, boiler reset control, and indirect water heater strata also had boilers or furnaces installed.

Table 2-2
Final Disposition (Completed Surveys vs. Targets)

Stratum	Sample Population		Target Completes		Final Disposition	
	n	Percent	n	Percent	n	Percent
1	23	0%	23	~2%	17	3%
2	27	0%	27	~2%		
3	295	3%	50	9%	50	9%
4	229	2%	30	5%	30	5%
5	330	3%	40	7%	40	7%
6	4,193	39%	190	35%	190	35%
7	1,412	13%	70	13%	70	13%
8	102	1%	5	1%	6	1%
9	149	1%	5	1%	5	1%
10	2,944	27%	100	18%	102	19%
11	1,168	11%	40	7%	40	7%
Total	**10,872**	**100%**	**550**	**100%**	**550**	**100%**

Notes: "Prog. Tstat" is an abbreviation for a programmable thermostat. *Participants in the duct sealing, boiler reset control, and indirect water heater strata also had boilers or furnaces installed.

2.2 Participant Characteristics

We asked the program participants a number of demographic questions and questions about their housing characteristics. Table 2-3 summarizes their responses to these questions. Some interesting findings included:

- *Age of housing:* Slightly over half (51%) the houses were built before 1960.
- *Housing size:* Over half the participants (58%) reported that their houses had less than 2,000 square feet of heated space
- *ENERGY STAR appliance ownership:* Over three quarters (77%) of the participants reported that they own ENERGY STAR appliances.

Table 2-3
Participant Demographic and Housing Characteristics

Gender	**Male**	**Female**	**DK/ Refused**
	61%	39%	0%
Age	**< 40**	**40-64**	**65 or older**
	11%	53%	29%
Education	**High school degree, some college, or less**	**Four-year college degree**	**Graduate degree or some grad school**
	33%	32%	32%
Household income	**< $50,000 annual income**	**> $50,000 annual income**	**DK/ Refused**
	24%	54%	22%
Household size	**Single-person household**	**Two-person household**	**Household size > 2**
	20%	44%	36%
Own vs. rent	**Own**	**Rent**	**DK/ Refused**
	99%	0%	1%
House characteristics	**Single-family unattached house**	**Other house types***	**DK/ Refused**
	95%	5%	0%
	House built after 1980	**House built 1960-1979**	**House built before 1960**
	22%	26%	51%
	2,000 sq. feet or less of heated space	**More than 2,000 sq. feet of heated space**	**DK/ Refused**
	58%	28%	13%
Energy Star appliance ownership	**Own Energy Star appliances****	**Do not own Energy Star appliances**	**DK/ Refused**
	77%	14%	8%

Notes: *The majority of these (61%) who lived in "other house types" lived either in a duplex or other kind of single-family house connected to other houses. A condominium was the second-most-cited (10%) housing type of those who did not live in a single-family unattached house. **The most common ENERGY STAR appliances owned were refrigerators (76% of those who reported owning any ENERGY STAR appliances), clothes washers (42%), dishwashers (39%), clothes dryers (34%), and ovens/ranges (27%).

We also looked at statistically-significant differences between the NYSEG and RG&E participant populations. Some of these included:

- *Education level:* The RG&E participants were more likely than the NYSEG participants to have graduate degrees (33% vs. 21%).
- *Age of house:* The NYSEG participants were more likely (60% of respondents) to have a house built before 1960 than the RG&E participants (47%).
- *Size of house:* The RG&E participants were more likely than the NYSEG participants to say they had a house with 2,000 square feet of heated space or less (64% vs. 49%). However, the NYSEG participants were much more likely than the RG&E participants to say that they did not know what the heated square footage of their house was (24% vs. 7%).
- *ENERGY STAR appliance ownership:* The NYSEG participants were more likely than the RG&E participants to say that they owned ENERGY STAR clothes washers (51% vs. 38%).

2.3 Characteristics of Equipment Purchase and Replacement

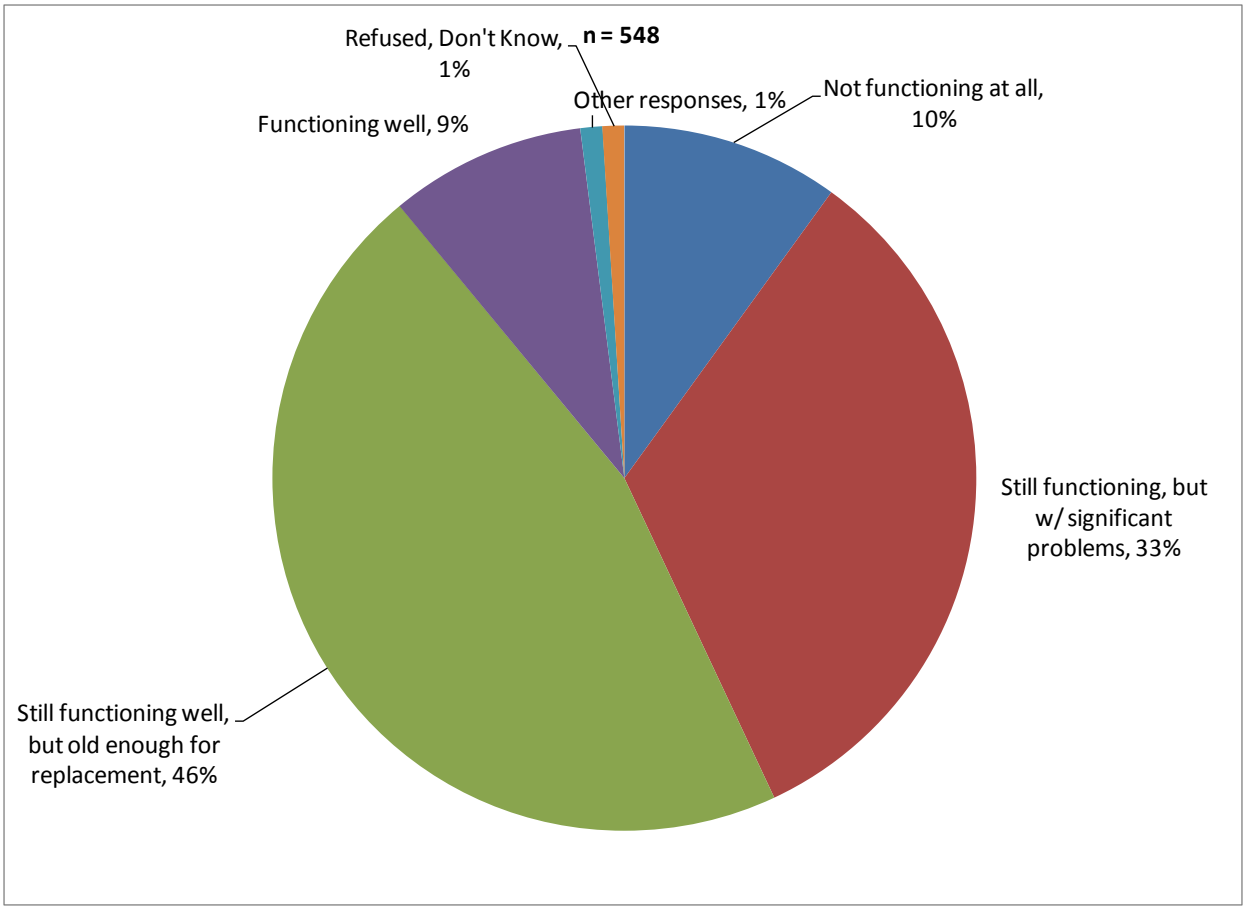
This subsection discusses what program participants said about the condition of the furnace/boiler they replaced, any changes in heating capacity of the old vs. the new furnace/boiler, and whether they had made any changes in the type of fuel they used to heat their homes.

2.3.1 The Condition of the Previous Equipment

One of the most interesting findings from the participant survey concerned what the participants said about the condition of the heating equipment they had replaced. The evaluators assumed that since a furnace or a boiler is a very expensive purchase, especially in the context of the current economic downturn, most of the existing furnaces or boilers would have either been completely inoperable or "on their last legs."

Yet the survey responses indicated that these assumptions were not true. The survey asked the participants: "Which of the following best describes the condition of your [boiler/furnace/water heater] before it was replaced …not functioning at all, still functioning but with significant performance or maintenance problems, still functioning well but old enough that I wanted to replace it, and functioning well." Figure 2-1 shows that more respondents said that their furnace or boiler was still functioning well than said that their furnace/boiler was functioning poorly or not functioning at all. This indicated that the program was encouraging more "early replacement" of less efficient furnaces and boilers than the evaluators had initially assumed.

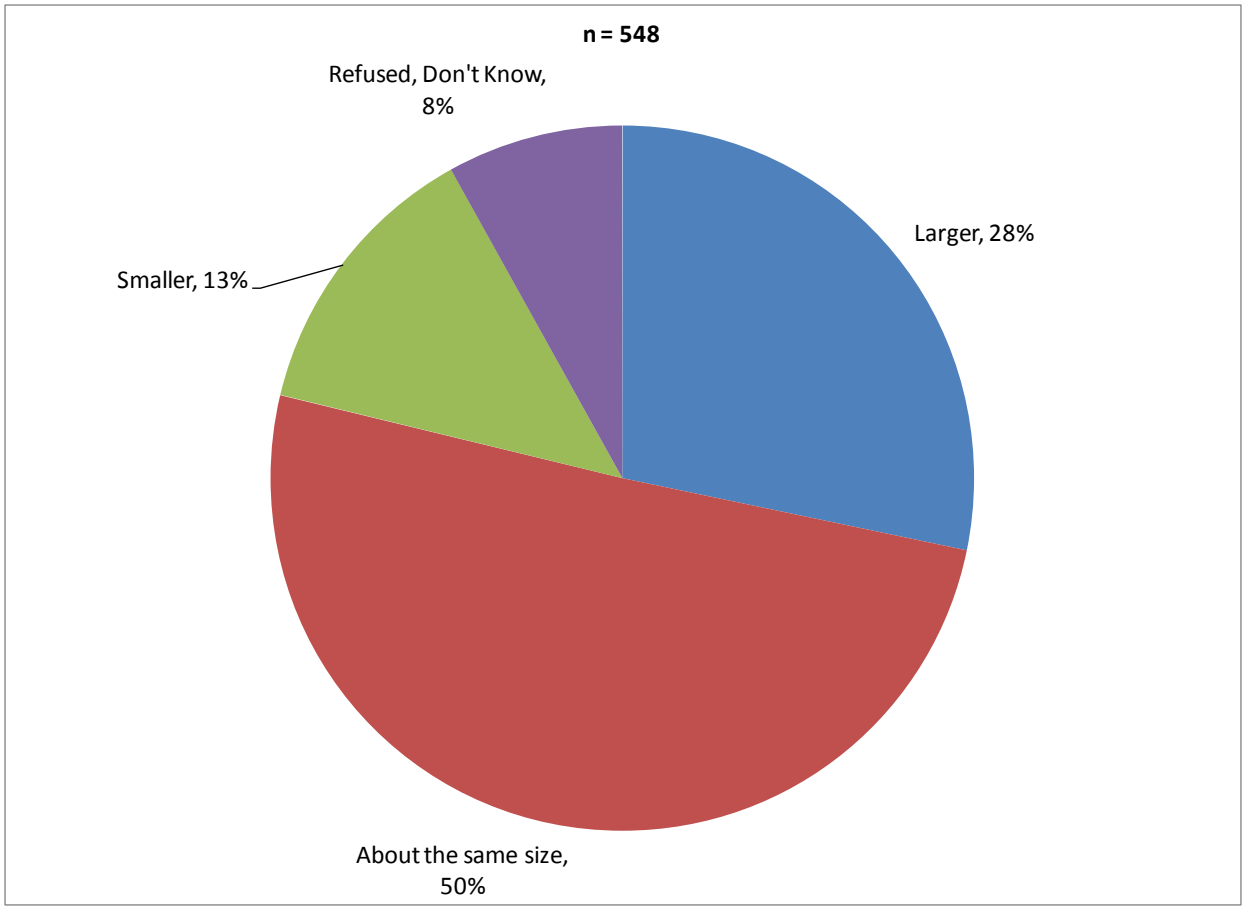
Figure 2-1
The Operating Condition of the Previous Equipment



2.3.2 Heating Capacity

The billing analysis indicated that the heating capacities of the new furnaces or boilers that contractors were installing were, on average, lower than the equipment they replaced. The participant survey results appeared to confirm this. We asked the participants: "In terms of its heating capacity, was your previous [boiler/furnace/water heater] larger, smaller, or about the same size as the [boiler/furnace/water heater] you recently had installed?" Figure 2-2 shows that while half the respondents said that the size of their equipment stayed the same, more than twice as many said that their previous equipment had been larger than said that their previous equipment had been smaller.

Figure 2-2
The Heating Capacity of the Old Equipment vs. the New Equipment



2.3.3 Fuel Switching

One issue of particular interest for the billing analysis was how many participants switched to natural gas for heating from another fuel (e.g., propane, wood, electricity). A high percentage of fuel switchers could potentially distort the billing analysis because the natural gas consumption data of fuel-switching households would show an upward spike as the household went from not using natural gas at all, or possibly just using gas for cooking or water heating, to using gas for heating.

Fortunately the program tracking database had data on which participants were fuel switchers and so the billing analysts were able to remove these participants from their analysis frame. As an additional check, the survey asked participants: "Before you had your equipment replaced, was natural gas your primary heating fuel?" Figure 2-3 shows that only five percent of the respondents reported to be fuel switchers.

Figure 2-4 shows that the majority of the fuel switchers were either using heating oil (42%) or wood (28%) as their primary heating fuel before switching to gas.

Figure 2-3
Whether Gas was Participant's Primary Heating Fuel
Before Equipment Replacement

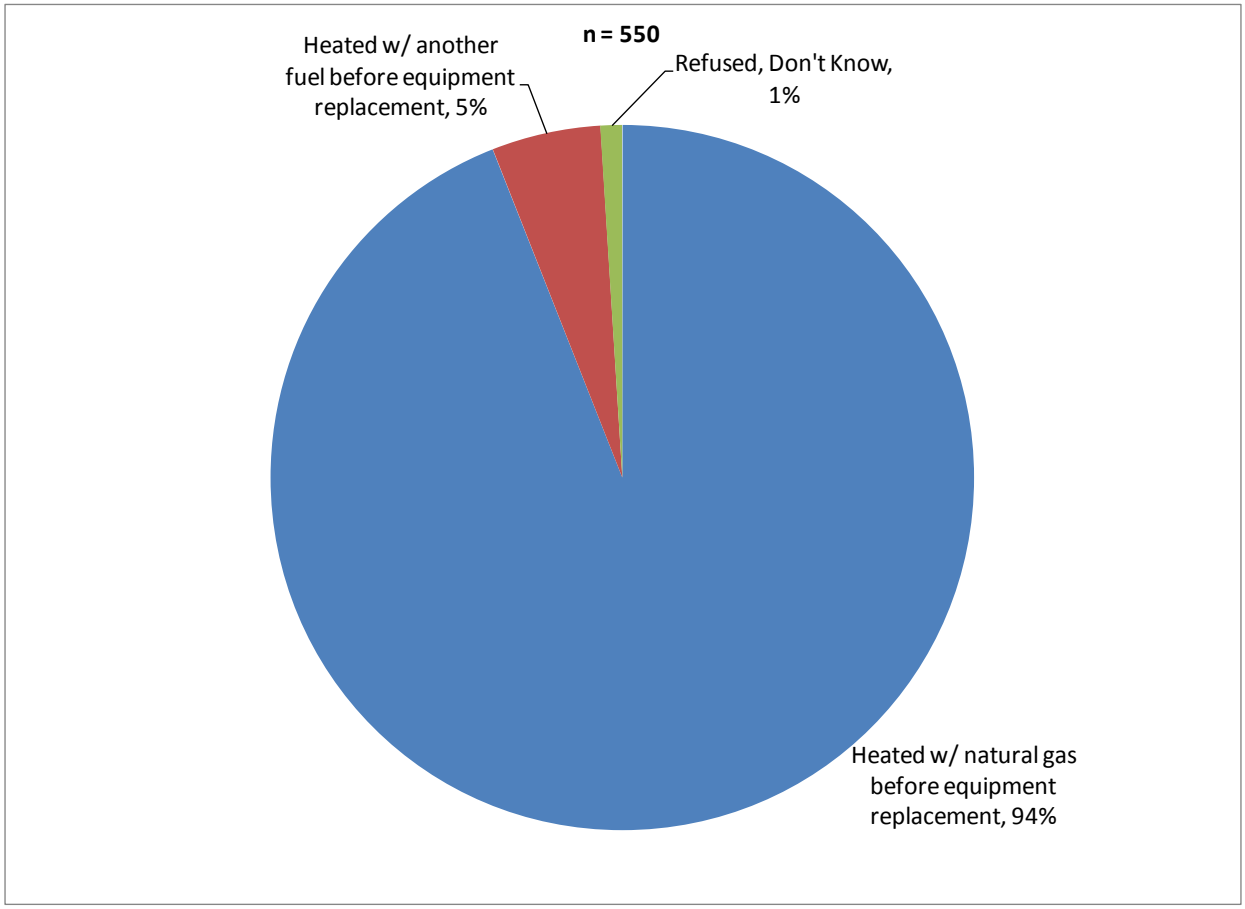
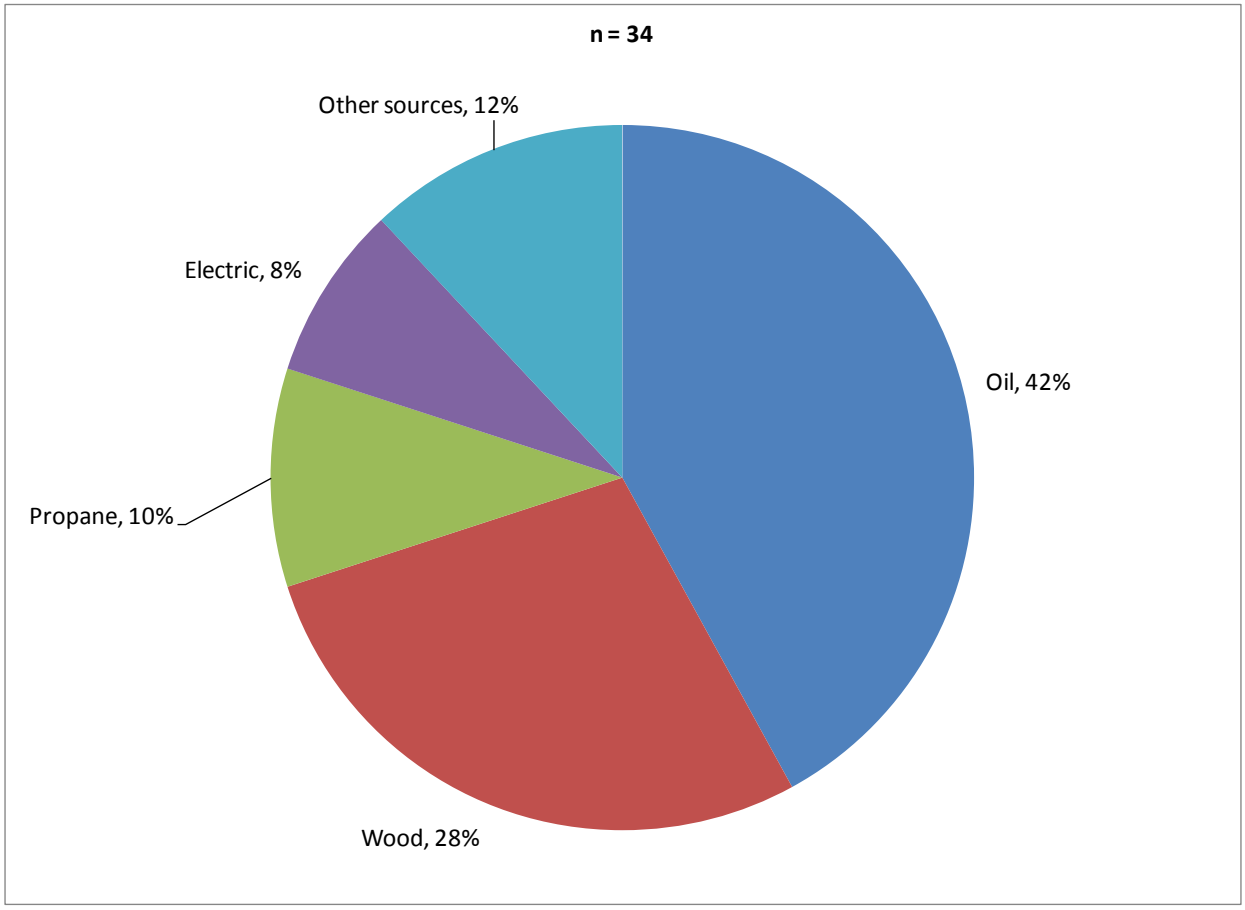


Figure 2-4
Previous Primary Heating Fuel
of Fuel Switchers



2.4 Participant Awareness and Motivations

This subsection discusses what program participants said about:

- Whether they were aware of receiving the program rebates;
- How they became aware of the program;
- Which sources of program information were most influential in getting them to take advantage of the rebates;
- Whether they were aware of the rebate program before they contacted their HVAC contractor about the furnace/boiler replacement;
- Their reasons for replacing their furnace/boiler;
- Whether they had an energy-efficient furnace/boiler in mind before joining the program; and
- Why they chose a high-efficiency furnace/boiler.

2.4.1 Participant Awareness

In some energy efficiency rebate programs a certain percentage of the program participants may not even be aware that they received a rebate. This can be due to a number of factors including:

- The HVAC contractors may be eligible to receive part or all of the rebates;
- The utility pays the rebate as a line item bill reduction rather than sending a check; and
- The program pays point-of-sale rebates which are automatically deducted from the equipment cost at the cash register.

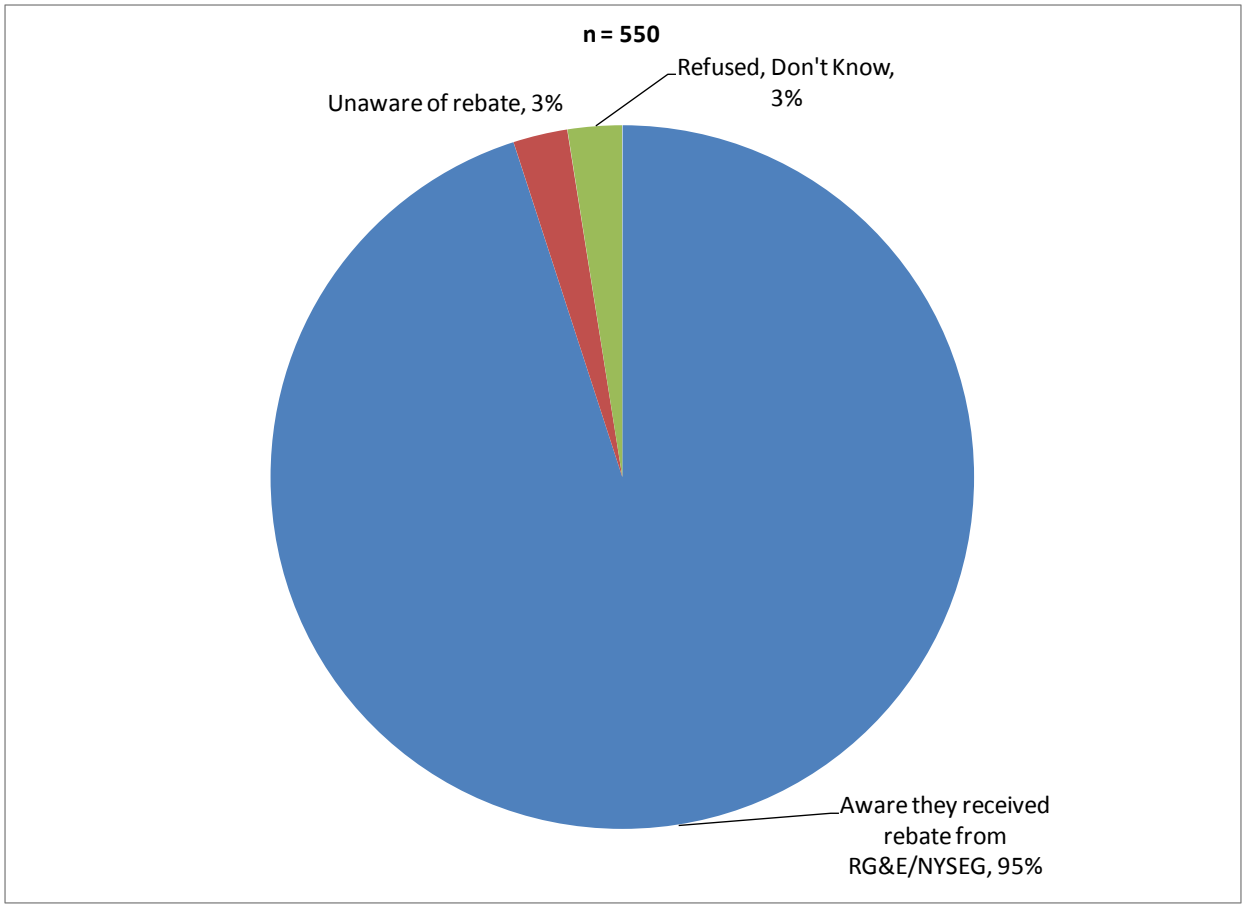
If a significant percentage of participants are unaware that they received a rebate from a program, it can reduce a program's net-to-gross ratio because these participants are not aware of the role the program played in reducing the cost of the energy-efficient equipment.

None of these factors affect the NYSEG/RG&E Natural Gas Equipment Rebate Program, however. Participants receive their rebates in the form of a check from RG&E/NYSEG rather than a utility bill reduction or point-of-sale discount. In addition HVAC contractors are not allowed to receive the rebate checks unless they installed some eligible equipment in their own houses.[6]

Therefore it was not surprising that awareness of the rebates among the NYSEG/RG&E program was very high. We asked the participants: "Were you aware that you received a rebate from the [RG&E/NYSEG] Residential Natural Gas Equipment Program for the equipment?" Figure 2-5 shows that almost all of the participants were aware of receiving the rebates. Not surprisingly, participants who said they had joined the program to get a rebate were more aware that they had received a rebate than those who had joined the program for other reasons.

[6] These requests are handled on a case-by-case basis and must be approved by the program manager. The rebate application must meet all other program requirements, including equipment, invoicing and inspection. (1/20/12 email from Kevin Schmalz, Program Manager)

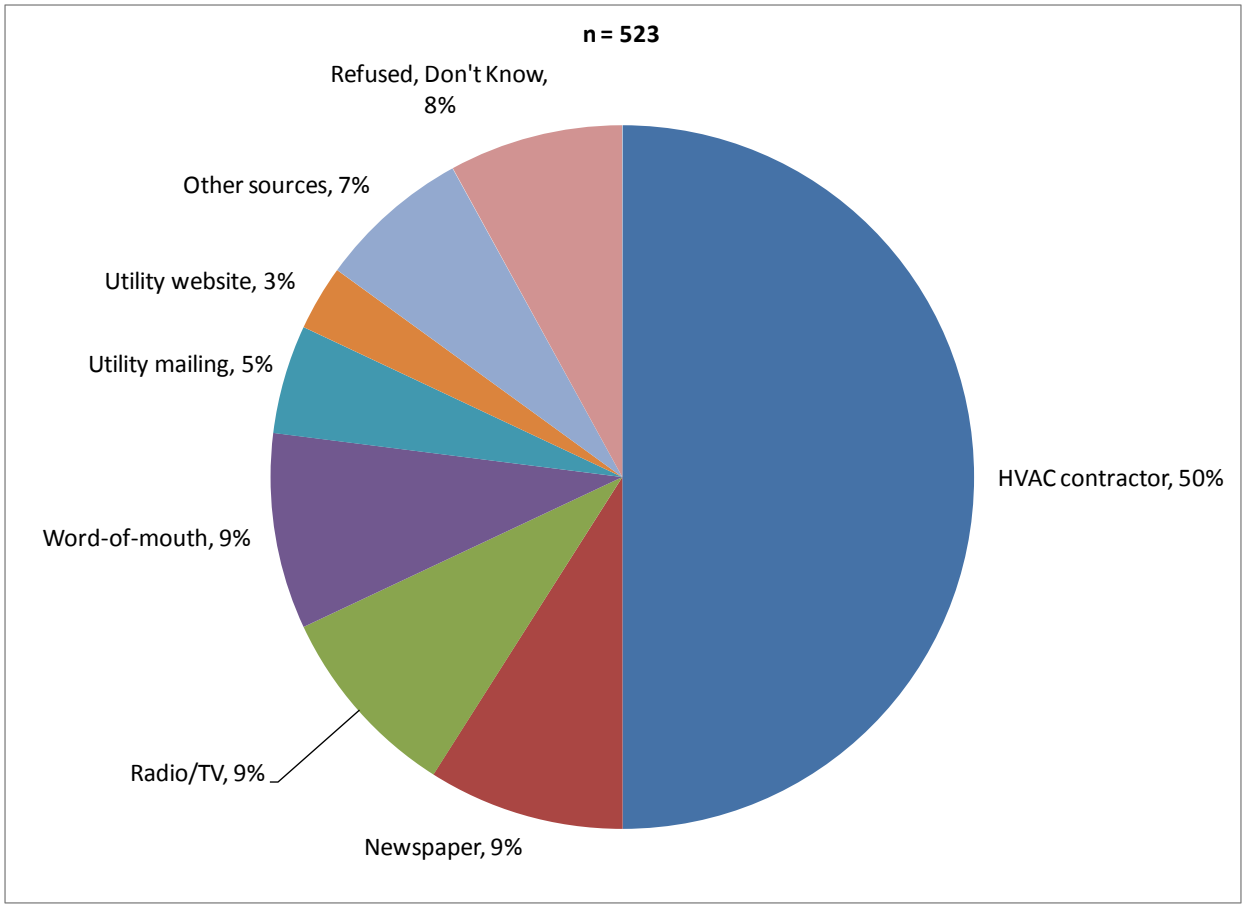
Figure 2-5
Participant Awareness of Receiving Rebate



2.4.2 Sources of Program Awareness

To learn something about the program marketing efforts we asked the participants how they first became aware of the rebates. Figure 2-6 shows that half the participants cited their HVAC contractor as their first source of rebate awareness. The remainder cited a wide variety of first sources – such as newspapers, radio/TV, word-of-mouth, utility mailings, and the utility website – with no one source being cited by more than nine percent of participants.

Figure 2-6
First Sources of Rebate Awareness



We examined the responses to see whether they were any statistically-significant differences among the respondents. We found many of these:

- *Reasons for replacing furnace/boiler:* Not surprisingly those who said that they replaced their furnace/boiler because it was no longer functioning were more likely (69%) to say they heard about the rebate first from their HVAC contractor than those who had replaced their furnace/boiler for other reasons (48%).

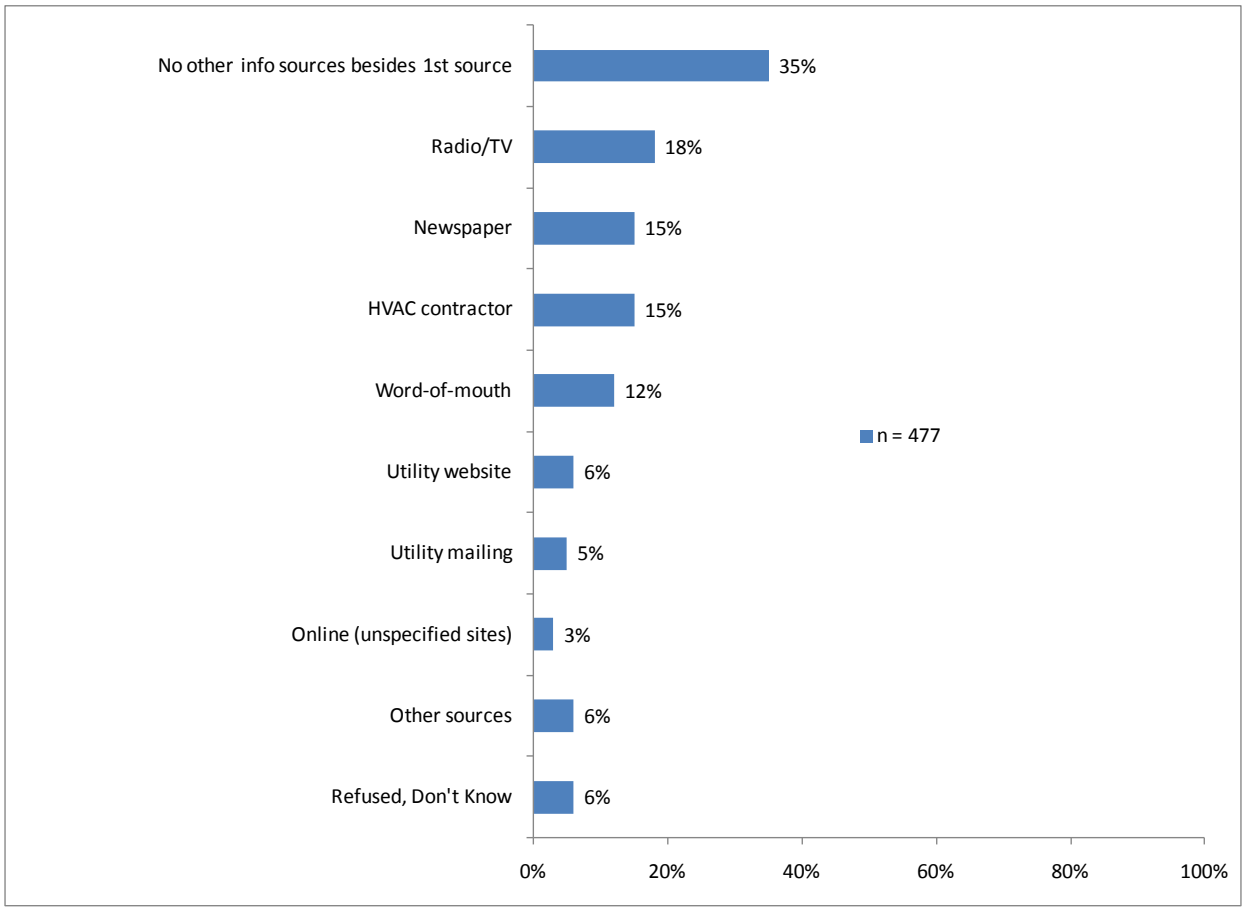
- *Program satisfaction:* Those who were less than satisfied with some aspect of the program were more likely (73%) to say they heard about the rebate first from their HVAC contractor than those who were totally satisfied (49%). One possible explanation for this is since hearing about the program first from HVAC contractors is correlated with one's furnace breaking down, these participants did not voluntarily "join" the program and therefore may have had a more skeptical attitude about the program than those who self selected themselves into the program. It is also

possible that the negative experience of their furnace/boiler breaking down led to general dissatisfaction which may have carried over into their attitudes towards the program.

- *Program year:* Participants from the 2010-2011 program period were more likely (56%) to have first heard of the program from their HVAC contractor than participants from the 2009-2010 program period (46%). One possible explanation for this is that as the program has matured, more HVAC contractors are aware of it and are promoting it.

We also asked the participants what were some other ways they heard about these rebates besides the first source of program information. Figure 2-7 shows that about a third of the participants did not have a secondary source of program information. The remainder named a wide variety of secondary sources with radio/TV, newspaper, and their HVAC contractor being the most-cited.

Figure 2-7
Secondary Sources of Program Awareness



The frequency with which program participants cited these secondary sources did vary, to a statistically-significant degree, among various demographic and other respondent groupings:

- Radio/TV:
  - *Education:* The less education a person had, the more likely they were to have heard about the program through radio or television. Thirty-one percent of respondents with a high school degree or less heard about the program through radio or television. This compares to 22% for people with some college education, 18% for people with a four-year college degree and 9% for people with a graduate degree.
  - *Program year:* Participants from the 2009-2010 program season were more likely to have heard about the program on the radio (21%) than participants from the 2010-2011 program season (15%).
  - *Utility:* The only statistically-significant difference between the two utilities was that the RG&E customers were more likely (21%) to have heard about the program through radio/TV as NYSEG customers (13%).
- Newspapers:
  - *Age:* Seniors were more likely to have heard about the program through newspapers (20% of respondents) than those in the 40-64 age range (13%) or the under-40 age group (8%).
  - *Education:* Those with a four-year degree or graduate degree were about twice as likely to have heard about the program through newspapers (17% and 18% respectively) than those with a high-school degree or less (9%).
- Word-of-mouth:
  - *Age:* Non-seniors were more likely to have heard about the program via word-of-mouth (13-14% of respondents depending on age group) than seniors (7%).
  - *Gender:* Male respondents were more than twice as likely to have heard about the program through word-of-mouth (15%) than female respondents (7%).
- Utility websites:
  - *Gender:* Male respondents were twice as likely (8%) to have heard about the program through the utility websites as females (4%).

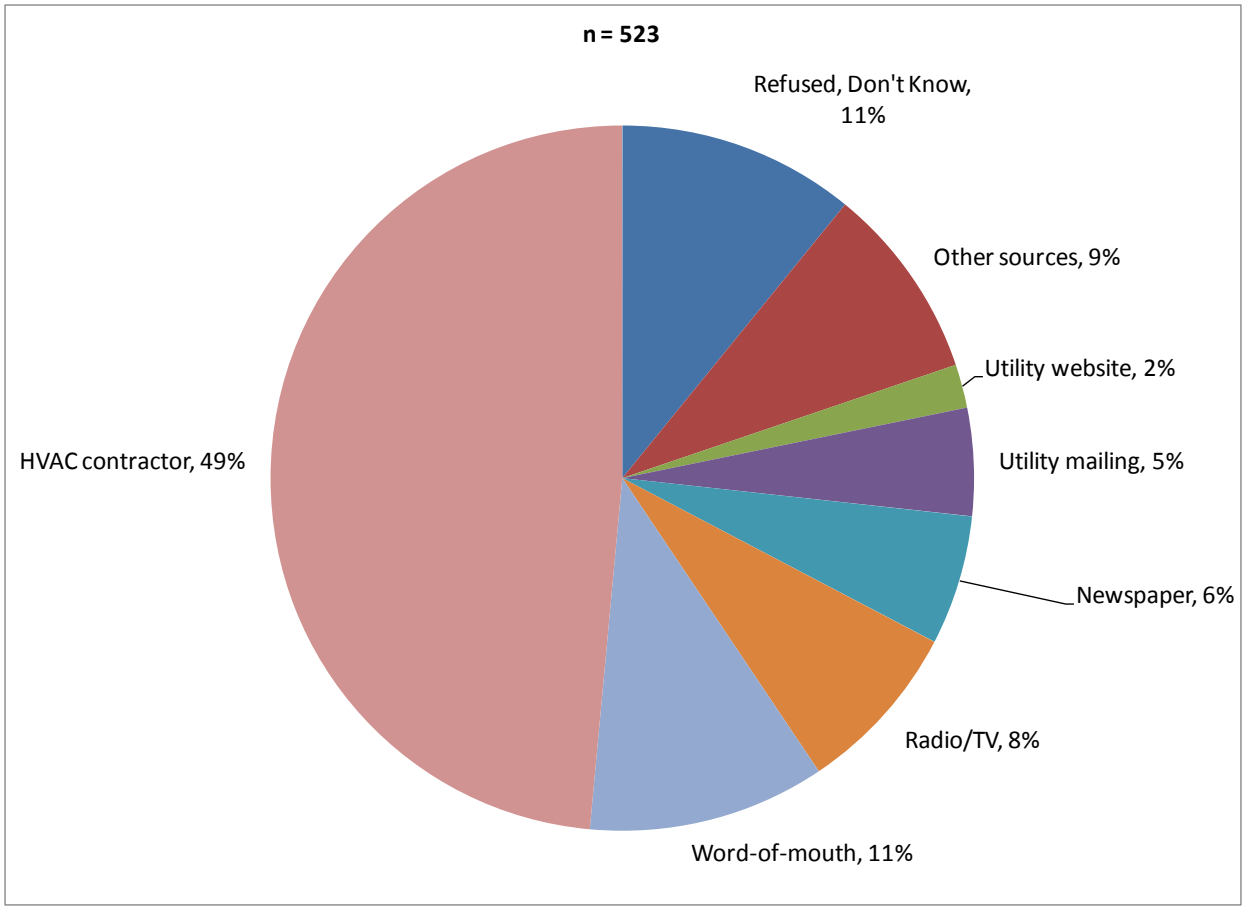
  - *Income:* Those participants who claimed to have annual household income above $50,000 were more likely to have heard about the program through a utility website (9%) or utility mailing (8%) than those with annual household incomes of less than $50,000 (4% for each of these program information sources).

- *Utility mailings:* Those with a four-year degree or graduate degree were more likely to have heard about the program through utility mailings (6% and 7% respectively) than those with a high-school degree or less (less than 1%).

2.4.3 The Most Influential Program Information Source

We asked the program participants which of the sources of program information they had mentioned had been the most influential in getting them to take advantage of the rebates. Figure 2-8 shows that about half (49%) of the respondents said that their HVAC contractor was the most influential information source and the other half cited a wide variety of sources with no particular information source being predominant. There were a number of statistically-significant differences in the responses rates of the various participant types, but they generally followed the same patterns as cited in the previous subsection. For example, seniors were more likely than non-seniors to cite newspapers as being influential; the less educated were more likely than the more educated to cite radio/television as being influential, etc.

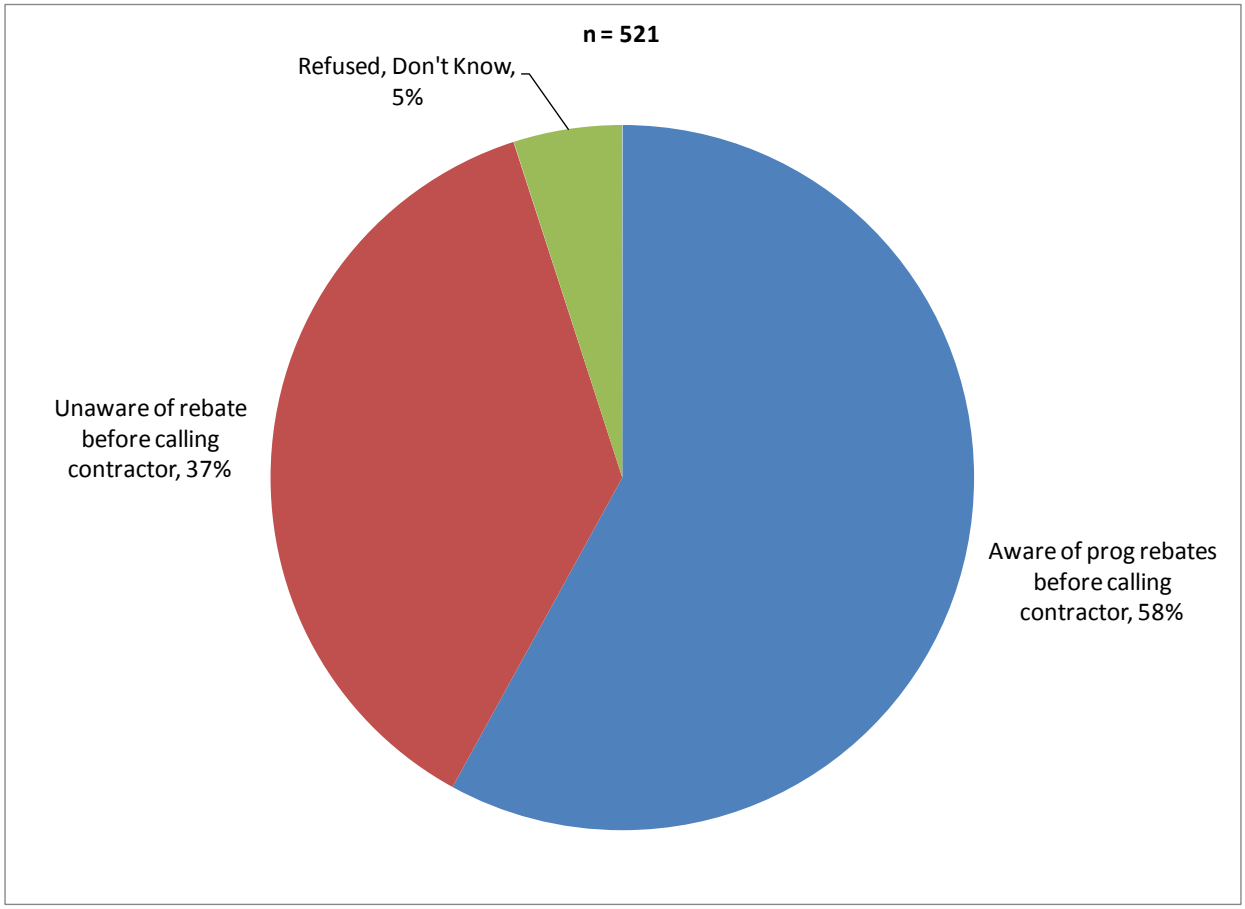
Figure 2-8
The Most Influential Sources of Program Information



2.4.4 The Timing of Program Awareness

We asked the program participants whether they were aware of the program rebates before contacting their HVAC contractor about getting their furnace/boiler replaced. Figure 2-9 shows that the majority (58%) said that they had. However, as noted elsewhere in this report, this initial program rebate awareness often originated with contractor marketing. There were a few statistically-significant differences in the responses among different participant groups. Male respondents were more likely (63% of respondents) to claim they had already been aware of the rebates than female respondents (50%). Respondents over 40 years of age were also more likely to claim prior awareness of the rebates (62% of those in the 40-64 age group and 57% of the seniors) than those in the under 40 group (46%).

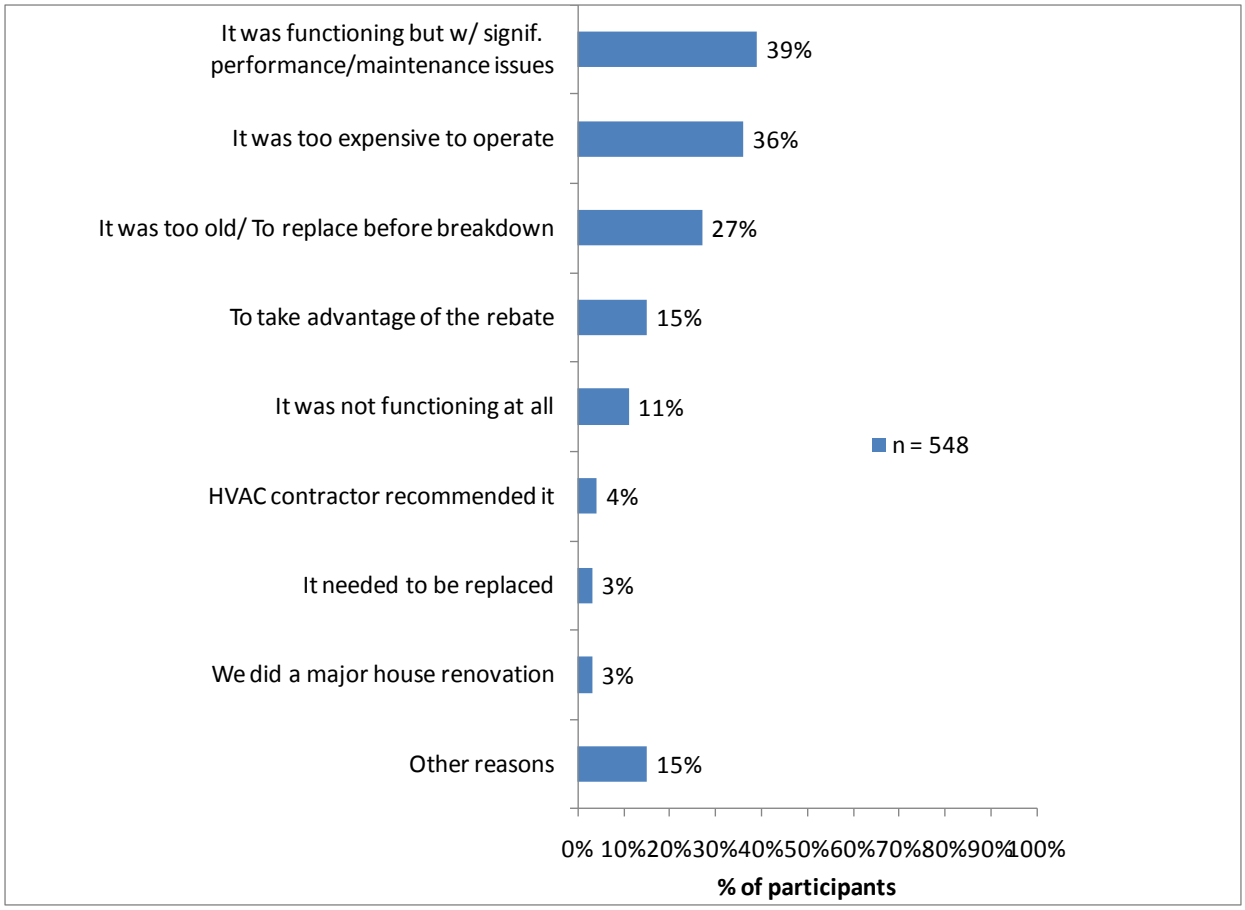
Figure 2-9
Awareness of Program Rebates Before Calling Contractor for Furnace/Boiler Replacement



2.4.5 Reasons for Replacing Furnace/Boiler

We asked the participants why they had their furnace or boiler replaced. We allowed responses to give multiple reasons. Figure 2-10 shows that the top three reasons included wanting to replace a furnace boiler with significant maintenance or performance issues, finding their existing furnace/boiler too expensive to operate, and wanting to replace an old furnace/boiler before it totally broke down.

Figure 2-10
Reasons for Replacing Furnaces/Boilers



Note: The percentages exceed 100% because respondents were allowed to cite multiple reasons.

The reasons for replacing the boiler/furnace varied depending on the demographics of the participants:

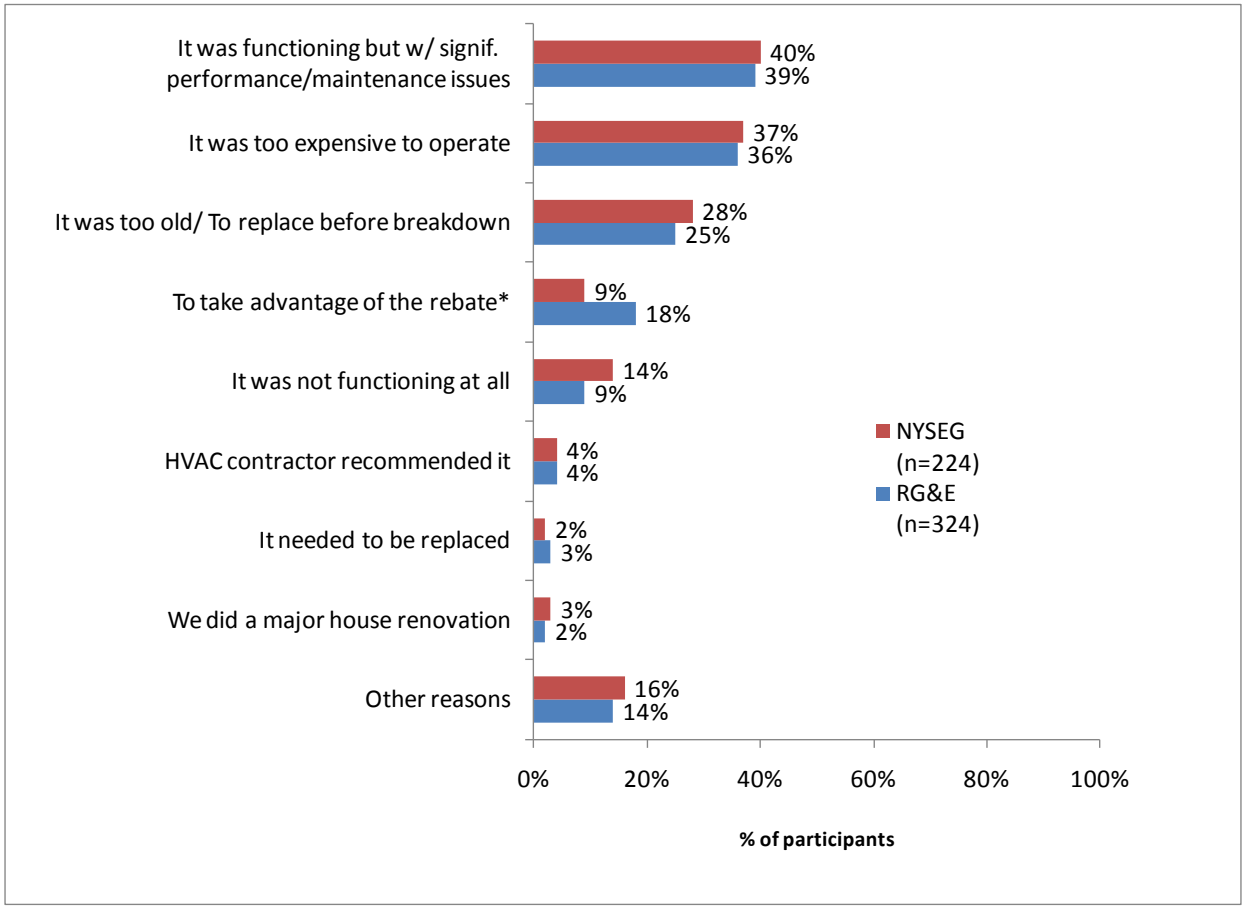
- *Participants who were more concerned about saving energy were more likely to be young, male, and to have higher household incomes:* Nearly half (49%) of those under the age of 40 said that they had their furnace/boiler replaced because it was too expensive to operate or not energy efficient compared to only 31 percent of seniors. Forty-one percent of male respondents cited these as their reasons for furnace/boiler replacement compared to only 29 percent of female respondents. Thirty-nine percent of those participants with annual household incomes equal or greater to $50,000 cited these reasons compared to 29 percent of those with incomes less than $50,000.

- *Participants who were interested in the rebates were more likely to be male, highly-educated, and have higher household incomes:* Male participants were more likely to have replaced their

furnace/boiler to take advantage of the rebates (18% of respondents) compared to female participants (11%). Interest in the rebate declined with participant education. Twenty-one percent of participants with graduate degrees cited the rebates as a motivating factor compared to 15 percent of those with four-year degrees, 13 percent of those with some college education, and nine percent for those with a high school education or less. Since income is correlated with education, it was not surprising that the higher-income participants were also more likely (19%) to cite the rebates as a motivating factor compared to the lower-income participants (8%).

Figure 2-11 shows the reasons that participants cited for replacing their furnaces/boilers broken out by the participant's utility service territory. It shows that there wasn't much variation in response based on the participant's utility. The one statistically-significant difference was that the RG&E participants were twice as likely as their NYSEG counterparts to have replaced their furnace/boiler because of the program rebates.

Figure 2-11
Reasons for Replacing Furnaces/Boilers
by Utility



Note: The percentages exceed 100% because respondents were allowed to cite multiple reasons.

2.4.6 Whether They Had an Energy-Efficient Furnace/Boiler in Mind before Joining the Program

We were interested in learning what percentage of program participants had an energy-efficient furnace in mind before they started speaking to their HVAC contractor. First we asked them whether they had any type or model of furnace/boiler in mind before they contacted their contractor. Only 20 percent of the participants did.

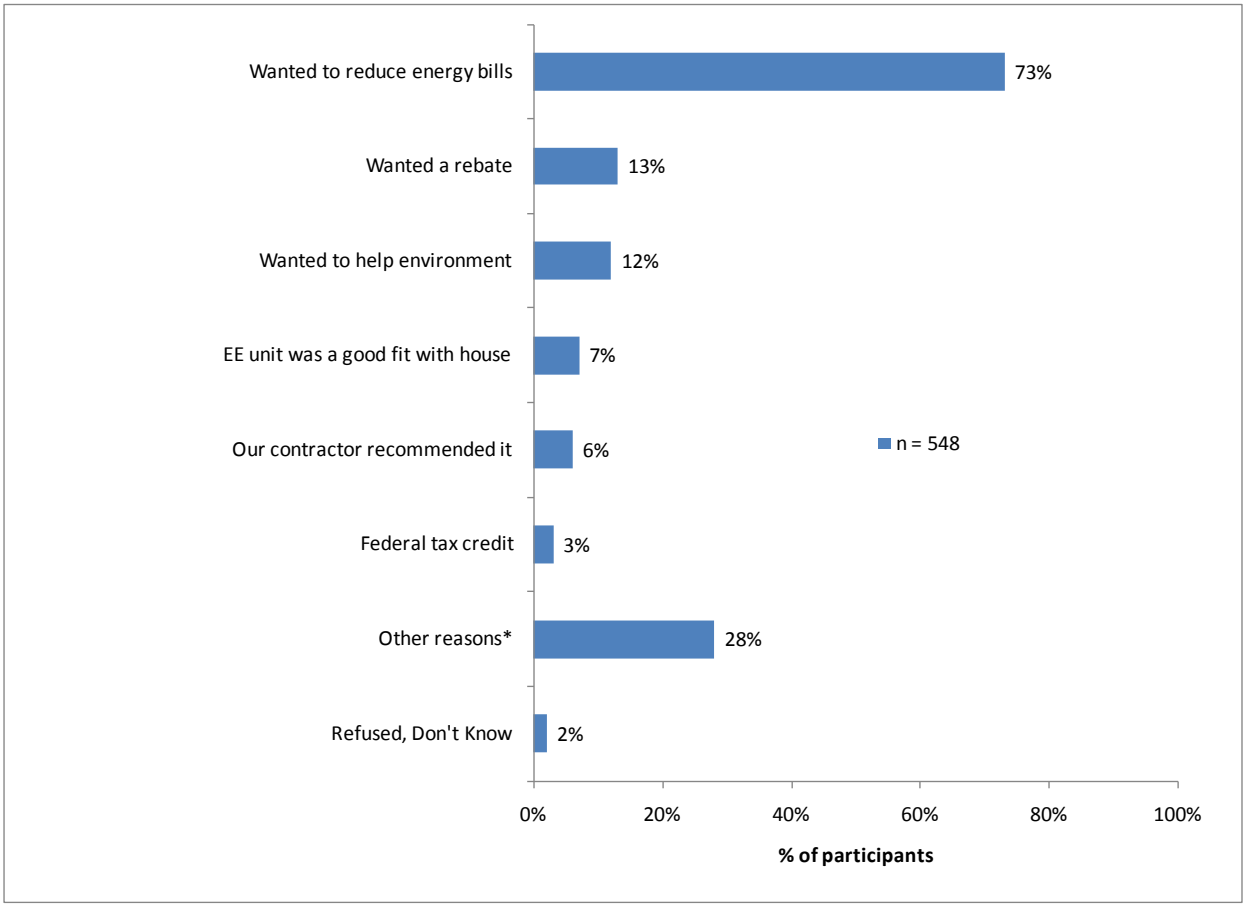
We then asked the participants who said they had a particular type/model of a furnace/boiler in mind (n=108) before contacting their contractor what type/model of furnace/boilers they had had in mind. Fifty-two percent of this subgroup (10% of the total participant population) said that they had had an energy-efficient furnace in mind. The participants who were most likely to have the energy-efficient

furnace in mind were male, highly-educated, and in the higher-income groups. Of the subgroup which had a particular type/model of a furnace/boiler in mind before contacting their HVAC contractor, RG&E participants were more likely (59% of respondents) than NYSEG participants (41%) to say they had an energy-efficient furnace/boiler in mind.

2.4.7 Why They Chose the High Efficiency Furnace/Boiler

We asked the participants for some reasons why they chose to go with the high efficiency furnace/boiler. About three quarters (73%) of the participants said they chose the high efficiency furnace/boiler because they wanted to reduce their energy bills. Participants gave other reasons, like wanting to get a rebate or helping the environment, much less often. Figure 2-12 shows the full range of responses.

Figure 2-12
Participant Reasons for Going with
High Efficiency Furnace/Boiler



Note: * Other reasons included improved heating performance/comfort, good/low cost of the unit, unit was old/needed replacement, to improve home/resale value, quieter operation, better warranty, high durability/reliability among others. The total percentages exceed 100% because respondents were allowed to cite multiple reasons.

There were many statistically-significant differences in response rates depending on the demographic or other characteristics of the respondents. The following are some of these:

- *Wanting to reduce their energy bills:* Participants who were male, non-seniors, and RG&E customers were more likely to cite this as a reason to get the high efficiency furnace/boiler.
  - *Gender:* Male participants were more likely (77% of respondents) than female participants (67%) to say they got the high efficiency furnace/boiler because they wanted to reduce their energy bills.

  - *Age:* Non-seniors (76%) were more likely than seniors (68%) to say they got the furnace/boiler because they were looking for energy bill reduction.

  - *Utility:* RG&E participants were more likely (76%) than NYSEG participants (67%) to say they got the furnace/boiler because they were looking for energy bill reduction.

- *Wanting the rebate:* Participants who were male, higher income, and who heard about the program before contacting their contractor were more likely to cite the rebate as a reason.

  - *Income:* Those in the higher income group (at least $50,000 yearly household income) were more likely (15%) to cite the rebate as a reason than those in the lower income group (9%).

  - *Gender:* Male participants were more likely (15%) than female participants (10%) to cite the rebate as a reason.

  - *When they heard about the program:* Participants who had heard about the NYSEG/RG&E program before contacting their HVAC contractor were more likely (16%) to say they wanted the rebate than those (9%) who only heard about the program after contacting their HVAC contractor.

- *Wanting to help the environment:* Younger and more educated participants were more likely to cite environmental reasons for getting the high-efficiency furnaces/boilers.

  - *Age:* Participants under the age of 40 were more than twice as likely (19%) to cite environmental reasons as senior participants (9%).

  - *Education:* The more educated a person was the more likely they would be to cite the environment as a reason. Participants with graduate degrees were the most likely (19%), followed by those with a four-year college degree (13%), followed by those with some college (11%), and finally those with a high school degree or less (2%).

We also asked the participants who cited multiple reasons for getting the high efficiency furnace/boiler which of these reasons was most important. The most important reason that was cited by the most participants, by far, was reducing the energy bills (64%) of participants. The next-most-cited important reasons included the HVAC contractor recommending it (4%) and wanting to get the rebate (4%). The most-cited of the second-most important reasons was helping the environment (8%), followed by getting an NYSEG/RG&E rebate, and then wanting to reduce their energy bills (6%).

2.5 The Role of the HVAC Contractor in the Equipment Purchase Decision

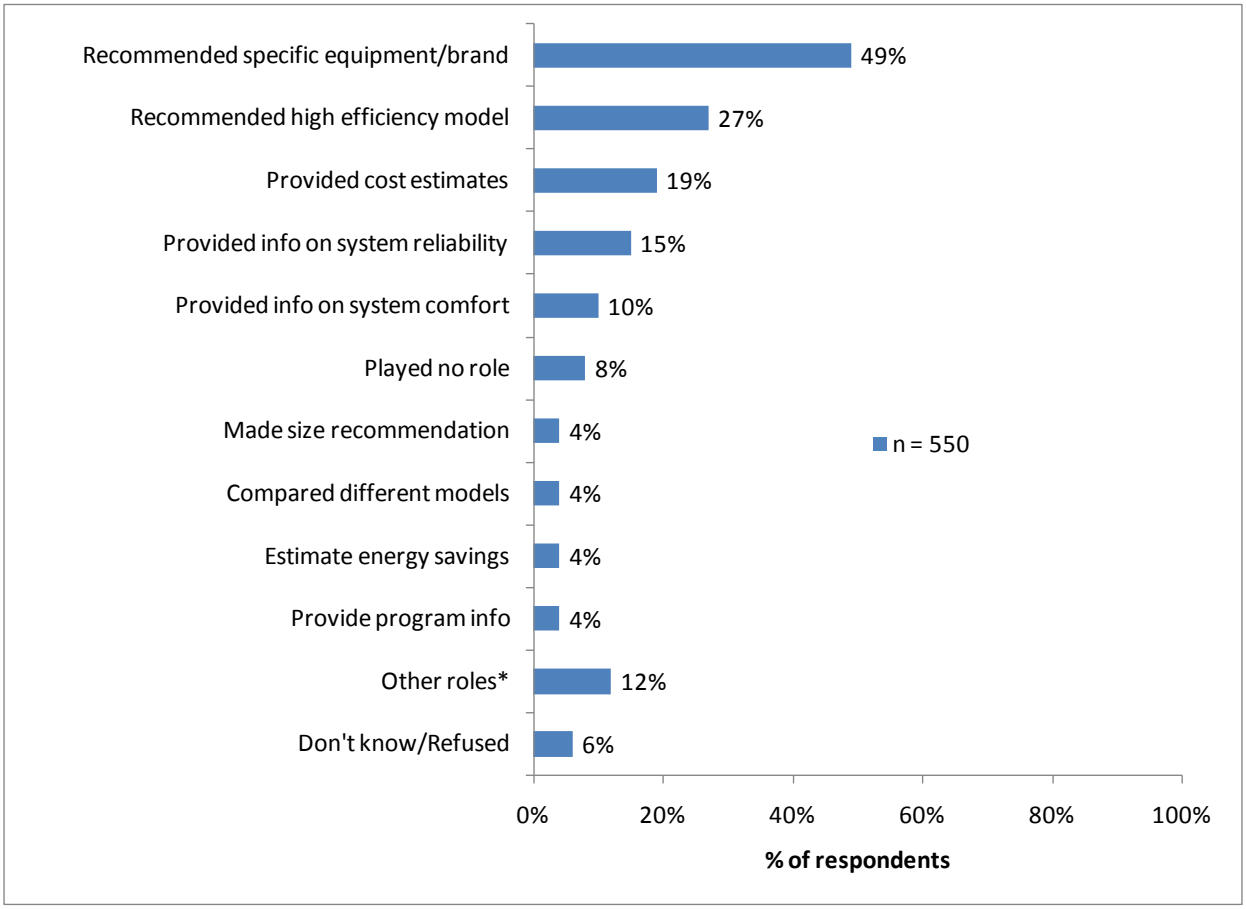
This subsection discusses what program participants said about:

- The role of the HVAC contractor in helping to select the furnace/boiler;
- Which furnace/boiler features the contractor emphasized;
- Which furnace/boiler features mattered most to customers;
- Whether the HVAC contractor presented them with multiple options in terms of models or prices;
- Whether they were aware of the higher incremental cost of the high-efficiency furnaces and boilers; and
- Whether they had any difficulty finding HVAC contractors who sold indirect water heaters.

2.5.1 The Role of the HVAC Contractor in Helping Select the Furnace/Boiler

We asked the participants what role the contractor played in helping select the furnace/boiler they had installed. Nearly half (49%) of the participants said that their HVAC contractor recommended a specific type of brand/equipment with about a quarter (27%) saying that their contractor recommended a high efficiency model. Other less common roles of the contractor included providing cost estimates, providing information on system reliability, and providing information on system comfort. Only eight percent said that their contractor played no role in helping to select the equipment. Figure 2-13 shows the full range of responses.

Figure 2-13
the Role of the HVAC Contractor
in Helping to Select the Furnace/Boiler



Note: Percentages add up to more than 100% because multiple responses were allowed. *Other roles included identifying equipment eligible for the rebate, encouraging the participants to replace the equipment when they did, recommending what they needed, among others.

What the participants recalled as the role of the HVAC contractors in equipment selection did, in some cases, vary to a statistically-significant degree depending on the demographics of the participants or other characteristics. The following are some of these statistically-significant differences:

- *Age:*
  - *Recommending energy-efficient model:* Senior participants were less likely (22% of respondents) than non-seniors (30%-33% depending on age bracket) to recall that their HVAC contractor recommended an energy-efficient model.

- *Identifying rebate-eligible equipment:* Senior participants were less likely (1% of respondents) than non-seniors (5%) to recall that their HVAC contractor identified equipment that was eligible for rebates.

- *Size recommendations:* Participants in the middle age bracket (40-64) were more likely (6% of respondents) than seniors (2%) or those in the youngest (under 40) age bracket (1%) to recall that their contractor recommended a certain size of furnace/boiler.

- Income

  - *Recommending specific brand:* Participants in the higher income group (>$50,000) were more likely (52% of respondents) than those in the lower income group (<= $50,000, 42%) to recall the HVAC contractor recommending a certain brand.

  - *Discussing system reliability:* Participants in the lower income group were more likely (13%) than those in the higher income group (6%) to say that their HVAC contractors discussed the reliability of the furnace/boiler.

  - *Information about the NYSEG/RG&E program:* Participants in the higher income group were more likely (5% of respondents) than those in the lower income group (1%) to recall that the HVAC contractor provided them with information about the NYSEG and RG&E programs.

- Program year:

  - *Recommending specific brand:* Participants in the 2010-2011 program year were more likely (55% of respondents) to recall their HVAC contractors recommending a specific brand than those who participated in the 2009-2010 program year (45%).

  - *Information about system reliability:* Participants in the 2010-2011 program year were more likely (20% of respondents) to recall their HVAC contractors providing information about the reliability of different systems than those who participated in the 2009-2010 program year (12%).

  - *Information about system comfort:* Participants in the 2010-2011 program year were more likely (15% of respondents) to recall their HVAC contractors providing information about the reliability of different systems than those who participated in the 2009-2010 program year (8%).

  - *Contractors playing no role in equipment decision:* Participants in the 2010-2011 program year were less likely (3% of respondents) to say that their HVAC contractors played no role

in their equipment selection decision than those who participated in the 2009-2010 program year (10%).

- Utility:
  - *Information about system reliability:* RG&E participants were more likely (18% of respondents) to recall their HVAC contractors providing information about the reliability of different systems than NYSEG participants (10%).
  - *Information about system comfort:* RG&E participants were more likely (12%) to recall their HVAC contractors providing information about the comfort of different systems than NYSEG participants (7%).
  - *Equipment satisfaction:* Those respondents who indicated that they were satisfied with the installed equipment were much more likely (28% of respondents) to say that they recalled their HVAC contractor recommending the high efficiency model than those who were less than satisfied (3%). One likely explanation for this is that those who learned about the energy efficiency benefits of their new furnace or boiler were more likely to overlook any negative attributes of the new equipment.
  - *Reasons for replacing furnace/boiler:* Those who had their furnace/boiler replaced because it was not working were much less likely (17% of respondents) to recall their HVAC contractor recommending the high efficiency model than those who had their furnace/boiler replaced for other reasons (29%). This is probably due to the fact that the HVAC contractors who are doing emergency furnace/boiler replacements are less likely to feel the need to give their customers a "sales pitch" on the efficiency benefits of the new equipment.

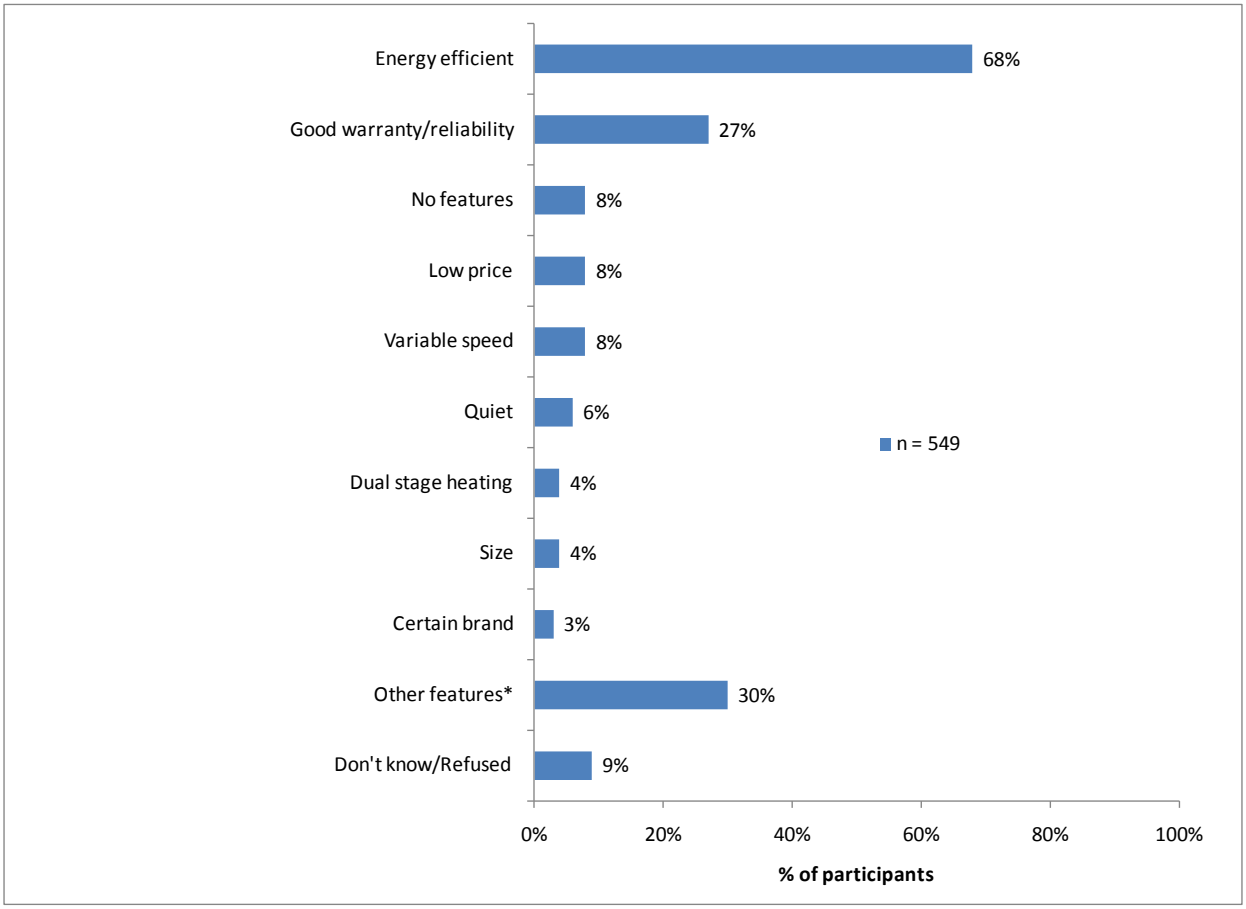
2.5.2 Which Furnace/Boiler Features the Contractor Emphasized

We then asked the participants: "What features, if any, of the <furnace/boiler> that you selected did your contractor emphasize?" The most-cited furnace/boiler feature, by far, was the energy efficiency of the new equipment, with over two-thirds (68%) of the respondents recalling contractor emphasis on this.[7] The

[7] We reported earlier that when we asked the participants what role the contractor played in helping select the furnace/boiler they had installed, nearly half (49%) of the participants said that their HVAC contractor recommended a specific type of brand/equipment with about a quarter (27%) saying that their contractor recommended a high efficiency model. At first glance this 27 percent seems low compared to the 68 percent in the chart above. One possible explanation for the large difference in these two responses is that a question about what role the contractor played in the furnace/boiler selection is going to generate a broader range of responses than a question about what furnace/boiler features the contractor emphasized. And whenever respondents are confronted with a broader range of possible interview responses, it reduces the chance that any one response is going to claim a

new furnace/boiler having a good warranty/reliability was a distant second with 27 percent of participants citing this as a contractor emphasis. Figure 2-14 shows the full range of responses.

Figure 2-14
What Features of the Furnace/Boiler
the HVAC Contractor Emphasized



Note: Percentages add up to more than 100% because multiple responses were allowed. *Other features included humidifier/humidity control, central air support, even heating, filtration system/high efficiency filter, constancy temperature capacity, modulation, cleanable/self cleaning, availability of rebates, outside venting, direct venting, hot water support, wall mounted.

larger share of the total number of responses simply because respondents are confronted with more things to think about. It should also be noted that in response to the first question nearly half (49%) of the participants said that their HVAC contractor recommended a specific type of brand/equipment. Since a large percentage of these brand recommendations were likely for high-efficiency models (since that is what all program participants eventually selected), there is likely some overlap between these respondents and the 27 percent.

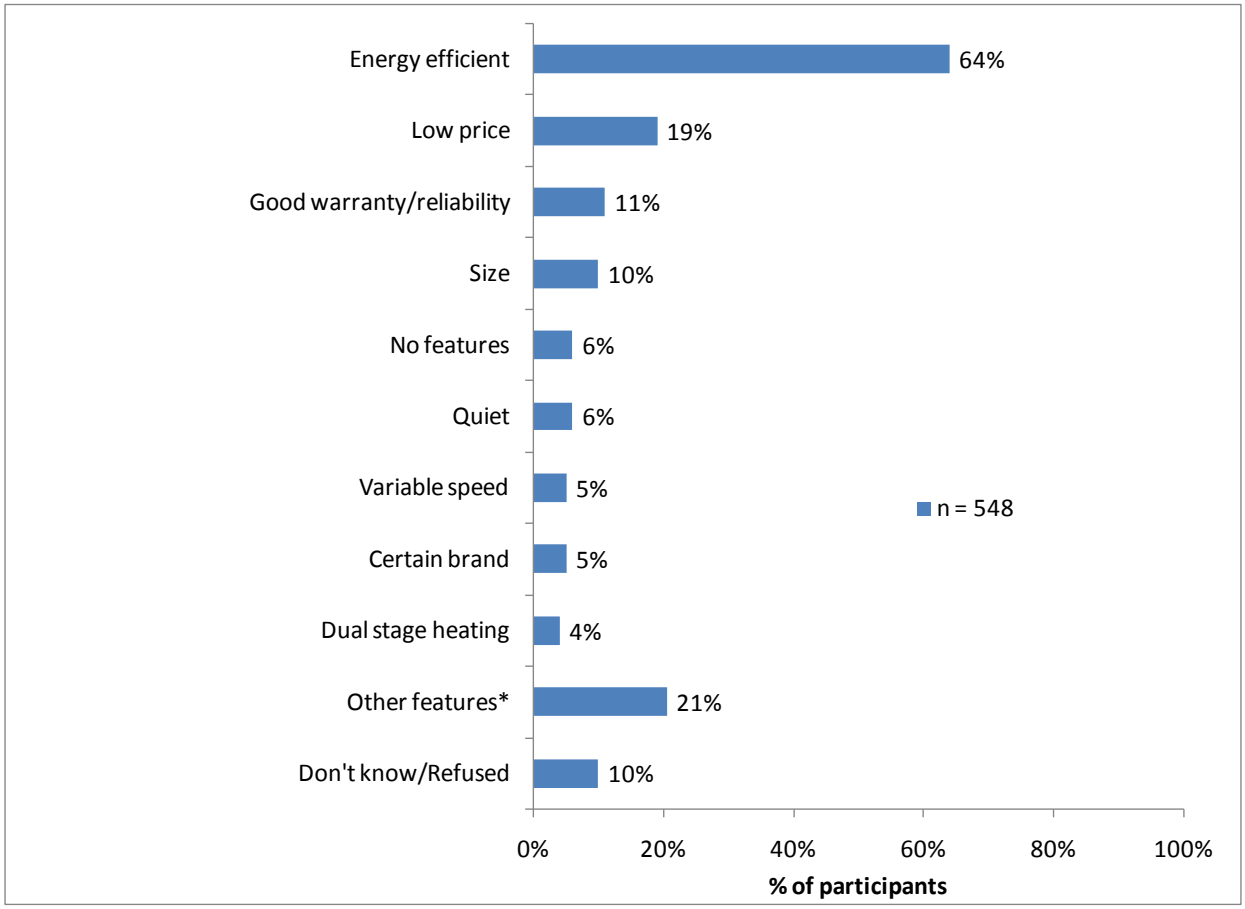
What furnace/boiler features their contractor emphasized varied to a statistically-significant degree depending on the demographics of the participants or other characteristics. The following are some of these statistically-significant differences:

- *Emphasis on energy efficiency:* The younger and better educated participants were more likely to recall their HVAC contractor emphasizing energy efficiency than their counterparts. It is not clear whether this was because their contractors were more likely to emphasize this, because they were more attuned to this message, or some combination of these factors. Participants from the 2010-2011 program year and those who bought their equipment to reduce their energy bills also were more likely to recall the emphasis on energy efficiency.
  - *Age:* Participants who were under 40 were more likely (77% of respondents) to recall their contractor emphasizing energy efficiency than seniors (63%).
  - *Education:* Participants with a high school degree or less were less likely (57%) to recall their contractor emphasizing energy efficiency than those with a four-year college degree or graduate degree (73% and 70% respectively).
  - *Program year:* Participants from the 2010-2011 program year were more likely (75%) to recall their contractor emphasizing energy efficiency than those from the 2009-2010 program year (63%).
  - *Bought equipment for energy efficiency:* Participants who said they purchased their furnace/boiler to reduce their energy bills were more likely (72%) to recall an energy efficiency emphasis from their contractor than those who did not purchase their equipment to reduce their energy bills (57%).
- *Emphasis on good warranty/reliability:* The more affluent participants were more likely to recall their HVAC contractor emphasizing the good warranty/reliability than their less affluent counterparts. Thirteen percent of those with household incomes about $50,000 recalled the emphasis on the good warranty/reliability compared to only seven percent recall among those with households earning less than $50,000.

2.5.3 Which Furnace/Boiler Features Mattered Most to Customers

We asked the participants which two or three features of the furnace/boiler made the most difference in what they selected. Figure 2-15 shows that for the furnace/boiler to be energy efficient was by far the most important feature with nearly two-thirds (64%) of the participants citing it. The next most-cited features were low price (19%) and the furnace/boiler having a good warranty or reliability (11%). Many other features were cited by a small percentage of participants. Figure 2-15 shows all responses.

Figure 2-15
Which Furnace/Boiler Features Mattered Most to Customers



Note: Percentages add up to more than 100% because multiple responses were allowed. *Other features included easy to use, humidifier/humidity control, availability of rebates, filtration system/high efficiency filter, good/contractor recommendation, even heating, constancy temperature capacity, new/modern, outside venting, modulating, direct venting, central air support, wall mounted, and cleanable/self-cleaning.

Some of the statistically-significant differences based on respondent characteristics included:

- *Valuing energy efficiency:* The participants that were more likely to value energy efficiency included well-educated, non-seniors, who had purchased their furnace/boiler to get a rebate or reduce their energy bill and not because their contractor recommended it.

  - *Education:* Those with some graduate school education or an advanced degree were more likely (72% of respondents) to say that energy efficiency was one of the more important features compared to those with only some college (60%) or those with a high school degree or less (54%).

- *Income:* Participants with household incomes of $50,000 or greater were more likely (70%) to value energy efficiency than those with households earning less than this (50%).
- *Age:* Seniors were less likely (56%) to value energy efficiency than those in the 40-64 age group (66%) or those under 40 (76%).
- *Whether they bought the furnace/boiler to get a rebate:* Those who said that they bought their furnace/boiler to get a rebate were more likely (78%) to say they valued energy efficiency than those who did not buy their equipment to get a rebate (62%).
- *Whether they bought the furnace/boiler to reduce their energy bills:* Those who said that they bought their furnace/boiler to reduce their energy bills were more likely (69%) to say they valued energy efficiency (51%) than those who did not say they bought their equipment to reduce their energy bills.
- *Whether they bought the furnace/boiler because their contractor recommended it:* Those who said that they did not buy their furnace/boiler because their HVAC contractor recommended it were much more likely (66%) to value energy efficiency than those who said they did buy the equipment because their contractor recommended it (36%).

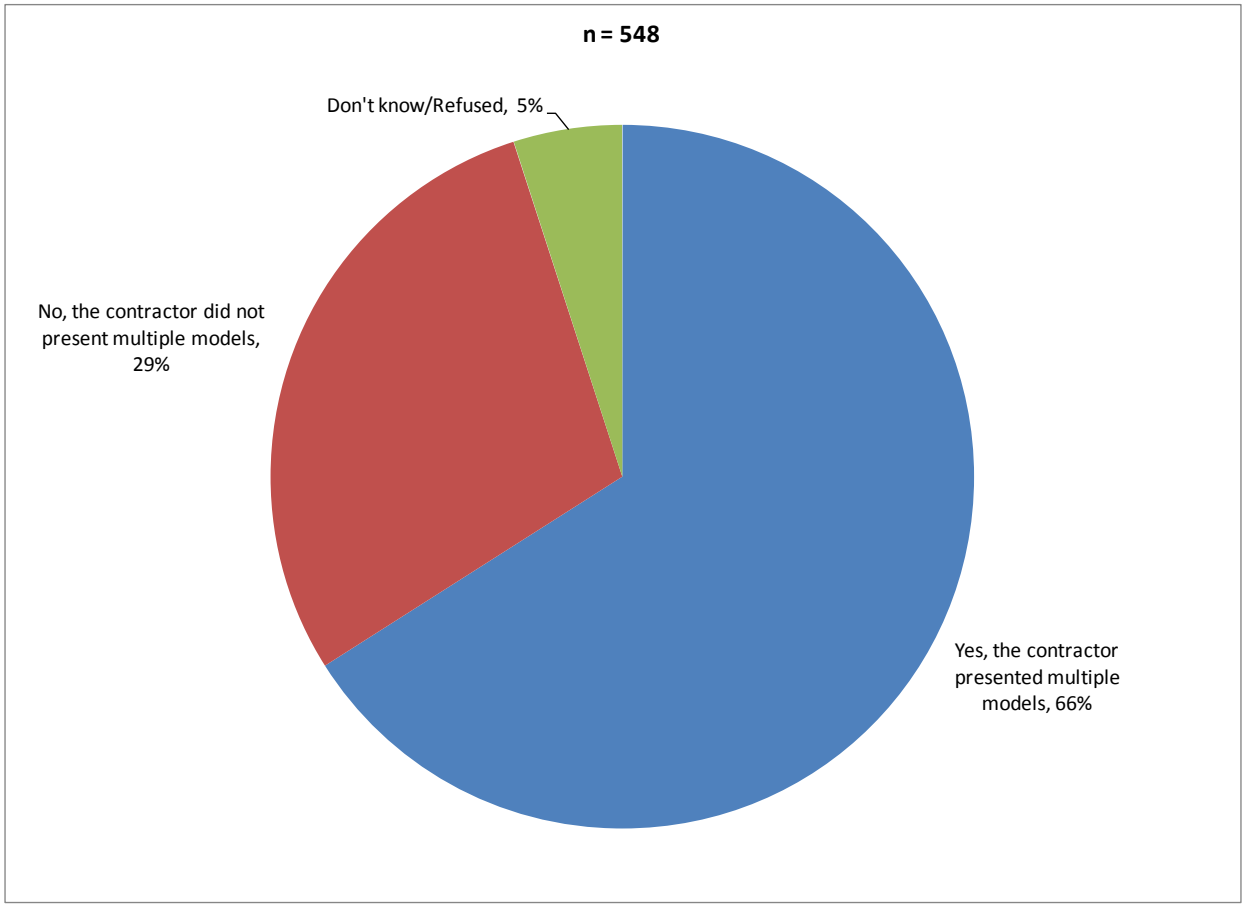
- *Low price:* The participants that were more likely to value a low price for their furnace/boilers included the middle-aged, women, those with higher incomes, and those who replaced their furnace/boiler because it had broken down.
  - *Gender:* Female participants (27% of respondents) were almost twice as likely as male participants (14%) to say they value a low price for their furnace/boiler.
  - *Age:* Middle-aged participants (24%) were twice as likely as seniors (12%) to value a low price for their equipment.
  - *Income:* Interestingly those in the $50,000 or higher household bracket were more likely (22%) to value a low price than those in the lower household income bracket (14%).
  - *Replaced furnace/boiler because it was malfunctioning:* Those who said that they replaced their furnace/boiler because it was not functioning were more likely (30%) to say that they value a low price than those who did not cite this reason (18%). One possible explanation for this is that the breakdown of a furnace/boiler is an unexpected expense that the household might not have budgeted for.

2.5.4 Contractor Presentation of Multiple Options

We asked the participants whether the HVAC contractor who installed their furnace/boiler presented them with multiple models to choose from. Two thirds of them said that their contractor did, as Figure 2-16 shows. Male participants, participants less than 40 years of age, and more highly-educated participants were more likely to say that they were presented with multiple options. RG&E customers (70% percent of respondents) were also more likely than NYSEG customers (60%) to say their contractor presented them with multiple options.

We asked the participants who said that their contractors presented them with multiple options whether their contractors had presented them with price quotes for those various options. Almost all of them (96%) said that their contractors had provided price quotes.

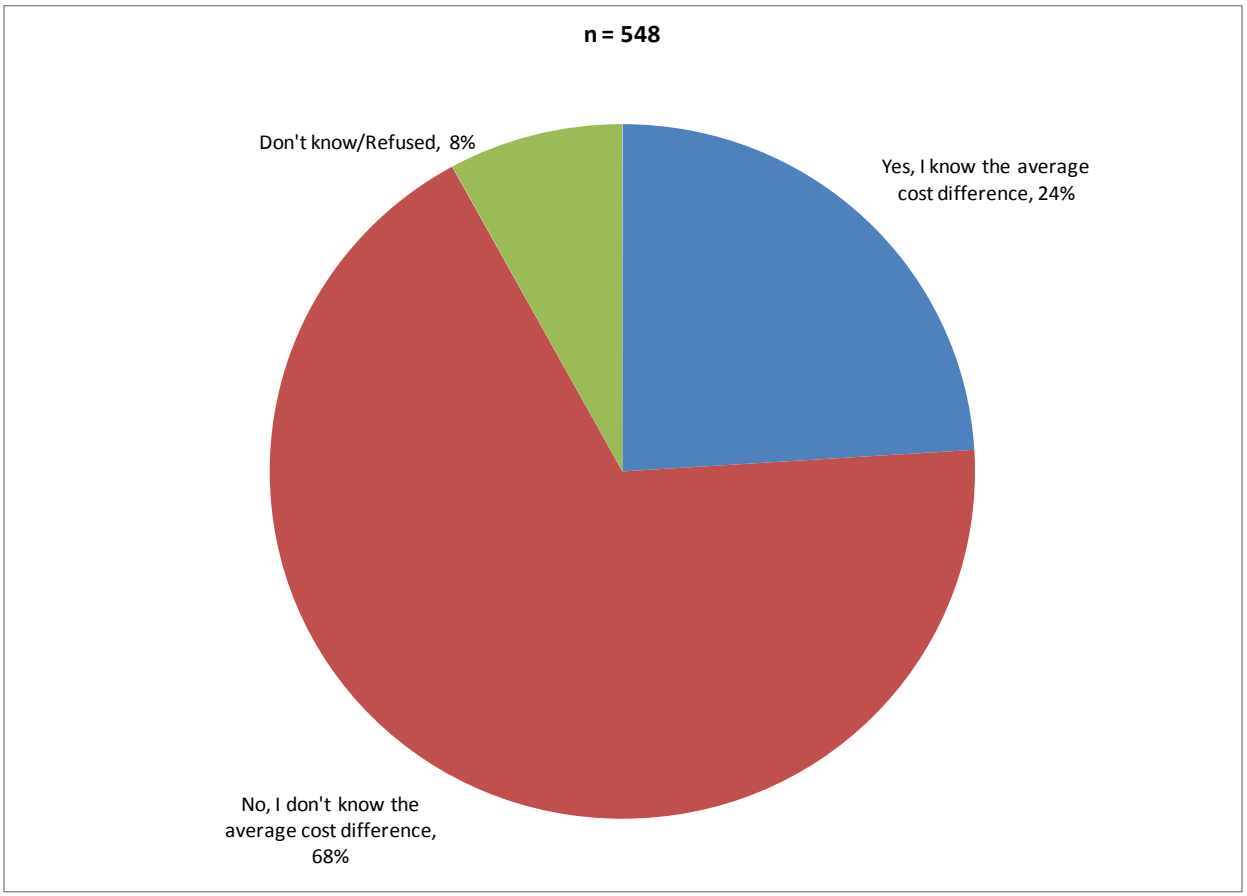
Figure 2-16
Whether Their HVAC Contractor
Presented Them with Multiple Furnace/Boiler Options



2.5.5 Participant Knowledge of High Efficiency Incremental Cost

We asked the participants whether they knew the average cost difference between the high efficiency furnace or boiler they had installed and a standard efficiency model. Figure 2-17 shows that only about a quarter (24%) of them did. Participant groups who were more likely to say they knew the cost difference included males, non-seniors, the highly-educated, those with higher incomes, and those who said they heard about the RG&E/NYSEG program before contacting their HVAC contractor.

Figure 2-17
Whether Participants Knew Average Cost Difference
Between High Efficiency and Standard Efficiency Furnace/Boilers

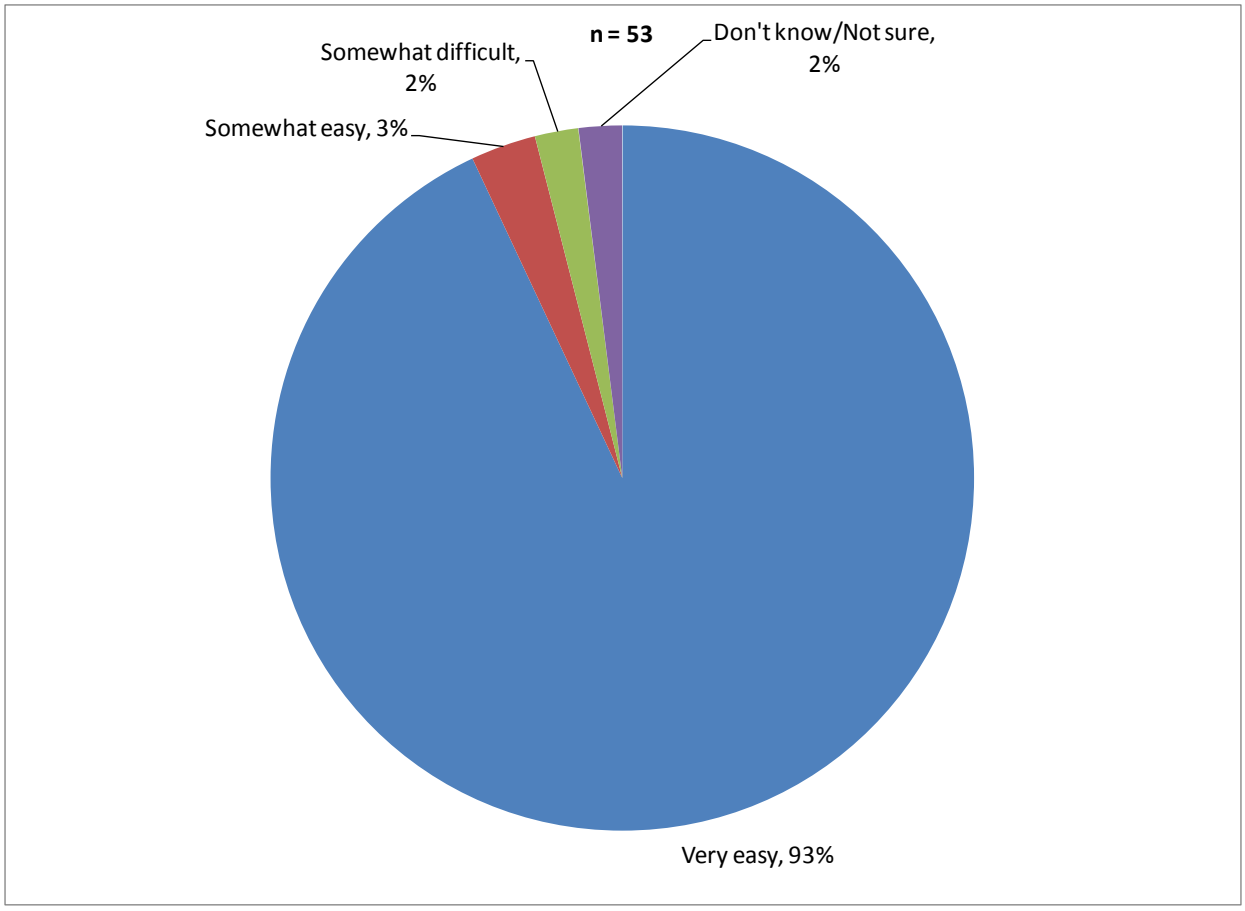


2.5.6 Finding Contractors That Sell Indirect Water Heaters

We were interested in knowing whether the participants who had indirect water heaters installed through the program had any difficulty finding an HVAC contractor who installed these. We asked the 53 participants in our survey sample who received rebates for indirect water heaters: “How hard was it to

find a contractor or store that carried the indirect water heater you had installed?" Figure 2-18 shows that the vast majority of these customers found it "very easy" to find an HVAC contractor who sold this equipment.

Figure 2-18
How Easy/Difficult It was
to Find HVAC Contractors Who Install Indirect Water Heaters



2.6 Participant Satisfaction

We asked the program participants how satisfied they were with the installed equipment, with a range of program activities, and with the program as a whole.

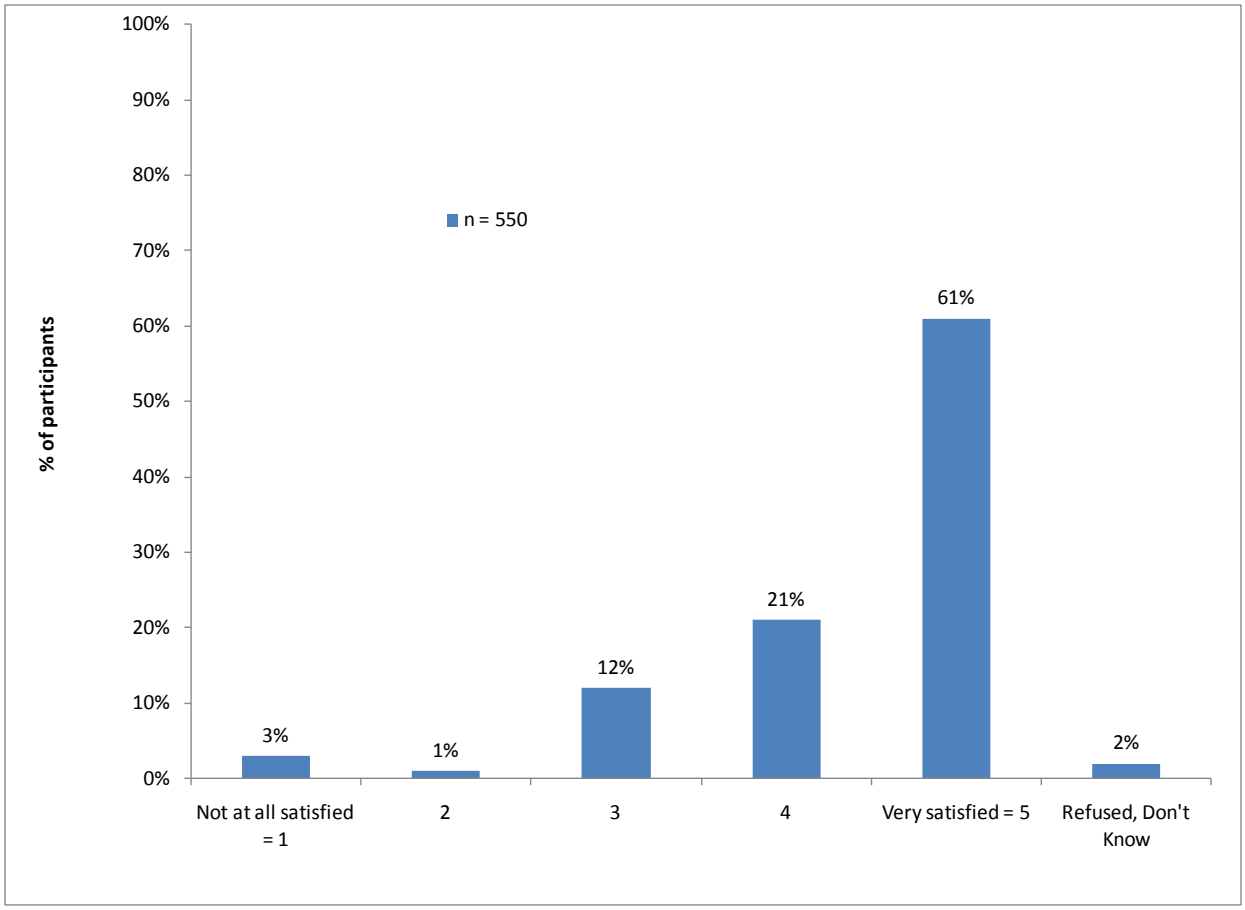
2.6.1 Satisfaction with the Installed Equipment

We asked the program participants how satisfied they had been with the equipment they had installed. The vast majority of the participants were satisfied with the new equipment with satisfaction ratings in the 96-97% range (depending on equipment type).

2.6.2 Satisfaction with the Rebate Amounts

We asked the participants about their satisfaction with the rebate amount. Figure 2-19 shows that 82 percent were satisfied (satisfaction ratings of 4 or 5). There were a few statistically-significant differences in satisfaction levels based on respondent type. Male participants were more likely (85% of respondents) than female participants (79%) to be satisfied with the rebate amounts. Participants with only a high school education or less were more likely (86%) than those with a graduate degree (78%) to be satisfied with the rebate amounts. Finally those who were aware of the NYSEG/RG&E program before contacting their HVAC contractor were more likely to be satisfied (87%) than those who only found out about the program after contacting their HVAC contractor (79%).

Figure 2-19
Participant Satisfaction with the Rebate Amount



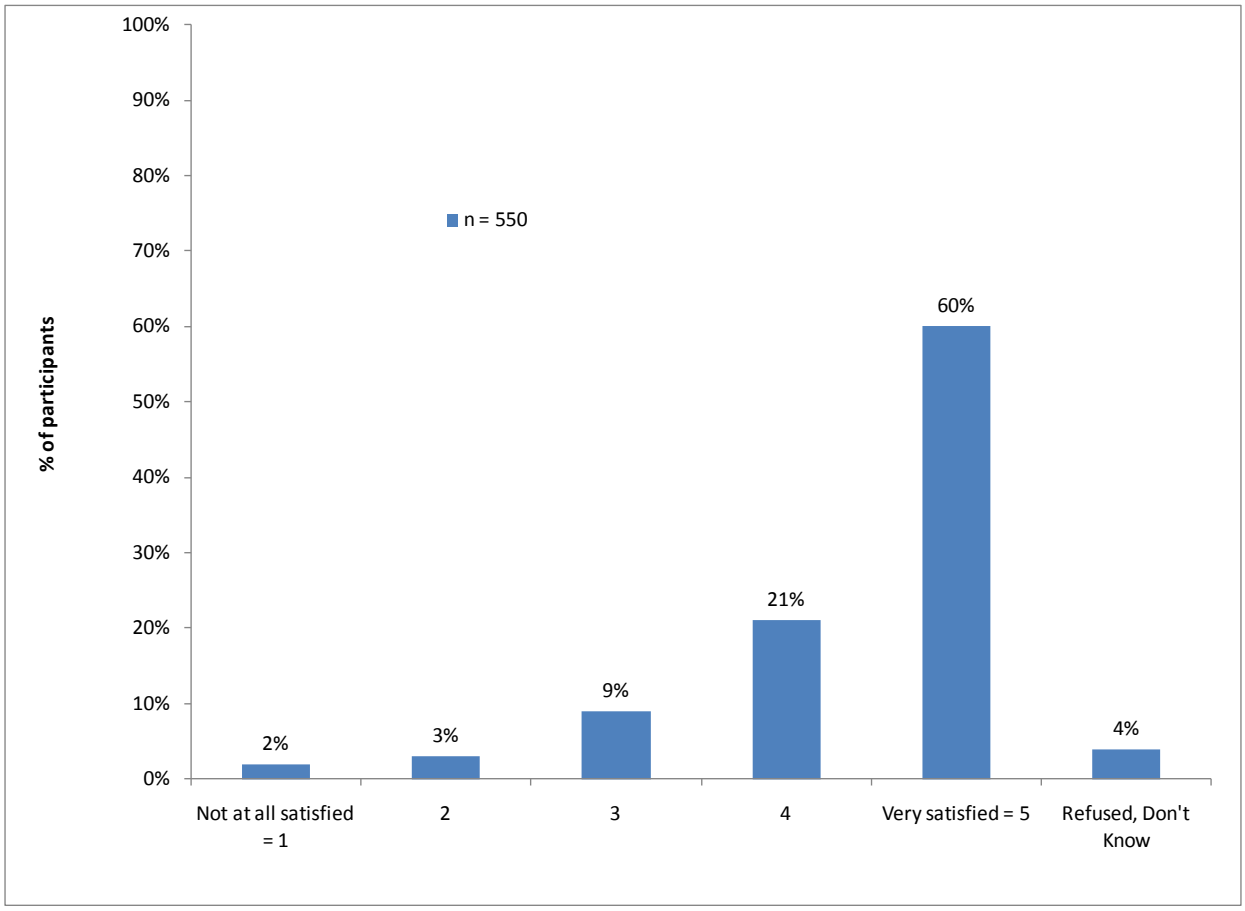
We asked the participants who were less-than-satisfied (satisfaction ratings of 1-3) with the rebate amounts about the reasons for their lower satisfaction ratings. Not surprisingly the large majority (69%) of these less-than-satisfied participants simply said that the rebates were not large enough. The most cited of the other reasons included not receiving the rebates (6%) and the rebate payment process being too lengthy (3%).

2.6.3 Satisfaction with the Timeliness of the Rebates

We asked the program participants how satisfied they were with the timeliness of the rebate payment. Figure 2-20 shows that 81 percent of the participants were satisfied. Participants with a high school degree or less were more likely to be satisfied (92% of respondents) with the timeliness of the rebate payments than those with some college education (71%) or those with a graduate degree (79%).

We asked the participants who were less-than-satisfied (satisfaction ratings of 1-3) with the timeliness of the rebate amounts about their reasons for their lower satisfaction ratings. Nearly two-thirds (62%) of the participants in this group simply said that the rebates took too long to arrive. Other reasons included the rebate application forms being too lengthy (15%) and not receiving the rebates (4%).

Figure 2-20
Participant Satisfaction with
the Timeliness of the Rebate Payment

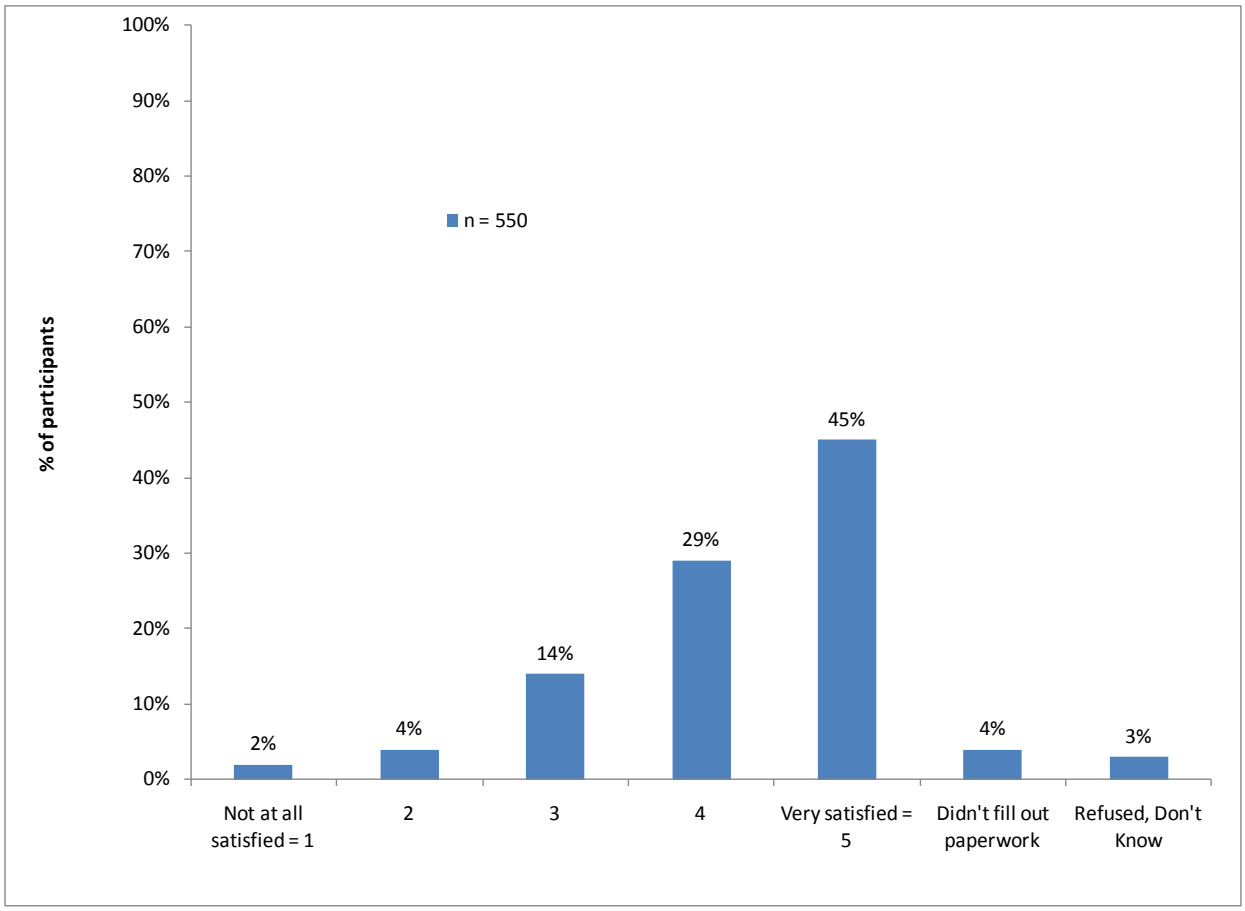


2.6.4 Satisfaction with the Rebate Application Forms

The lowest satisfaction ratings among program participants concerned the program's rebate application forms. We asked the participants for their satisfaction rating for the rebate application forms and other paperwork. Only 74 percent were satisfied (Figure 2-21). We consider satisfaction ratings below the 80 percent level to indicate a program area where some improvement is needed.

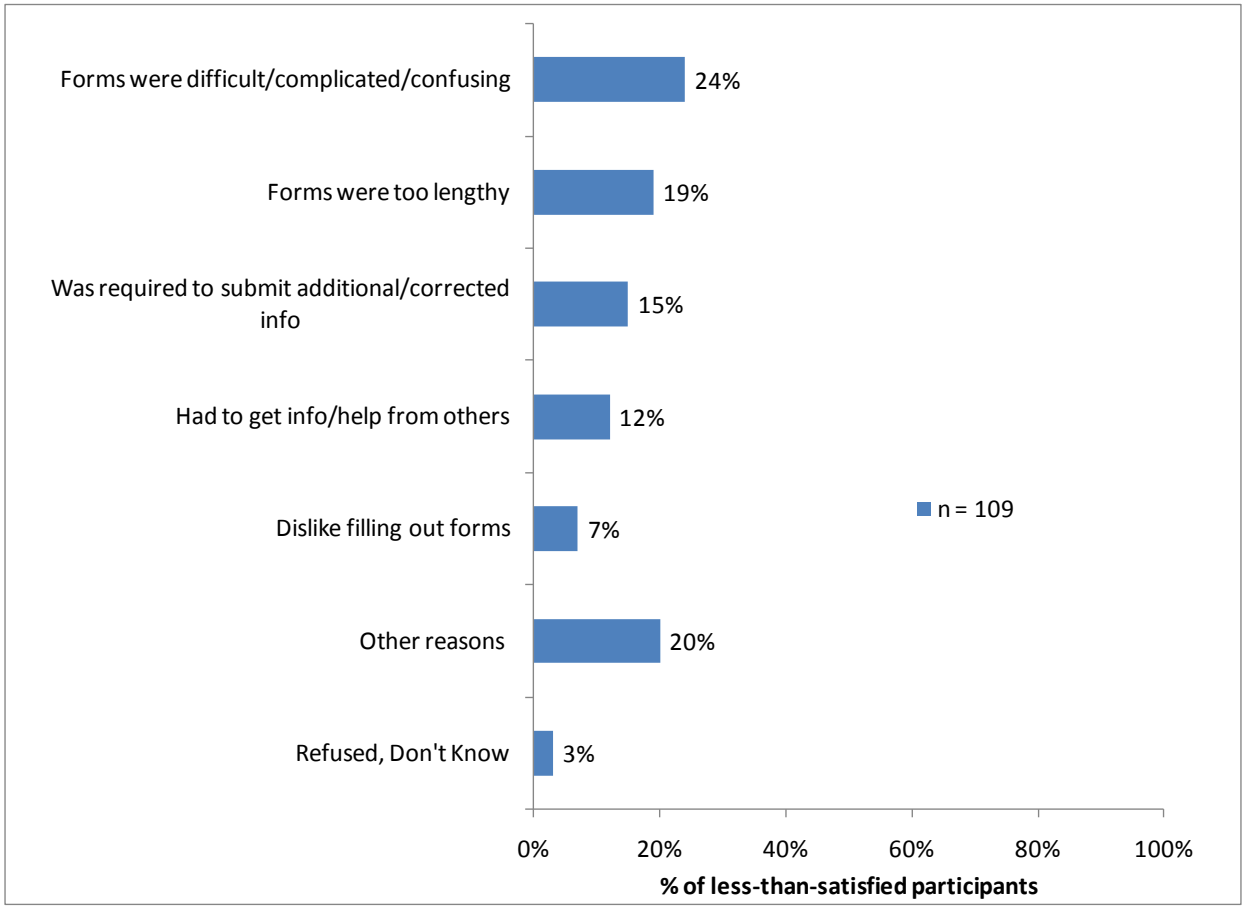
Younger (under the age of 40) participants were more likely to be satisfied (89% of respondents) with the rebate forms than older participants (73%). Those who bought the high-efficiency furnace/boiler for environmental reasons (a group that was correlated with younger participants) were also more likely to be satisfied (86%) with the rebate forms than those who did not make the purchase for environmental reasons (72%).

Figure 2-21
Participant Satisfaction with
the Rebate Application Forms



We asked the participants who were less-than-satisfied with the rebate application forms to explain their low satisfaction ratings. They cited a number of reasons including the forms being too complicated/confusing or lengthy, being asked to submit additional or corrected information, and having to get information or assistance from others to complete the forms (Figure 2-22).

Figure 2-22
Why Participants Were Less-Than-Satisfied with the Rebate Application Forms



There were some statistically-significant differences based on participant subgroups. Some of these included:

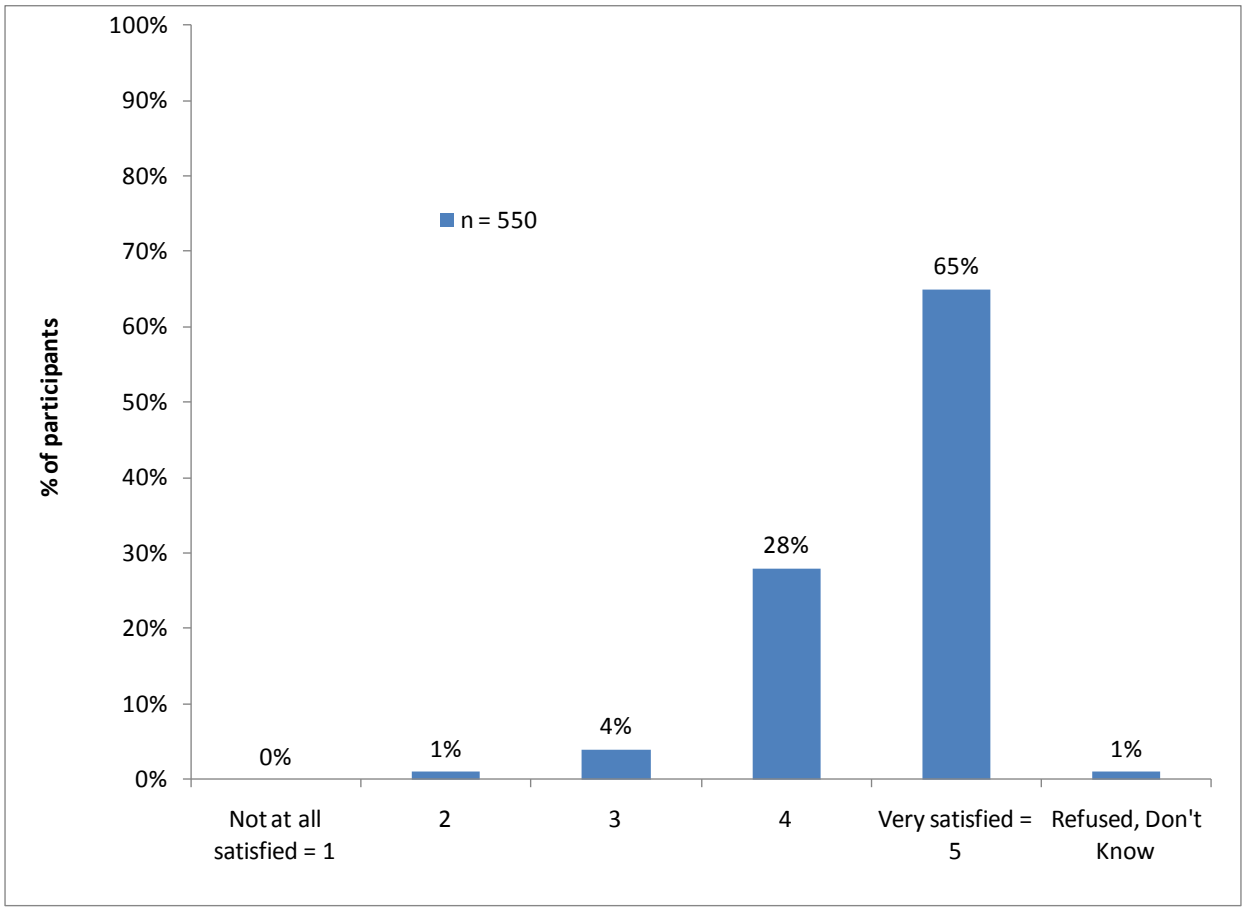
- *Gender:* Male participants were nearly three times as likely (23% of respondents) as female participants (8%) to cite the length of the forms as a reason for their dissatisfaction.
- *Education:* Participants with graduate degrees were much more likely (29%) than those with less education (9-13%) to complain about the length of the rebate forms.
- *Why bought EE equipment:* Participants who bought the energy-efficient equipment for reasons other than to get the rebate were much more likely (17%) to complain about having to submit additional/corrected information than those who bought the equipment to get the rebate (2%).

- *Recent home additions/renovations:* Participants who had recently made additions or renovations to their home were much less likely (6%) to complain about the length of the rebate forms than those who had not recently done home additions/renovations (23%).

2.6.5 Satisfaction with the Whole Program

We asked the participants for their satisfaction with the program as a whole. A large majority of the participants (93%) were satisfied with the program (Figure 2-23).

Figure 2-23
Participant Satisfaction
with Program as a Whole



There were some statistically-significant differences in the response levels of the participants. The biggest differences concerned satisfaction with the equipment. Of those who were totally satisfied with their installed equipment, 94 percent were satisfied with the program as a whole and 66 percent were very satisfied with the whole program. In contrast, of those who were less than satisfied with at least one of the

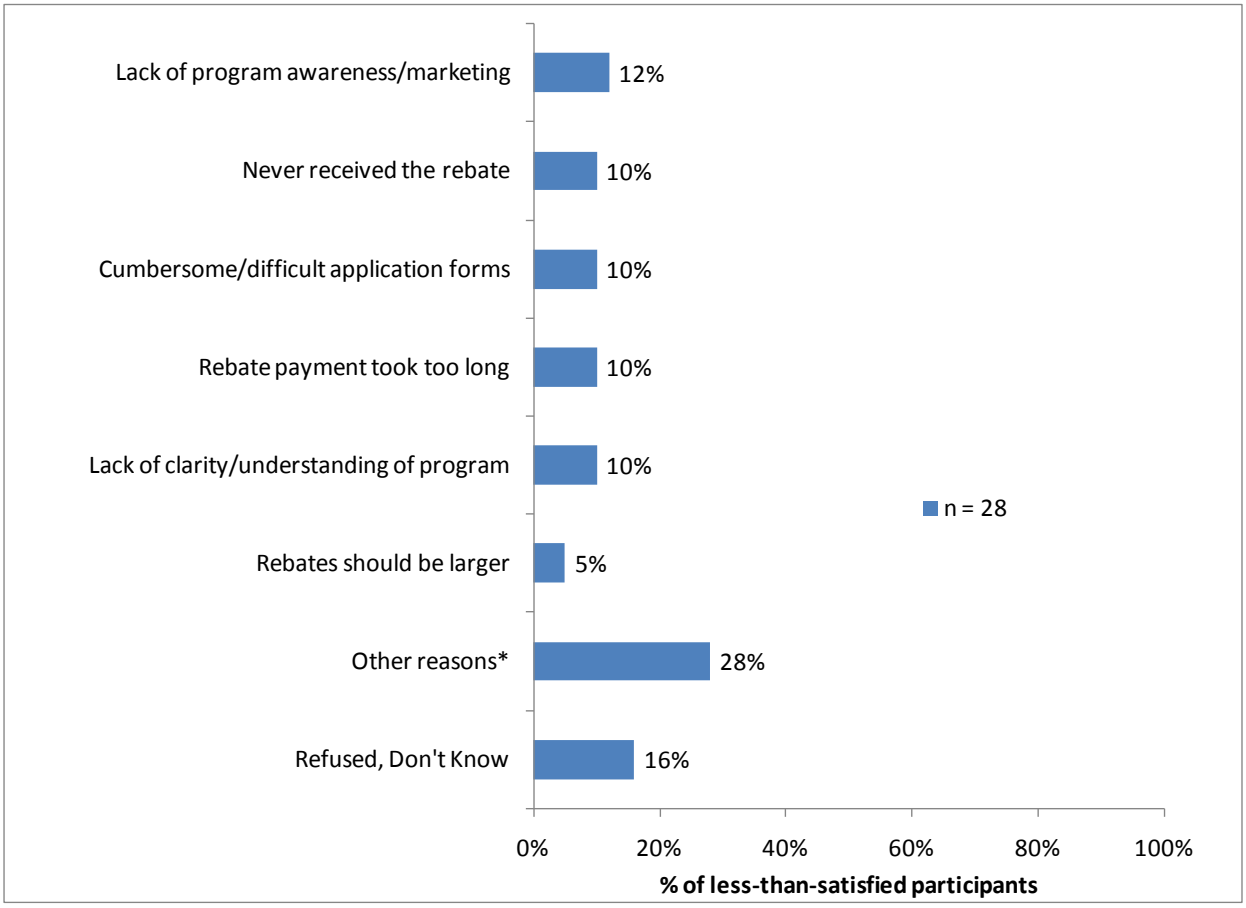
pieces of equipment installed through the program, only 69 percent were satisfied with the program as a whole and only a third were very satisfied.

The less-educated participants also tended to be the most satisfied with the whole program. Seventy-eight percent of those with a high school education or less were very satisfied with the program. In contrast the percentage of more educated participants who were very satisfied with the whole program ranged from 60-64% depending upon education level. Since education level is usually correlated with income level, it was not surprising that those participants with households earning less than $50,000 were also more likely (72% of respondents) to be very satisfied with the program than those participants with households above this level (62% very satisfied).

There were other statistically-significant differences in levels of whole program satisfaction among respondent groups. Those who joined the program for environmental reasons were more likely to be satisfied with the whole program than those who joined for other reasons. Those participants who only got a furnace or boiler through the program also tended to be less satisfied with the whole program than those who got a furnace/boiler and a programmable thermostat or those who got less common equipment such as indirect water heaters.

We asked the participants who were less than satisfied with the program as a whole about their reasons for giving these lower satisfaction scores. Figure 2-24 shows that participants gave a wide range of reasons for being less than satisfied with no one reason predominating.

Figure 2-24
Reasons Why Participants
Were Less-Than-Satisfied with Whole Program

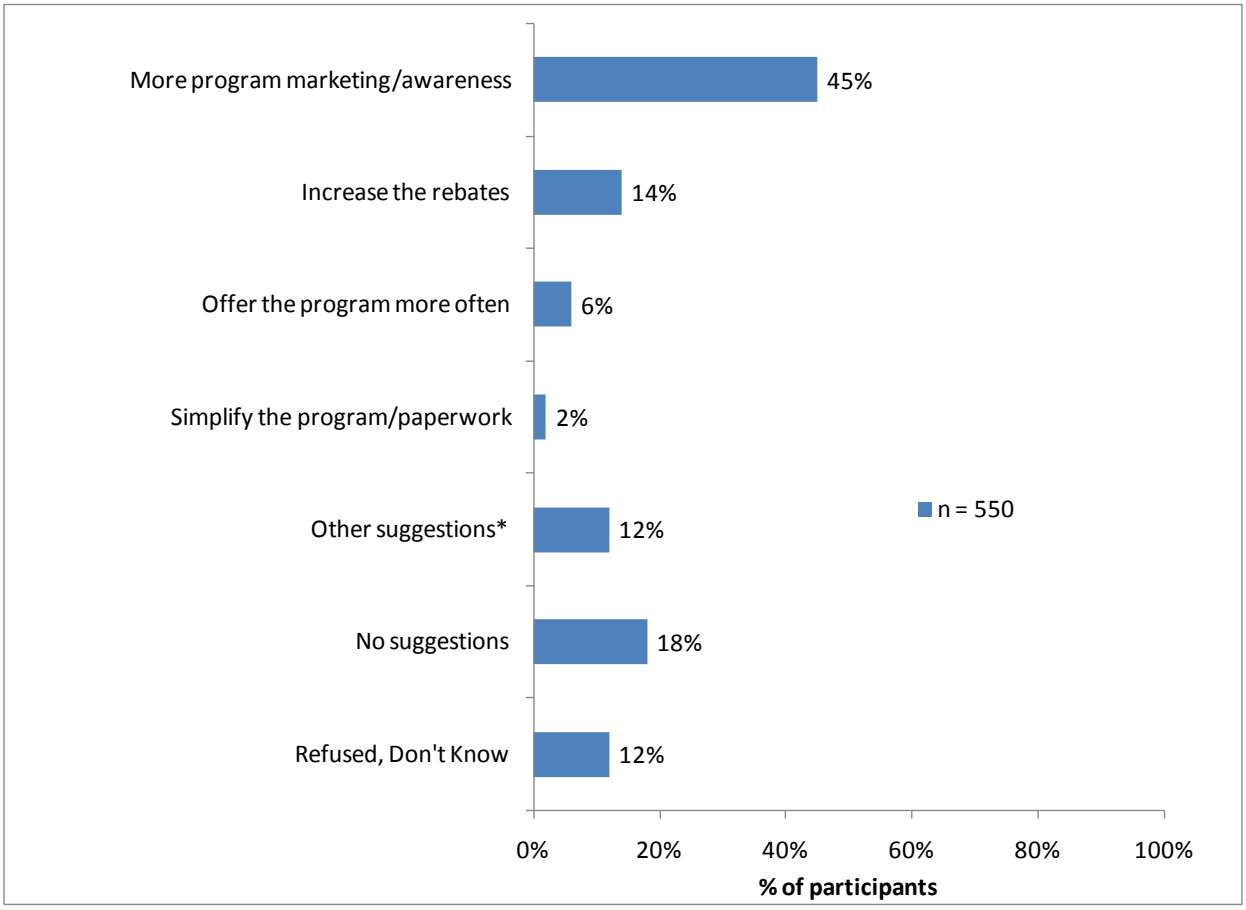


Notes: The total percentages exceed 100% because respondents were allowed to give multiple responses. *Other reasons included not thinking what was installed had much value, not believing the utilities or the government should be able to distribute these incentives, unhappiness that the program was not offering rebates for windows/doors, et al.

2.6.6 Suggestions for Increasing Program Participation

We asked the participants what RG&E and NYSEG could do to get more people to participate in the rebate program. The most common suggestion, by far, was that the program should do more advertising and building of customer awareness (45% of respondents) followed by a suggestion that the program increase the rebates levels (14%). Figure 2-25 shows the full range of responses.

Figure 2-25
Participant Suggestions for
Program to Increase Participation in Program



Notes: The total percentages exceed 100% because respondents were allowed to give multiple responses. *Other suggestions for program improvements are summarized below.

There were a few statistically-significant differences in suggestions among the respondent subgroups. For those suggesting the program do more advertising, these differences included:

- *Age:* The younger participants were, the more likely they were to recommend that the program do more advertising. Fifty-seven percent of those less than 40 years of age made this suggestion compared to 47 percent of those in the 40-64 age group and 38 percent of seniors.

- *Environmental motivations:* Those who got an energy-efficient furnace/boiler for environmental reasons, which is a group correlated with younger participants, were also more likely (62% of respondents) to suggest more advertising than those who did not join for environmental reasons (42%).

- *Program year:* Participants from the 2010-2011 program year were more likely (51%) to suggest more advertising than participants from the 2009-2010 program year (41%).

- *Awareness of program before calling contractor:* Not surprisingly those who only heard about the program from their HVAC contractor were more likely to suggest more advertising (53%) compared to those who had already heard about the program before they called their HVAC contractor (38%).

For those suggesting that the program increase participation by increasing rebate levels, statistically-significant differences in response rates included:

- *Income and Education:* Participants with household incomes of $50,000 or greater were twice as likely to recommend increasing the rebates compared to those in the lower income group (16% vs. 8%). Income and education are highly correlated and therefore it is not surprising that those with graduate degree were more than twice as likely as those with only some college to suggest increasing the rebates (18% vs. 8%).

- *Gender:* Male participants were more likely (16%) than female participants (11%) to suggest increasing the rebates.

- *Energy reduction motivations:* Those who said they bought the energy-efficient furnace/boiler to reduce their energy bills were twice as likely (16% vs. 8%) to suggest higher rebates as those who did not get this equipment for this reason.

- *New home additions/renovations:* Participants who had recently done a home addition/renovation were only half as likely as those who had not (8% vs. 16%) to suggest higher rebates.

In addition to these more-frequently-cited suggestions for increasing program participation, there were many other suggestions from the participants we surveyed. Most of these suggestions were only offered by a single respondent, but a few of these (highlighted in bold) were offered by multiple respondents. These included:

- *Marketing suggestions:*
  - Offering financial rewards to those who recommend others to join the program;
  - Producing case studies that highlight participants who saved energy;
  - Emphasizing the potential energy savings more in the marketing messages;
  - Emphasizing the environmental benefits of reducing energy consumption more in the marketing messages;
  - Stop promoting tankless water heaters;
  - Start promoting high efficiency windows and insulation; and
  - Paying HVAC contractors to promote the program.

- *Program information recommendations:*
  - Making a local contact or utility representative available to better explain the program;
  - Allowing RG&E/NYSEG to recommend good or "green" HVAC contractors;
  - Providing customers with advice and assistance in filling out the rebate applications;
  - Educating HVAC contractors about how to get the rebate applications and how to fill them out;
  - Being more clear upfront about what types of equipment information the customers or HVAC contractors are supposed to collect;
  - Showing people how much they are saving through the program; and
  - Explaining to customers why the program is encouraging programmable thermostats.

- *Rebate, rebate application forms, and program eligibility recommendations:*
  - Reducing the amount of time it takes to pay rebates;
  - Extending the time period for which program rebates are available;
  - Making the program more available to landlords and rental properties;
  - Offering a "needs-based" rebate program where rebates would be larger for lower-income participants;
  - Coordinating the program rebates with government tax credits;
  - Allowing customers to fill out rebate applications online;
  - Encouraging HVAC contractors to help customers with the rebate applications them;
  - Have the HVAC contractors fill out the rebate application forms;
  - Offering separate rebates for programmable thermostats (e.g., not tied to furnace/boiler installation);
  - Offering rebates for windows and doors;
  - Offering rebates for geothermal systems;
  - Making it easier for customers to qualify for the rebates;
  - Following up with the customers to see if they've received the rebate payments; and
  - Extending the program's eligibility to equipment with lower efficiencies than are currently rebated.

- *Miscellaneous other suggestions:*
  - Lowering utility gas rates;
  - Having RG&E/NYSEG inspect furnaces to determine whether they are wasting energy;
  - Offering a payment plan or financing plan to help reduce the upfront cost burden of the energy-efficient furnace/boiler;
  - Making furnaces less expensive;
  - Offering home energy audits;
  - Making the program "simpler";
  - Offering more value;
  - Making sure that the RG&E/NYSEG auditors are better trained;

- Working more closely with home owners associations or bankers who offer mortgages;
- Being more "honest" with the customers;
- Reducing utility staff pay levels to be more "fair"; and
- Not allowing the utilities to be so "mercenary" in their collection of unpaid utility bills.

2.7 Changes in Energy Consumption after Participation

We asked the program participants a number of questions about their energy consumption observations and behaviors after the installation of their furnace.

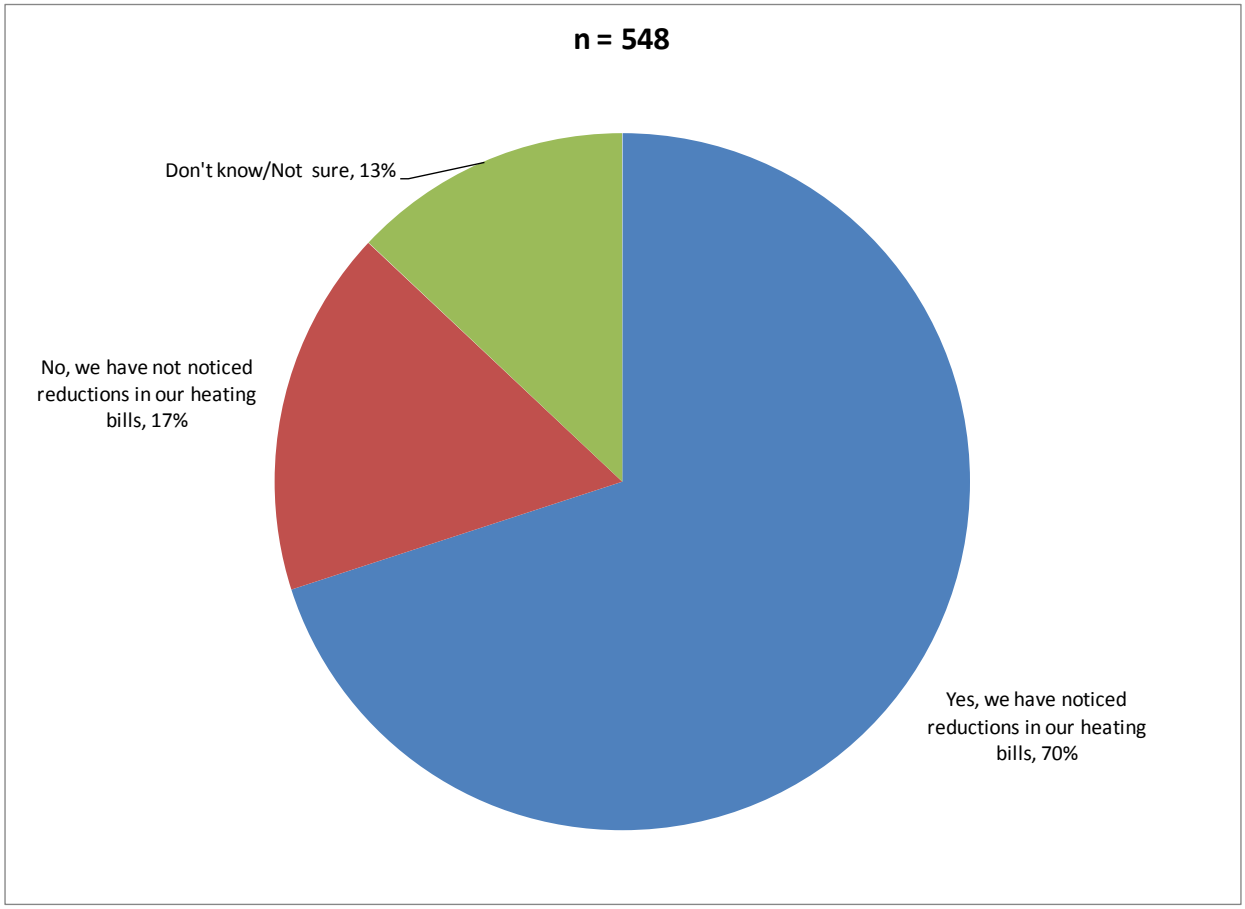
2.7.1 Noticing Reductions in Their Heating Bills

We asked the participants whether since getting their new furnace/boiler they had noticed any reductions in their heating bills. Seventy percent of them said that they did notice some reduction in their heating bills (Figure 2-26).

Among the participant subgroups there were some statistically-significant differences in response rates. Male participants were more likely (75% of respondents) than female participants (62%) to have reported that there were energy savings. Seniors were less likely (63%) than participants from the young (78%) or middle age (75%) groups to claim to have seen energy bill reductions.

Participants who had heard about the program before contacting their HVAC contractors were more likely (74%) to report seeing energy bill reductions than those who learned about the program through their HVAC contractor (64%). One possible explanation for this is that participants who were already aware of this energy-efficiency program were also more likely to have general concerns about energy costs and their greater bill reductions may be due not only to their new furnace/boiler but also due to other energy-efficiency improvements they may have made in their house.

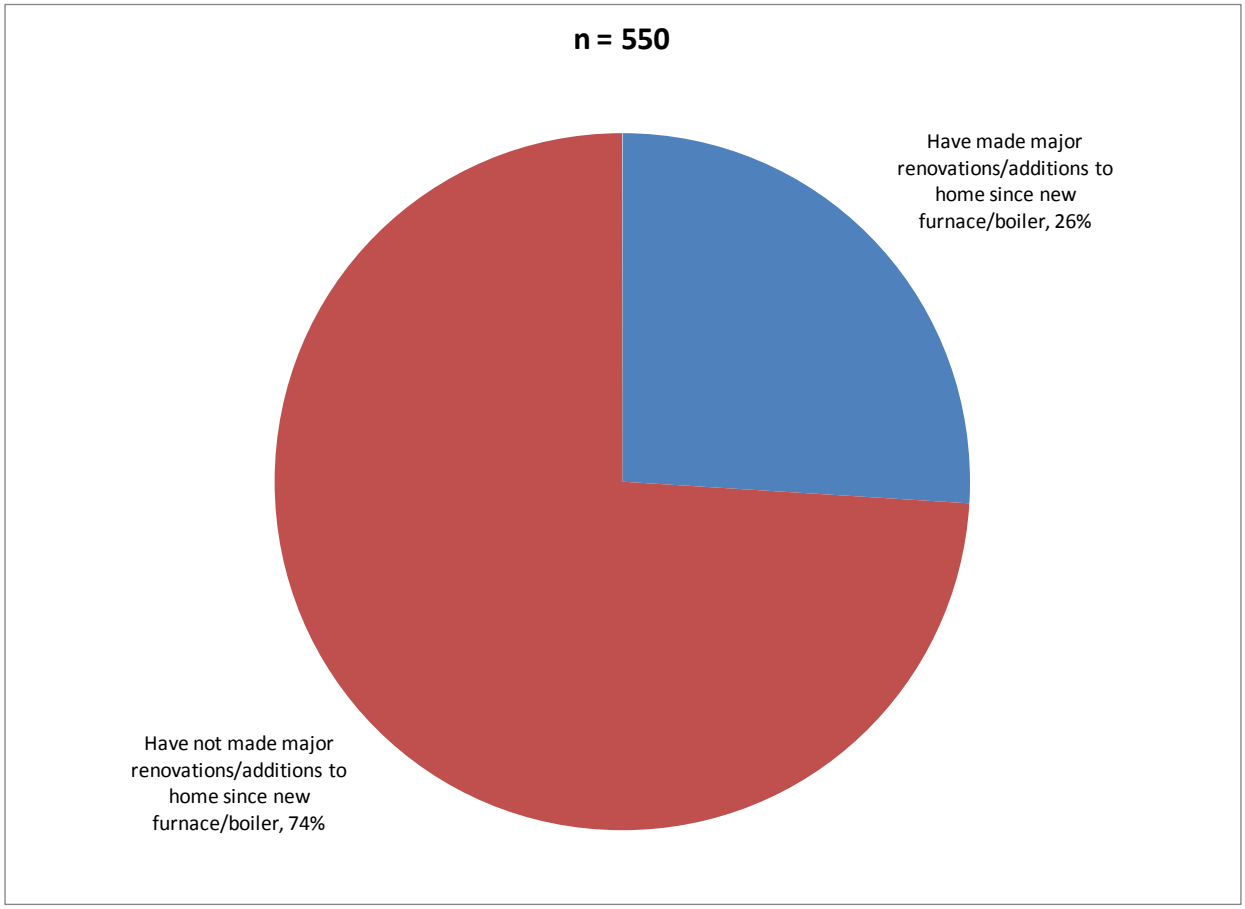
Figure 2-26
Noticing Reductions
in Their Heating Bills



2.7.2 Major Renovations/Additions since Furnace/Boiler Installation

We asked the program participants whether they have made major changes in their home since they had the new furnace/boiler installed, such as new additions, major renovations, new windows, new insulation, etc. Figure 2-27 shows that about a quarter of the participants said that they made major renovations/additions to their home since the installation of the new furnace/boiler.

Figure 2-27
Whether Participants Made Major Home Renovations to Their Home Since the Installation of the New Furnace/Boiler



We asked the participants who had reported making major renovations/additions to briefly describe the changes to their home. The most-cited changes included new windows (42%) and new insulation or siding (27%). We assume that much of this activity was driven by federal tax credits that were available for these measures. Figure 2-28 shows the full range of responses.

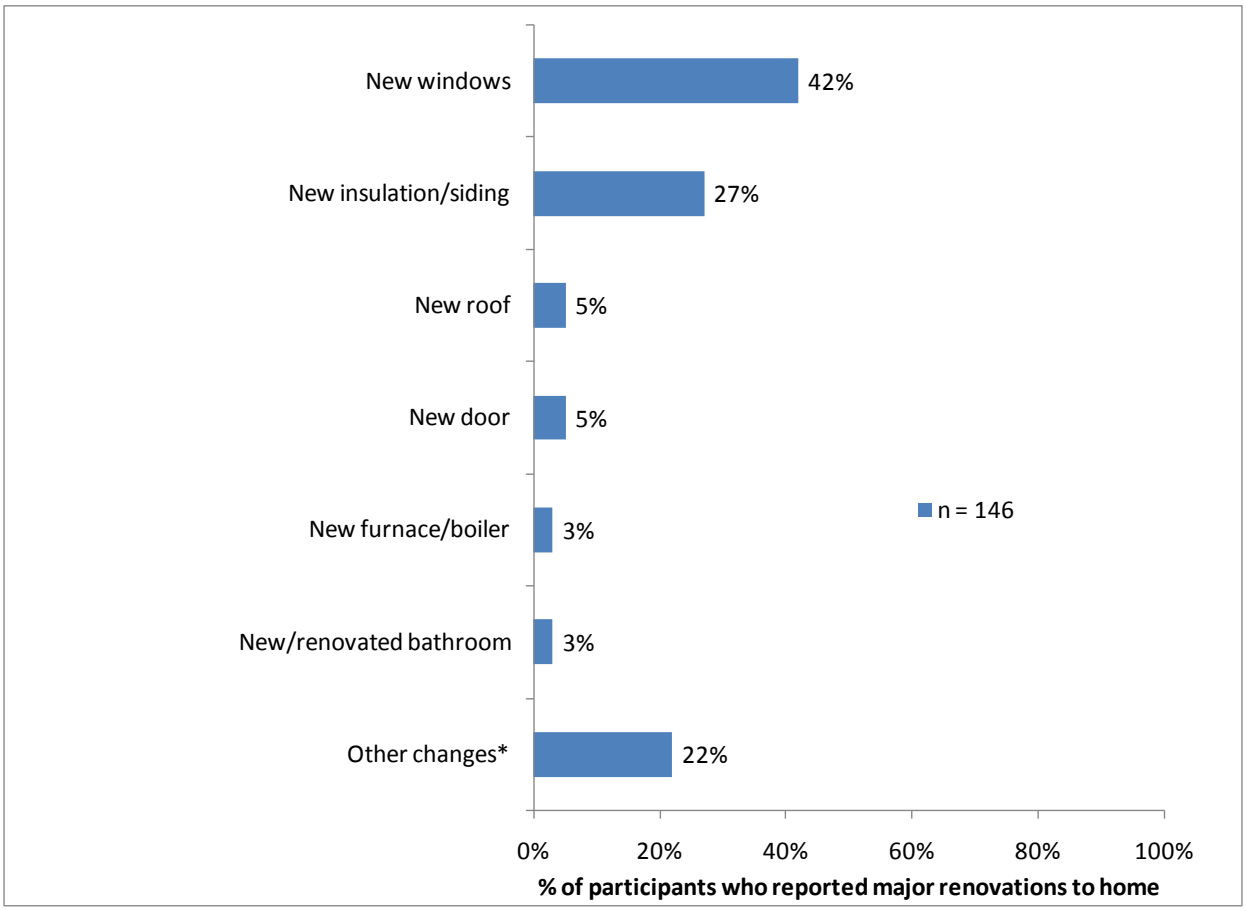
The statistically-significant differences among respondents included:

- *NYSEG participants were more likely (56% of respondents) than RG&E participants (35%) to have installed new windows.*
- *The 2009-2010 participants were more likely (47%) than the 2010-2011 participants (28%) to say they had installed new windows.* The longer period of time since the furnace/boiler installation for the 2009-2010 participants likely explains some of this difference.

- *Those in the lower income group (< $50,000 in annual household income) were more likely to be saying they were replacing their windows (56%) than those in the higher income group (38%).* One possible explanation for this is that lower-income residents may be living in older homes and may have only been able to afford the window replacements once the federal tax credits became available.

- *Those in the 40-64 age range were more likely to be replacing their roofs (8%) than seniors (< 1%).*

Figure 2-28
What Changes Participants Made to Their Homes
Since the Installation of the New Furnace/Boiler



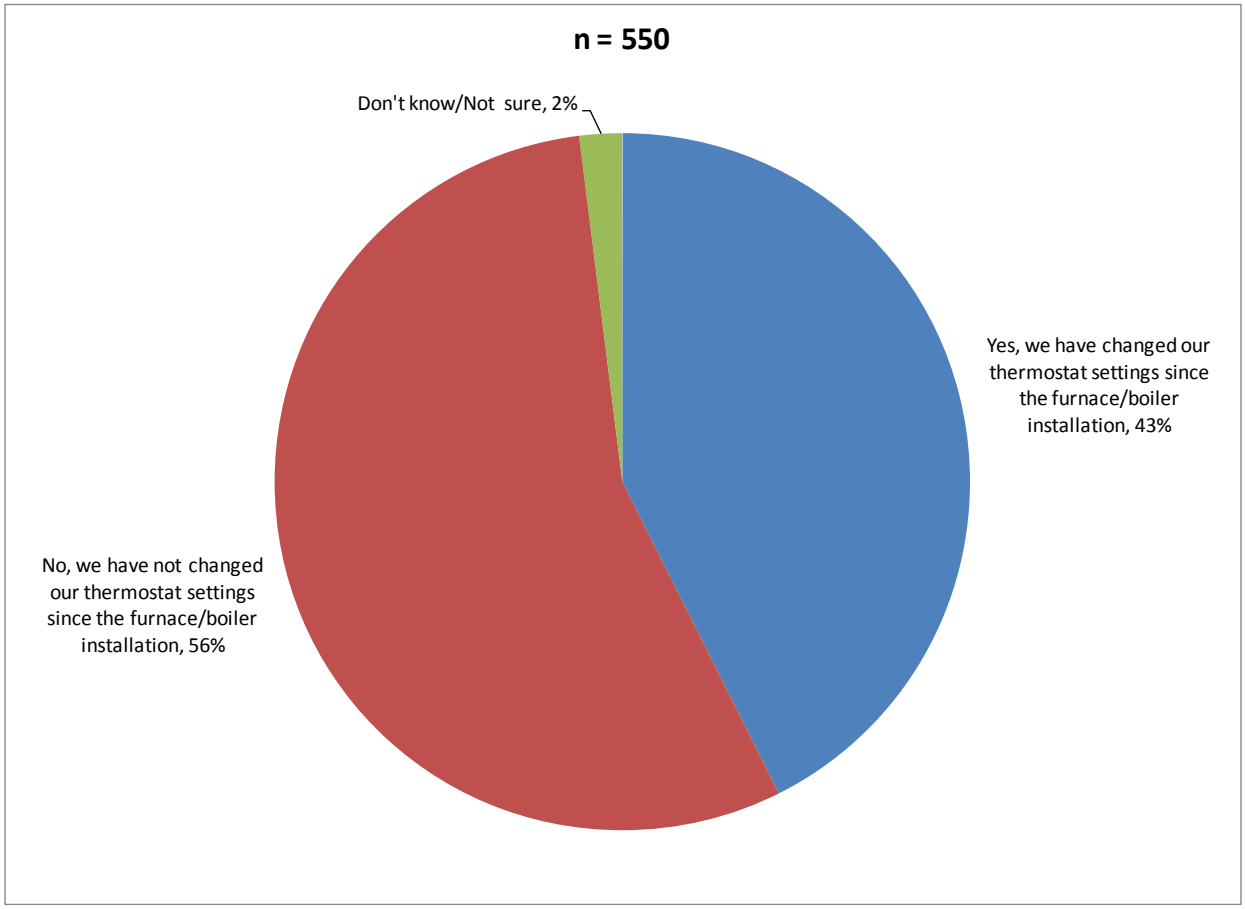
Note: *Other changes included new sunroom, new/renovated kitchen, selling the house, new/redone basement, acquiring a generator/backup power source, et al.

2.7.3 Changes in Thermostat Use since Furnace/Boiler Installation

We asked all the participants, whether or not they got a new programmable thermostat through the program, if they had changed the way they set their thermostat during the heating season after they had their new furnace/boiler installed. Figure 2-29 shows that slightly less than half (43%) said that they had changed their thermostat settings for heating since the installation.

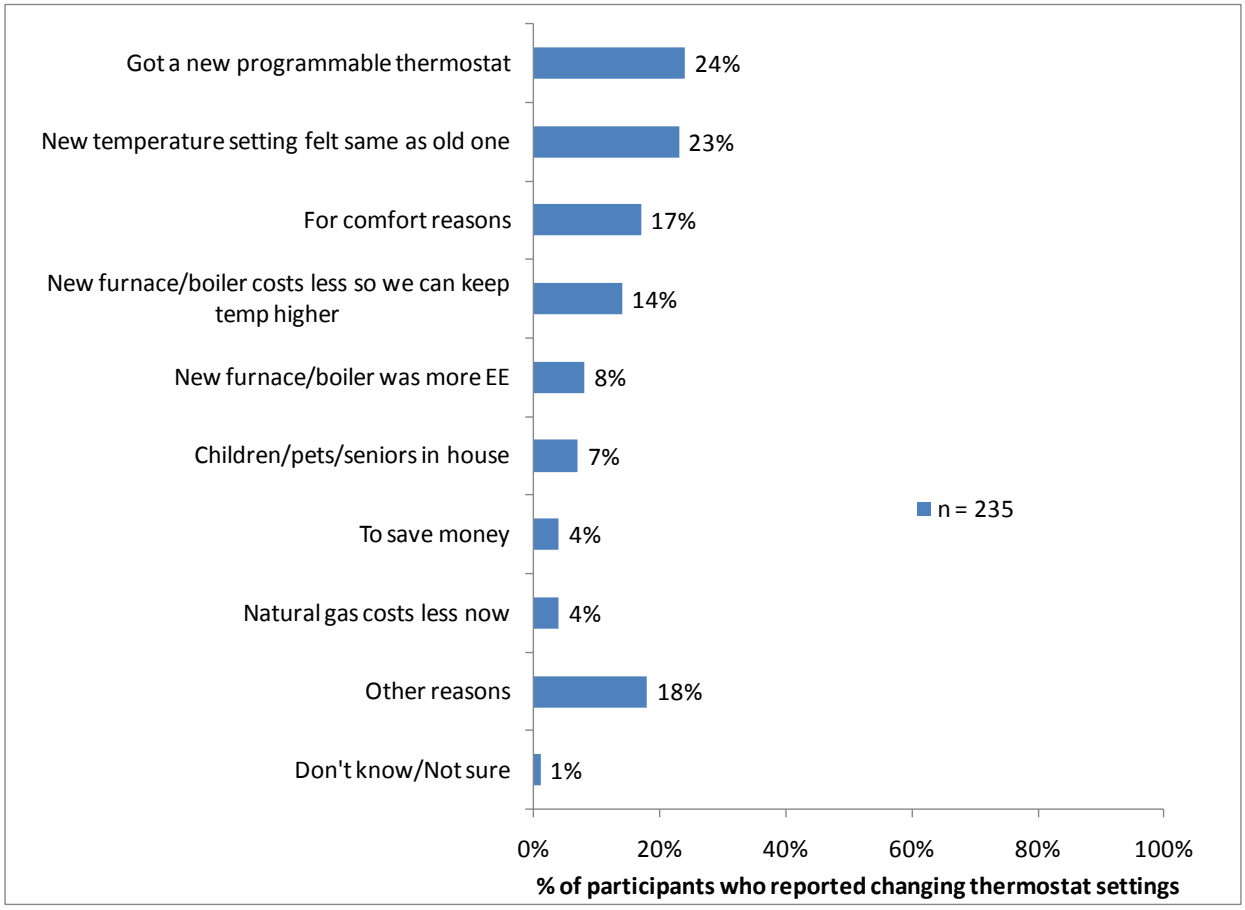
There were only a few statistically-significant differences between respondent groups for this question. Those who had first heard about the program from a source other than their HVAC contractor were more likely (54%) to have changed their thermostat settings than those who first heard about the program from their HVAC contractor (41%). We assume that participants who had heard about the program in ways other than their HVAC contractors were more interested in energy savings and therefore more likely to change their thermostat settings to save energy. However, interestingly there was no statistically significant difference in the responses of the participants who got a new programmable thermostat through the program and those who did not.

Figure 2-29
Whether Participants Changed Their Thermostat Settings for Heating Since Getting the New Furnace/Boiler Installed



We also asked the participants why they changed their thermostat settings. The two most-cited reasons included the fact that they got a new programmable thermostat (24%) and the fact that the new temperature settings felt the same as the old ones (23%). Figure 2-30 shows these and other responses.

Figure 2-30
Why Participants Changed Their Thermostat Settings
Since Getting the New Furnace/Boiler Installed



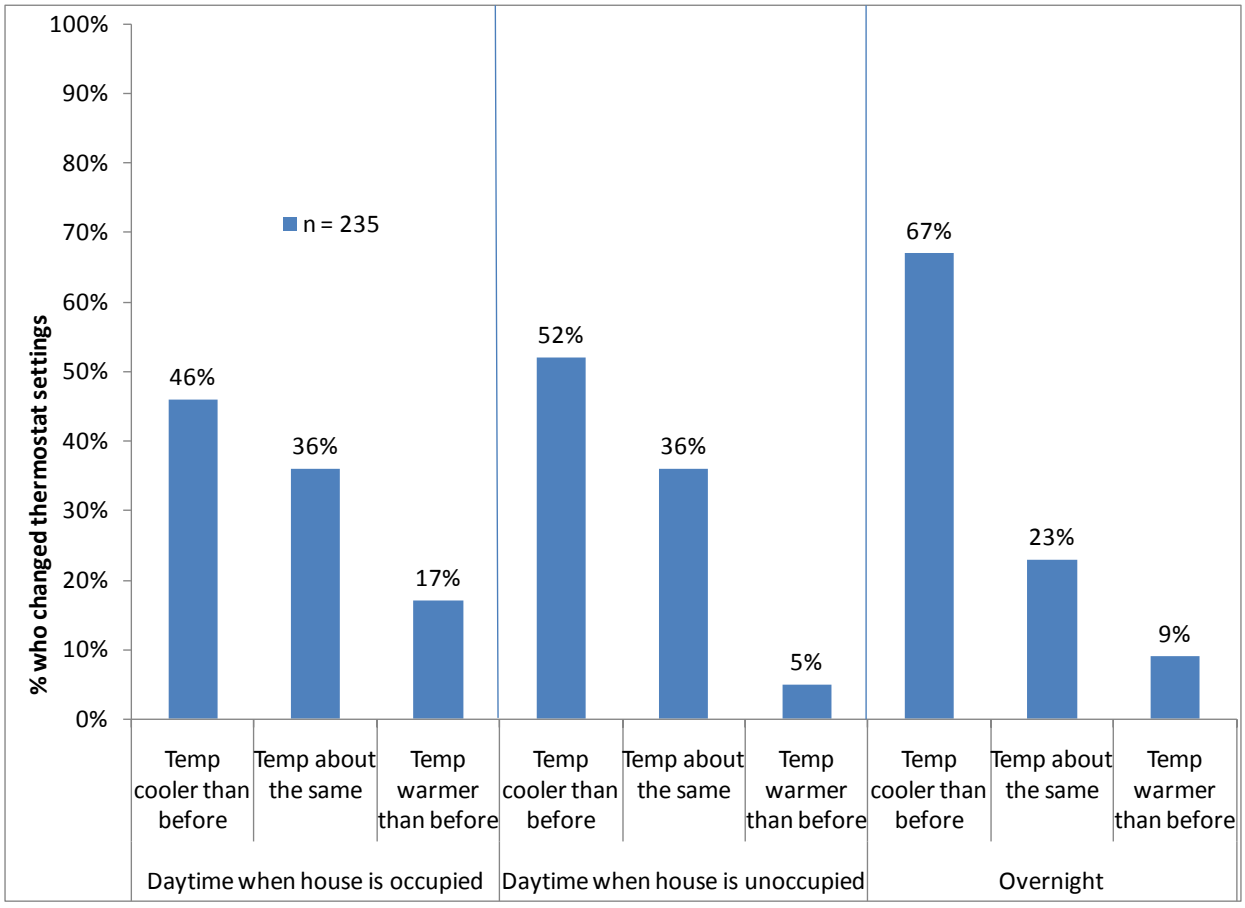
Note: The total percentages exceed 100% because the participants were allowed to give multiple responses.

To understand how participants were changing their thermostat settings, we asked them whether they were keeping their temperatures warmer, cooler, or about the same during three time periods: overnight, daytime when their homes were occupied, and daytime when their homes were unoccupied. Figure 2-31 shows that for all of these time periods the percentage of participants who kept their homes cooler than they had before the furnace/boiler installation was much higher than those who kept their homes warmer. This indicates that some of the energy savings discovered by the billing analysis were coming from participants using their thermostats in a more efficient manner. This also justifies the decision of the billing analysis to combine the energy savings from the high-efficiency furnaces/boilers and the program-rebated programmable thermostats into one savings estimate. Because while Figure 2-30 shows that many participants are changing their temperature settings because they got new programmable thermostats, about an equal percentage are also changing their thermostat settings because they are finding that a

cooler temperature with the new furnace/boiler feels the same as the higher temperature they had used with their previous furnace boiler.

Finally it is difficult to disentangle the acquisition of the energy-efficient furnace/boiler from the acquisition of the programmable thermostat. While it is our experience that installing a new programmable thermostat along with a new furnace/boiler is standard practice for most HVAC contractors regardless of the energy efficiency of the new furnace/boiler, there is evidence earlier in this report that the energy savings benefits of the more energy-efficient furnaces/boilers are encouraging some participants to replace their furnace/boiler sooner than they otherwise would have to. In such situations the high-efficiency furnace/boiler is accelerating the acquisition of the programmable thermostat as well as any energy savings associated with the acquisition of that new thermostat.

Figure 2-31
How Participants Changed Their Thermostat Settings
Since Getting the New Furnace/Boiler Installed

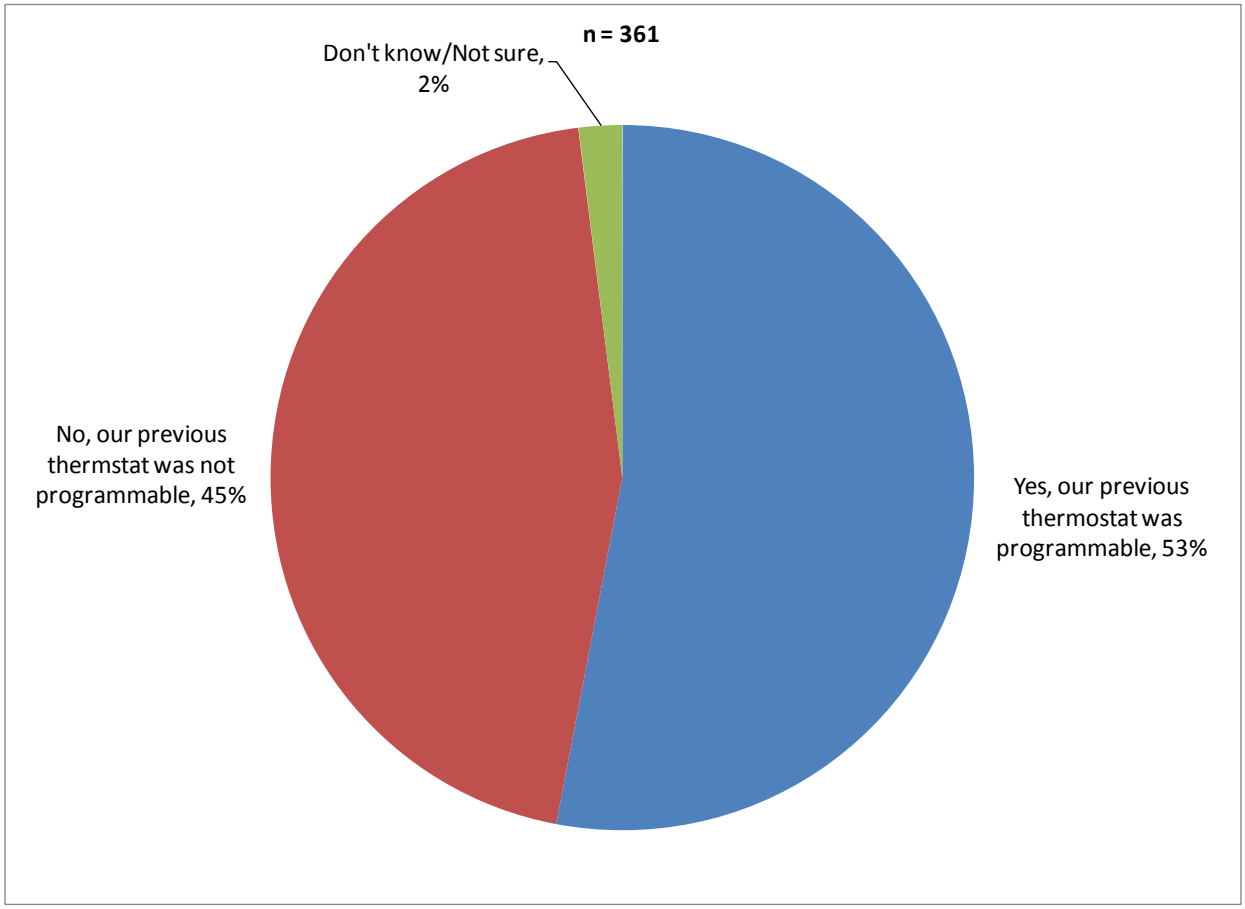


We were also interested in knowing which percentage of the participants who had acquired new programmable thermostats through the program previously had programmable thermostats.8 Figure 2-32 shows that slightly over half (53%) of these recipients of program-rebated programmable thermostats reported that they previously had a programmable thermostat.

The higher the education of the participant, the more likely they were to report previously having a programmable thermostat. Sixty-two percent of the participants with at least some graduate school education said they previously had programmable thermostats compared to 57 percent of those with a four-year college degree, 40 percent of those with only some college, and 39 percent of those with a high school education or less. RG&E customers were also more likely (57%) than NYSEG customers (42%) to report that their previous thermostat was programmable.

[8] Two thirds of the participants in our survey sample received a programmable thermostat through the program.

Figure 2-32
Whether Recipients of a Programmable Thermostat through the Program Previously had a Programmable Thermostat

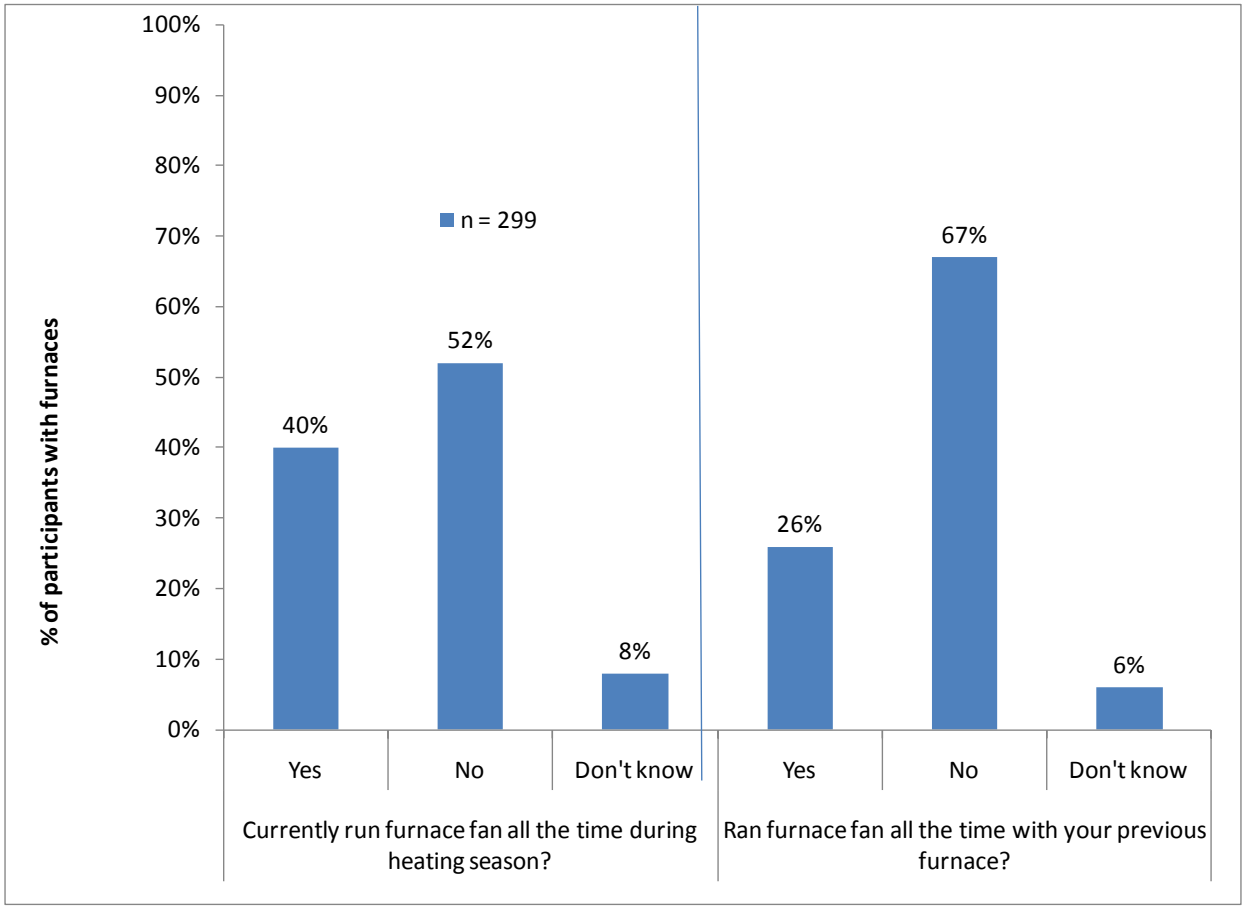


The fact that over half of the recipients of the program-rebated programmable thermostats previously had a programmable thermostat raises some questions about the energy savings attributed to this measure in the New York Technical Reference Manual. This issue is discussed in more detail in the engineering analysis section of this report.

2.7.4 Changes in Furnace Fan Use since Furnace/Boiler Installation

We asked the program participants who had furnaces installed through the program whether they currently run their furnace fan all the time during the heating season and then whether they did this with their previous furnace. Figure 2-33 shows that the participants were more likely to be running their fans all the time with their current furnaces than they had been with their previous furnaces. This finding is of some concern because such a behavioral change would offset some of the potential savings from the new ECM motors that were installed.

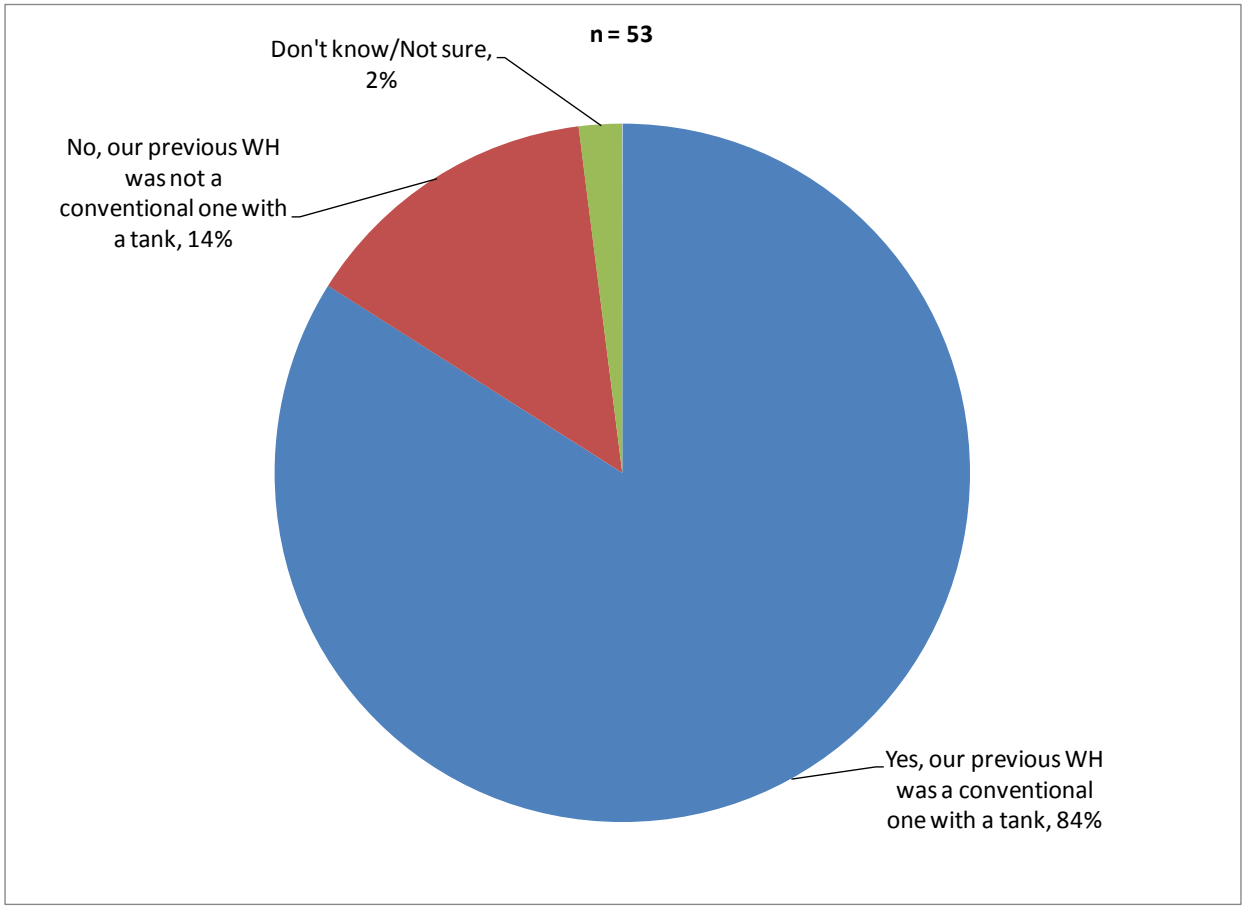
Figure 2-33
Running Furnace Fans During the Heating Season
Currently vs. with Previous Furnace



2.7.5 Changes in Waters Heaters

We asked the 53 participants in our sample who had received indirect water heaters through the program whether their previous water heaters had been a conventional water heater with a tank. Figure 2-34 shows that the large majority of these indirect water heater recipients previously had a conventional water heater. We asked the participants who said that their previous water heater was not a conventional water heater what kind of water heater they had. Most of them (57%) said that they had coil heating and 14% of them said that they previously had an indirect water heater.

Figure 2-34
Whether Indirect Water Heater Recipients
Previously Had a Conventional Water Heater



3. The Findings from the HVAC Trade Ally Interviews

This section contains the detailed findings from the interviews we conducted with 36 HVAC trade allies.

3.1 Background

This section reports the results of in-depth interviews completed with HVAC distributors and contractors who operate in the upper New York State area. Some of these contractors and distributors participated in the New York State Electric & Gas (NYSEG) and Rochester Gas and Electric (RG&E) Natural Gas Equipment and Duct Sealing Rebate Program while others did not. The objectives of the interviews were to determine:

- Trade ally understanding of the program;
- Trade ally satisfaction with the program;
- Marketing and sales trend information; and
- Effectiveness of program on increasing sales of high efficiency HVAC equipment.

The purpose of the NYSEG/RG&E program is to increase the market penetration of high efficiency space heating and water heating equipment in the NYSEG and RG&E service territories. The program provides rebates to customers for the purchase of high efficiency space and water heating equipment to reduce the upfront cost of the energy efficient equipment. To be eligible for rebates, customers must purchase a central heating system or indirect water heater that meets or exceeds minimum program requirements. Participants are also eligible for rebates on boiler reset controls, duct sealing and programmable thermostats.

3.2 Trade Ally Sample Characteristics

DNV KEMA completed 36 in-depth interviews with HVAC distributors, participating HVAC contractors, and nonparticipating HVAC contractors. The evaluators defined distributors as businesses which sold at least 10 gas boilers or furnaces to HVAC contractors in upstate New York during the past two years. The evaluation team defined participating HVAC contractors as those who installed at least 10 gas boilers or furnaces during the past two years for which the program issued a rebate to a utility customer. The evaluators defined nonparticipating contractors as those that installed at least 10 gas boilers or furnaces, but have not installed equipment for which the program issued a rebate.

The evaluators had planned to complete 35 interviews and ended up completing 36. Table 3-1 shows at a high level the target number of completed interviews and the number actually completed by HVAC trade ally group category. The interviews were conducted during the January- February 2012 period.

Table 3-1
Sampling Targets for
HVAC Contractor/Distributor In-Depth Interviews

HVAC Trade Ally Group	Target # of Completed Interviews	# of Completed Interviews
Participating contractors	5 large	5
	5 medium	5
	5 small	5
Nonparticipating contractors	10	10
Distributors	10	11
Total	**35**	**36**

The following subsections describe how the evaluators developed the sample frames for each of these contractor/distributor groups.

3.2.1 Sampling the Participating Contractors

The evaluators developed the sample frame of participating HVAC contractors from the NYSEG/RG&E tracking database. The sample frame of participating HVAC contractors was 1,193 contractors after removal of HVAC contractors who did not have contact information in the tracking database. The evaluators then stratified this sample frame into small, medium and large strata with each stratum accounting for about a third of the total measures installed in the tracking database.

3.2.2 Distributors and Nonparticipating Contractors:

The evaluators used the following steps to create the sample frame for the distributors and nonparticipating HVAC contractors:

- *Review service territories covered by NYSEG and RG&E.* The evaluators divided the New York State counties into four categories: 1) the NYSEG service territory and any bordering counties; 2) the RG&E service territory and any bordering counties; 3) Both NYSEG and RG&E territories and bordering counties; and 4) All other counties.

- *Develop list of HVAC distributors.* The sample frame of HVAC distributors was obtained in two ways:

  1. A list of 70 businesses was obtained from Dun and Bradstreet using the following SIC codes:

  – SIC 5074: Plumbing and Heating Equipment and Supplies
  – SIC 5075: Warm Air Heating and Air-Conditioning Equipment and Supplies
  – SIC 5084: Industrial Machinery and Equipment
  – SIC 1711: Plumbing, Heating & Air Conditioning Contractors (only included if "Line of Business" description indicated business as wholesaler)

  2. An additional list of businesses was obtained from HVAC contractors we interviewed who identified distributors supplying them with HVAC equipment (n=10).

- *Develop list of nonparticipating HVAC contractors.* The evaluators obtained a list of 3,284 businesses from Dun and Bradstreet using the following NAICS and SIC codes:

  – NAICS 23821: Electrical Contractors
  – NAICS 23822: Plumbing, Heating & Air-Conditioning Contractors
  – SIC 1711: Plumbing, Heating & Air Conditioning Contractors (did not include if "Line of Business" description indicated business as wholesaler)

DNV KEMA compared this list to the list of trade allies for participating customers to establish the list of nonparticipating contractors (n=2,919).

- *Identify small, medium and large businesses.* Similar to the 2010 study, the number of employees was used to determine business size categories for nonparticipating contractors and distributors:

  – Small – Less than 6 employees
  – Medium – Between 6 and 30 employees
  – Large – More than 30 employees

As noted above, the original sampling plan was to conduct 10 interviews with distributors, 15 interviews with participating contractors and 10 interviews with nonparticipating contractors. For the distributor interview, an additional interview was completed because a large distributor returned a call to complete an interview after the distributor stratum target had already been met. Table 3-2 shows some of the characteristics of the HVAC trade allies that we completed interviews with.

Table 3-2
Characteristics of HVAC Trade Ally Sample

Trade Ally Category	Business Size Category	n	Service Territory	n	# of Firms with More than One Location	Range of # of Natural Gas Furnaces Sold/Installed in 2011	Range of # of Natural Gas Hot Water Boilers Sold/Installed in 2011
Distributors (n=11)	Small	2	Both	11	9	0 to 10,000	10 to 3,000
	Medium	5					
	Large	4					
Participating Contractors (n=15)	Small	5	NYSEG	3	1	7 to 1,025	0 to 200
			RG&E	1			
			Both	1			
	Medium	5	NYSEG	1			
			RG&E	3			
			Both	1			
	Large	5	NYSEG	------			
			RG&E	3			
			Both	2			
Nonparticipating Contractors (n=10)	Small	8	NYSEG	10	0	0 to 75	2 to 40
	Medium	1					
	Large	1					

Table 3-3 describes the HVAC equipment sold or installed by trade allies.

Table 3-3
Equipment Sold or Installed by Trade Allies

Equipment Sold or Installed	Distributors (n= 11)	Participating Contactors (n=15)	Nonparticipating Contractors (n=10)	Total (n=36)
Gas Furnaces	82%	93%	90%	89%
Gas Water Boilers	100%	93%	100%	97%
Gas Steam Boilers	82%	80%	90%	83%
Indirect Water Heating Systems	82%	87%	90%	86%
Boiler Resets	82%	67%	90%	77%
Programmable Thermostats	100%	100%	100%	100%

3.3 Trade Ally Awareness of the NYSEG/RG&E Program and Other Programs Encouraging EE Gas Equipment

This section discusses:

- Whether HVAC contractors and distributors were aware of the NYSEG/RG&E program,
- How they became aware of the NYSEG/RG&E program;
- What they thought about the suspension of the NYSEG/RG&E program during the July – October 2010 period;
- Whether they were aware of other programs to encourage energy-efficient gas equipment besides the NYSEG/RG&E program and, if so, how these other programs differed from the NYSEG/RG&E program; and
- Whether they were aware of new federal requirements that would increase the minimum AFUE of furnaces/boilers and what they thought would be the impact of these new requirements on the HVAC market.

3.3.1 Awareness of the NYSEG/RG&E Program

We asked the HVAC trade allies whether they were aware of the NYSEG/RG&E Natural Gas Equipment Rebate Program. All the participating HVAC contractors and the vast majority (91%) of HVAC distributors said that they were aware of the program. Half of the nonparticipating HVAC contractors also claimed awareness of the program. Many distributors and all participating contractors report being involved with the program from its inception in 2009.

All participating HVAC contractors reported knowing what types of energy efficient equipment the program rebates. Almost half (45%) of the distributors and a fifth of the nonparticipating contractors also indicated being familiar with energy efficient equipment the program rebates. When asked to describe the energy efficient equipment the program rebates, some of the trade allies indicated having the program rebate sheet on hand with them as a reference.

We also asked the HVAC contractors and distributors who were aware of the NYSEG/RG&E program how they heard about it. Table 3-4 shows their responses. Distributors tended to learn about the program from contractors. Contractors often indicated becoming familiar with the program via contact with the utility.

Table 3-4
How HVAC Trade Allies
Heard about the NYSEG/RG&E Natural Gas Equipment Program

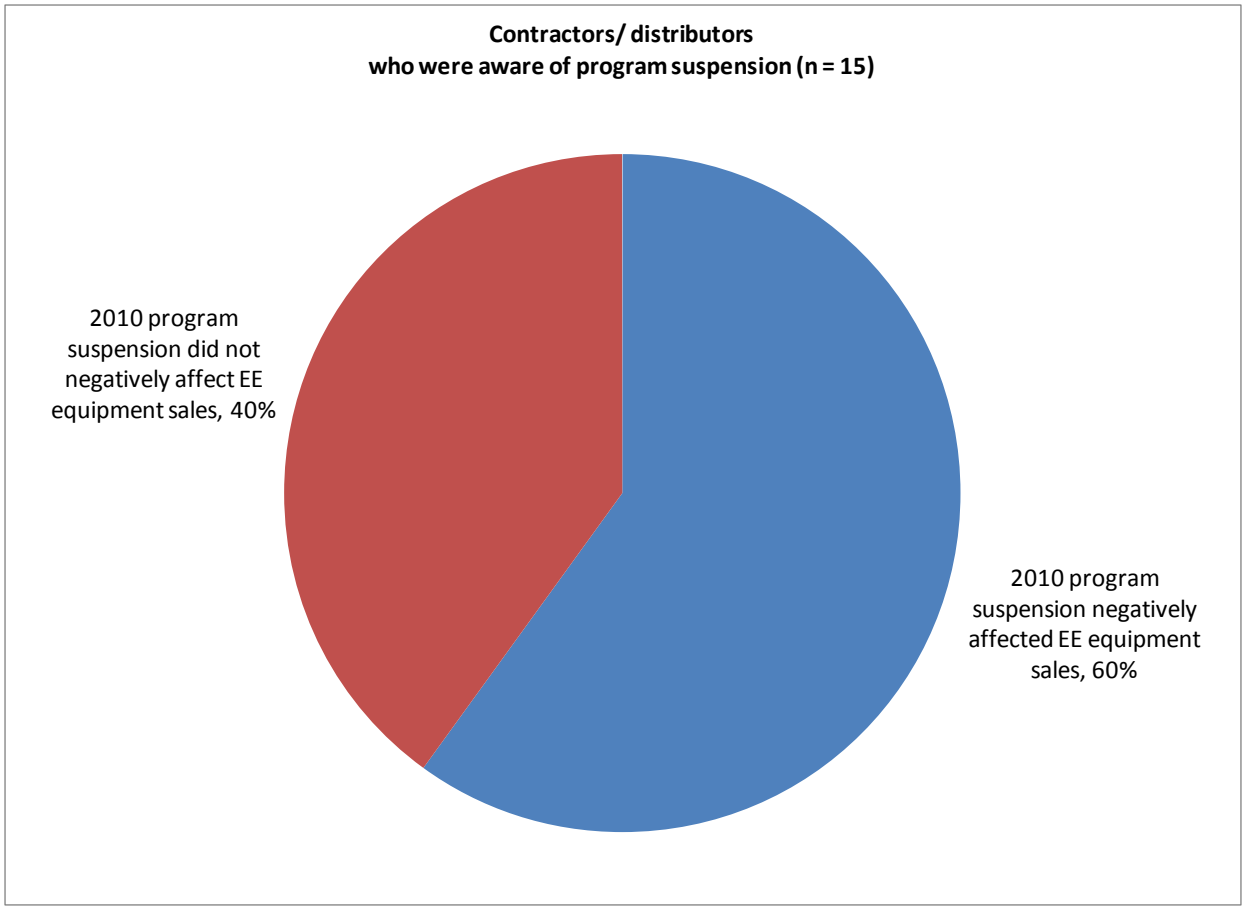
Trade Ally Category	How Heard about Program
Distributors	▪ Contractors (indicated 4 times) ▪ Word of mouth ▪ Trade ally meeting ▪ Customers ▪ Outside salesperson ▪ Email from utility
Contractors	▪ Letter from utility (indicated 7 times) ▪ Email from utility (indicated 3 times) ▪ Outside salesperson (indicated 2 times) ▪ Call from utility representative (indicated 2 times) ▪ Word of mouth ▪ Trade ally meeting ▪ Customers ▪ Online ▪ Newspaper

3.3.2 Impact of Program Suspending Activities

The NYSEG/ RG&E program was suspended from July to October in 2010 and the utilities were interested in knowing whether HVAC trade allies were aware of this suspension and how they reacted to this suspension. None of the nonparticipating contractors were aware of this suspension but over half (58%) of the participating contractors and distributors indicated being aware of this program suspension.

Figure 3-1 shows that those who were aware of the program suspension provided mixed messages about the impact of the program suspension on sales of residential HVAC equipment. Those HVAC contractors and distributors who said that the suspension negatively affected them said the break in the program service caused sales of high efficiency equipment to slow down. The other group said that the availability of federal tax credits for energy-efficient furnaces/boilers and growing natural demand for these energy-efficient products essentially offset the impacts of the program suspension.

Figure 3-1
The Impact of the 2010 Program Suspension



3.3.3 Additional Programs Encouraging Purchase of Energy Efficient Gas Equipment

We asked the HVAC trade allies whether they were aware of other programs besides the NYSEG/RG&E program which encouraged the purchase of energy-efficient gas equipment. A quarter of the distributors and participating contractors and over half (60%) of nonparticipating contractors indicated being aware of other such programs. These programs included:

- National Fuel (indicated 4 times);
- NYSERDA (indicated 2 times);
- National Grid (indicated 2 times);
- Orange and Rockland Utilities;

- Central Hudson Gas & Electric; and
- FEMA (for flood victims).

We asked the HVAC trade allies who were aware of other programs besides the NYSEG/RG&E program how these other programs compared to the NYSEG/RG&E program. Table 3-5 presents trade ally perspectives on this topic. While some trade allies said that the other programs were similar to NYSEG/RG&E regarding incentive levels, a few claimed that the other programs offered more substantial rebates for energy efficient equipment. A couple of trade allies indicated that the process for obtaining rebates was more complicated at NYSERDA compared to NYSEG/RG&E.

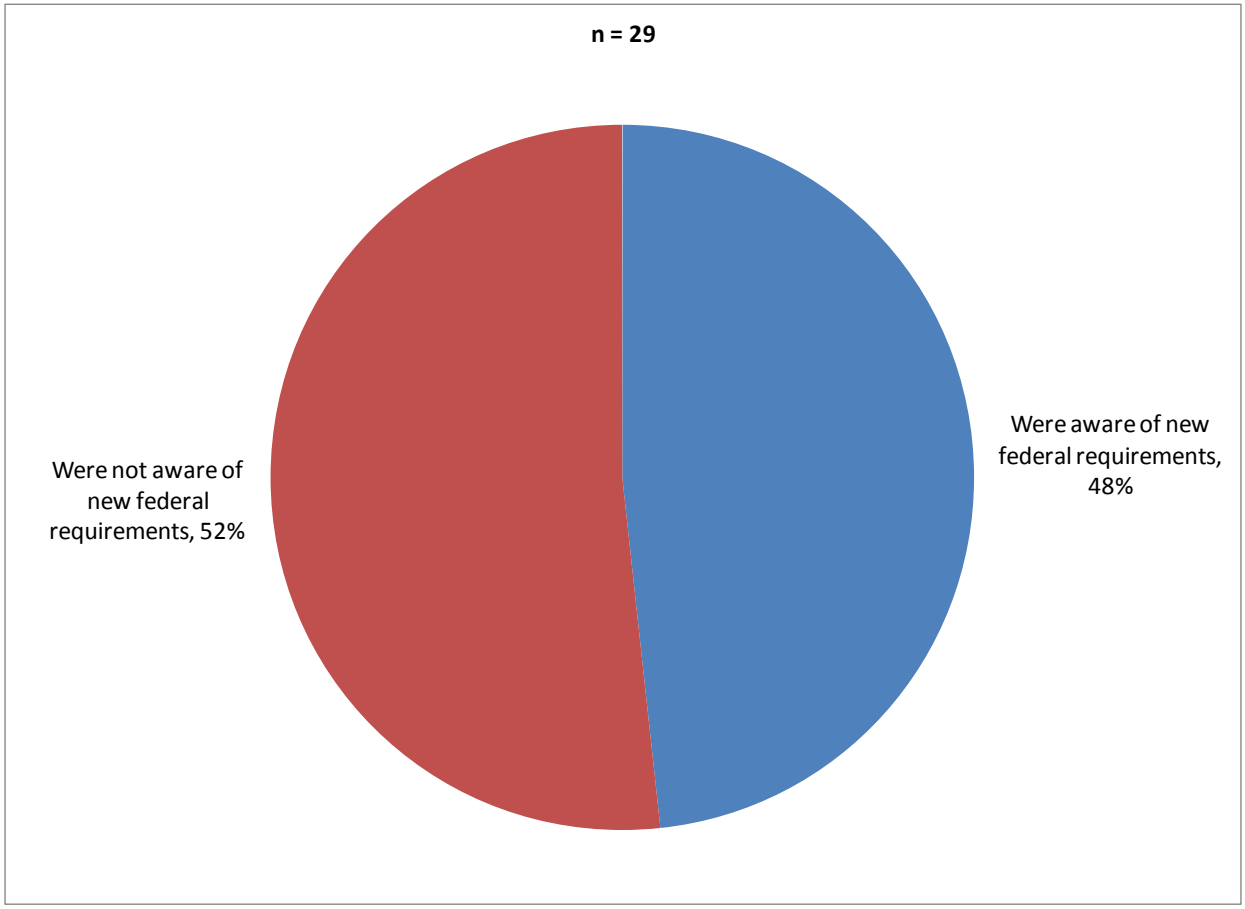
Table 3-5
Comparison of Other Programs Promoting Energy Efficient HVAC Equipment to the NYSEG/RG&E Program

Program	Comparison to NYSEG/RG&E Program
National Fuel and NGRID	▪ "Pretty similar – NYSEG/RG&E 90% efficiency boiler rebate was better than the other ones. Incentive levels are pretty competitive." ▪ "Very similar incentive levels from what I hear. Same approach emailing us to get us information and posting to their websites, but the others are more involved with co-op advertising." ▪ "Extremely close in efficiency requirements and dollar amount."
NYSERDA	▪ "They have a much higher rebate, you have to jump through a lot of hoops but it's much more substantial. It's much more widely recognized and participated." ▪ "The NYSERDA program has more red tape than the NYSEG/RG&E program."
Orange and Rockland Utilities	▪ "Similar to NYSEG/RG&E program."
Central Hudson Gas & Electric	▪ "I remember looking up something for NYSEG and they weren't offering as much as the other rebate programs. Central Hudson gives away very good money."

3.3.4 Awareness of New Federal Requirements

We asked the HVAC trade allies whether they were aware of upcoming federal requirements which will increase the minimum AFUE requirements for furnaces and boilers. Figure 3-2 shows that slightly less than half of the interviewees were aware of the coming federal standards.

Figure 3-2
Trade Ally Awareness of New Federal Furnace/Boiler Requirements



Note: The decision to add this question to the interview guide came only after the interviews were already in the field. Therefore the questions concerning the new federal requirements were only asked of 29 of the 36 trade ally respondents.

We also asked the trade allies what they thought would be the impact of these new federal requirements on the HVAC market. Table 3-6 presents the responses of the HVAC trade allies on how they anticipated the new federal requirements will impact HVAC equipment sold and installed. Some suppliers said it will be a challenge to install higher AFUE furnaces in homes not designed to accommodate such systems such as town houses. Regarding boilers, a number of suppliers claimed that the systems will have to move away from using constantly-burning pilots when the requirements go into effect.

Table 3-6
Impact of New Federal Regulations on HVAC Equipment Sold/Installed

HVAC Equipment	Impact Caused by New Federal Requirement
Furnaces	▪ "Side ventilation - people are going to have to make modifications installing a PVC pipe for the exhaust and this is a pretty common design problem in townhouses were you have the furnace in a hallway closet. The piping is going to add some significant costs for the homeowner." ▪ "The furnace regulations are going to be difficult and unfair for houses that aren't designed to support the flue exhaust." ▪ "Instances where the 90% AFUE will not be applicable without making structural changes." ▪ "92% AFUE will then become our low end line as opposed to the 80% AFUE."
Boilers	▪ "Going to be a pretty big transition moving away from the standing burning pilot." ▪ "As for hot water boilers, the biggest shocker is no constant burn pilot - this means there are four or so electronic pieces to replace it and those are subject to failure. They tried requiring this back in the 1970-80's and it was a big disservice. I think there are going to be a lot of repair and replacement problems as a result." ▪ "[Will have to] get rid of those no constant burning pilot boilers." ▪ "As for the boilers the impact is going to be negative for us as we are selling equipment that will require design changes."

Table 3-7 shows how trade allies perceived changes in the federal requirements will influence their business practices. It shows there was a mixed reaction with some contractors. Some welcomed the new standards as a way to even the playing field with competition which sells less-expensive lower-efficiency equipment. Yet others were concerned about the challenges of installing high-AFUE equipment in the tight spaces frequently found in condominiums, apartments, or townhouses. Still others thought that the greater costs of the higher-efficiency equipment would hurt future sales and burden those with lower incomes.

Table 3-7
Impact of New Federal Regulations on Business Practices

Business Practice	Impact Caused by New Federal Requirement
Have to address installation issues in replacement market	▪ "Have concerns as there are some installations in the replacement market such as a condo or apartment where there are limitations on venting issues. In order to vent the house you have to use PVC and that piping would cause you to tear into the walls to get it installed correctly." ▪ "If this ruling applies to replacement construction, they are going to have to put some provision on getting around it because in the replacement market you can't always put in what you what due to piping and other restrictions."
Appreciate the increased energy efficiency standards	▪ "Seen the improvements in air conditioning and felt furnaces needed to be improved upon as well." ▪ "Creates efficiency and reduces the usage of gas."
Lower income households could be challenged to purchase more expensive equipment	▪ "May fix instead of replace equipment." ▪ "Higher upfront cost may turn people away." ▪ "Will impact customers who want cheap furnaces with low AFUE levels." ▪
Will become more competitive with businesses that sell/install cheaper equipment	▪ "It will make us much more competitive with other contractors that are pushing cheaper, lower efficiency models." ▪ "Will have an impact because some of our competition doesn't do high efficiency, so they can do the job for much less."

Even though many trade allies expected the new federal requirements to have an influence on the HVAC market, a quarter anticipated that the changes would have little to no impact on their business. In most cases this was because they were already selling equipment that meets the upcoming standards. Some of their verbatim responses included:

- "I don't think these new requirements will matter much. We are already selling equipment well above the minimum efficiency requirements."
- "I've always pushed for energy efficient equipment, so from that perspective no impact. "

- "I give the customer a great product with a five year warranty. I don't sell them 80% efficient furnaces, so it won't have an impact on me."
- "I don't think these new requirements are that much of a change from the current standards, so it shouldn't really have much of an impact."
- "I don't think there will be a substantive change in terms of the volume for furnaces. For boilers – negligible, if any change - most manufacturers are ready for it now."
- "There are not an awful lot of options in the boiler market. The change is going to have minimal effect as there are few boilers getting installed as compared to forced air systems."
- "Boilers - there is no standing pilot allowed in New York, so no equipment is even sold here with a standing pilot….so no impact."

3.4 Marketing and Sales Trends

This section describes the findings from the HVAC contractor/distributor interviews concerning marketing practices and sales trends.

3.4.1 Trade Ally Marketing Practices

We asked the HVAC trade allies how they advertise their services. Table 3-8 shows that over half the trade allies (56%) reported using word of mouth as a way to promote their business. Many contractors also advertised in the phone book (60%) and marketed their services in the newspaper (40%). Relative to contractors, unique ways distributors publicized their businesses included trade publications, billboards and sales calls. There were some interesting differences in the advertising methods of participating and nonparticipating contractors. The nonparticipating contractors were more likely than the participating contractors to rely on low-cost advertising methods like phonebook listings and word-of-mouth. This is likely related to the smaller average size of these nonparticipating contractors.

Table 3-8
How Trade Allies Advertise Services

Method of Advertising Services	Distributors (n=11)	Participating Contractors (n=15)	Nonparticipating Contractors (n=10)	Total (n=36)
Word of mouth	45%	47%	80%	56%
Phone book	9%	53%	70%	44%
Newspaper	18%	33%	50%	33%
Website	18%	47%	10%	28%
Flier/Postcard/Mailer	27%	33%	10%	25%
TV	27%	27%	0%	19%
Radio	27%	20%	10%	19%
Ad in Penny Saver	9%	20%	0%	11%
Newsletter	0%	20%	0%	8%
Trade Publication	27%	0%	0%	8%
Company truck/ Sign outside installation location	9%	7%	10%	8%
Billboard	18%	0%	0%	6%
Sales calls	9%	0%	0%	3%

3.4.2 Promoting Energy Efficient Products

We were interested in learning how the HVAC trade allies promote energy-efficient gas equipment, what they see as the advantages and disadvantages of the higher-efficiency equipment, and whether the frequency with which they recommend energy efficiency has changed over the last two years (the NYSEG/RG&E program started in 2009).

3.4.2.1 How Trade Allies Define Energy-Efficient Gas Equipment

First to get a better sense of what the trade allies meant when they talked about energy-efficient gas equipment, we asked them what Annual Fuel Utilization Efficiency (AFUE) they considered to be high efficiency for 1) gas furnaces; 2) gas hot water boilers; and 3) gas steam boilers. Table 3-9 shows the average AFUE level of residential HVAC equipment deemed to be high efficiency for each trade ally group. Across the board the trade allies were fairly consistent in what equipment types they considered to be high efficiency for gas furnaces and hot water boilers. However, there was a noticeable difference

between contractors - both participating (AFUE=89%) and nonparticipating (AFUE=88%) – compared to distributors (AFUE=82%) in what they consider to be high efficiency for gas steam boilers. Over a third of distributors (36%) said that they do not sell many gas steam boilers, so they may not be as familiar with this equipment as contractors.

Table 3-9
AFUE Levels Considered High Efficiency
by Trade Allies for HVAC Equipment

HVAC Equipment	Distributors (n=11)	Participating Contractors (n=15)	Nonparticipating Contractors (n=10)	Total (n=36)
Gas furnace	93% (n=9) (Range: 90 to 95%)	93% (n=15) (Range: 90 to 97%)	95% (n=9) (Range: 90 to 98%)	93% (n=33) (Range: 90 to 98%)
Gas hot water boiler	89% (n=11) (Range: 84 to 95%)	91% (n=11) (Range: 81 to 95%)	91% (n=9) (Range: 83 to 95%)	90% (n=31) (Range: 81 to 95%)
Gas steam boiler	82% (n=7) (Range: 80 to 86%)	89% (n=7) (Range: 81 to 95%	88% (n=7) (Range: 83 to 97%)	86% (n=21) (Range: 80 to 97%)

3.4.2.2 Whether Trade Allies Feature Energy Efficiency in Their Promotional Activities

We asked the HVAC trade allies whether they feature energy efficiency in any of their advertising. Almost three quarters (73%) of participating contractors said that they did. However, less than half (45%) of distributors and nonparticipating contractors mentioned energy efficiency in their marketing efforts.

We also asked these trade allies how they featured energy efficiency in these promotional efforts. Table 3-10 describes energy efficiency topics that trade allies reported discussing with their customers when promoting their services.

Table 3-10
Energy Efficiency Messages
Contained in Trade Ally Advertising

Topic of Energy Efficiency Advertisement	Number of Trade Allies Citing EE Message
Lower energy bill/energy consumption ▪ "We focus specifically on customer ability to lower utility bill." ▪ "We talk about saving money on utility bills through buying the efficient furnaces." ▪ "Will mention something about higher efficiency, save money by increasing the efficiency of their product (gas and electric savings)." ▪ "For the 95% [AFUE], we talk about the savings to the customer."	7
Discuss energy efficient features of equipment ▪ "[Advertise] most of them are featuring the 95% [efficiency]." ▪ "We'll showcase different energy efficient furnaces." ▪ "For the furnaces, we advertise mostly the X drive with the entry level ECM."	5
Publicize rebates ▪ "We mention the utility rebates available for energy efficient equipment." ▪ "Every advertisement is indicating information that meets qualifying rebates." ▪ "We did some over this past year with NYSERDA and National Fuel. They had co-op advertising funds available and it was a requirement to mention rebate. It's something that we would like NYSEG/RG&E to think about (co-op advertising)."	4
Promote business as green ▪ "We try to be the greenest that we can - same approach over the last 30+ years." ▪ "We're definitely thought of as the green wholesaler because we do alternative energy." ▪ "We say "Go Green" on our website."	3

We were also interested in learning whether the HVAC distributors promoted the NYSEG/RG&E program to the HVAC contractors they sold equipment to. Almost half (45%) of the distributors said that they mention the NYSEG/RG&E Natural Gas Equipment Rebate Program when recommending ENERGY STAR qualifying equipment to residential contractors. Two thirds of the distributors have helped contractors participate in the program.

3.4.2.3 The Pros and Cons of Promoting Energy-Efficient Gas Equipment

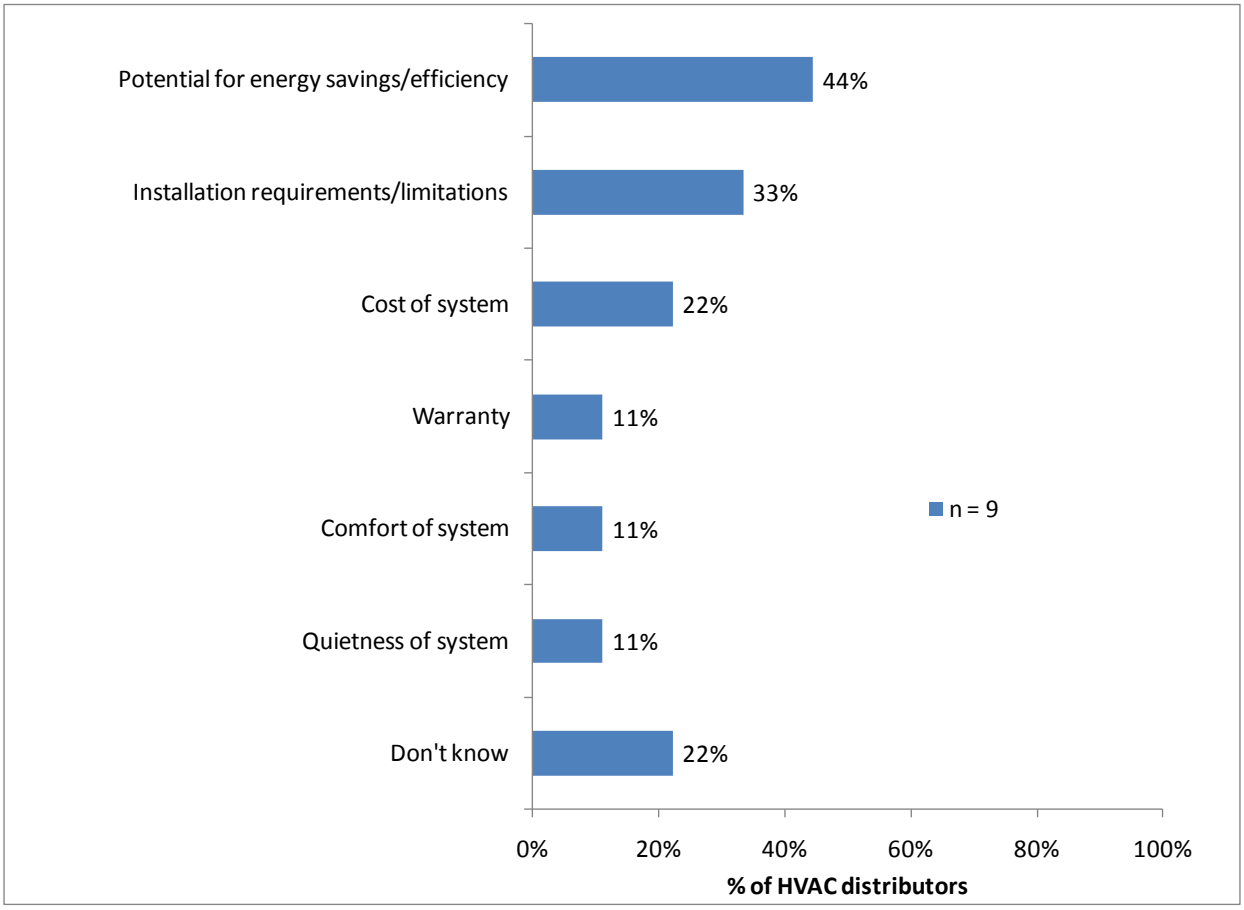
We also asked the trade allies what they saw as the advantages and disadvantages of promoting energy-efficient technologies in residential applications. Table 3-11 summarizes their responses. It shows that HVAC contractors and distributors often cited increased sales and customer satisfaction as benefits to endorsing energy efficient equipment. On the other hand, the disadvantages of the high efficiency systems included having to spend additional time with customers explaining the program and the simple fact that some households wish to have less expensive systems installed.

Table 3-11
Trade Ally Advantages and Disadvantages
to Promoting Energy Efficient Equipment

Advantages to Promoting Energy Efficient Technologies	Number of Respondents Citing Advantage	Disadvantages to Promoting Energy Efficient Technologies	Number of Respondents Citing Disadvantage
▪ Helps increase sales (e.g., makes higher upfront costs more tolerable).	16	▪ Have to spend additional time with customers to discuss program (e.g., helping fill out paperwork).	4
▪ Provides increased customer satisfaction (e.g., lower fuel bill).	7	▪ Increased cost of energy efficient systems turn people off (e.g., lower income households).	3
▪ Opens up the possibility to sell other energy efficiency equipment/services.	2	▪ Have to make more service calls because installations are more technical and prone to improper installations.	1
▪ Offers opportunity for customers to take advantage of rebates/incentives.	1	▪ Would not recommend to older to customers (i.e., 70+ yrs old) because don't think they will see savings in their lifetime.	1

We asked distributors what factors they thought HVAC contractors considered when choosing to promote high efficiency versus standard efficiency residential furnaces and boilers to customers. Figure 3-3 shows that the most-cited response (44% of respondents) was the potential for energy efficiency and customer cost savings. “Saving the homeowner money that’s absolutely positively where the bottom line is concerned,” said one distributor. “If they can save their customer money -- a large dollar value -- and where 50 percent of their business is word-of-mouth, the homeowner is much more likely to recommend them.”

Figure 3-3
What HVAC Distributors Say HVAC Contractors Consider
When Choosing to Promote High Efficiency vs. Standard Efficiency Furnaces/Boilers



3.4.3 Operating Status of Furnaces/Boilers Being Replaced

Contractors were asked when replacing a residential customer's furnace or boiler, the percentage of time the pre-existing system was 1) "not functioning at all"; 2) "still functioning, but with significant performance/maintenance issues"; or 3) "still functioning well." The contractors indicated that the new furnace/boiler is usually replacing equipment that was not functioning at all (49% of the time) or with considerable problems (35% of the time). However, contractors also reported replacing furnace/boiler systems that were still functioning well somewhat frequently (17% of the time). Participating contractors reported replacing furnaces/boilers that were still operating well twice as often as nonparticipating contractors did (20% vs. 10% of the time).

This suggests that some customers wish to take advantage of rebates to obtain higher efficiency equipment regardless of the condition of their current system. However, there was also evidence from

HVAC contractors that the federal tax credit was driving many furnace/boiler replacements and it is possible that the participating contractors, who were on average larger and more sophisticated than the nonparticipating contractors, were also savvier about using this tax credit to encourage early furnace/boiler replacement among some customers.

3.4.4 Contractor Dealings with Customers when Performing HVAC Installations

We asked the HVAC contractors what options or factors they discuss with the customers when replacing a furnace or boiler. The two most-cited topics of conversation were energy efficiency/energy savings (62%) and the cost of the system/affordability (39%). Figure 3-4 gives the full range of responses. Table 3-12 provides representative quotations from the contractors on these topics.

Figure 3-4
The Frequency of Topics That Contractors Discuss with Customers When Installing a New Furnace/Boiler

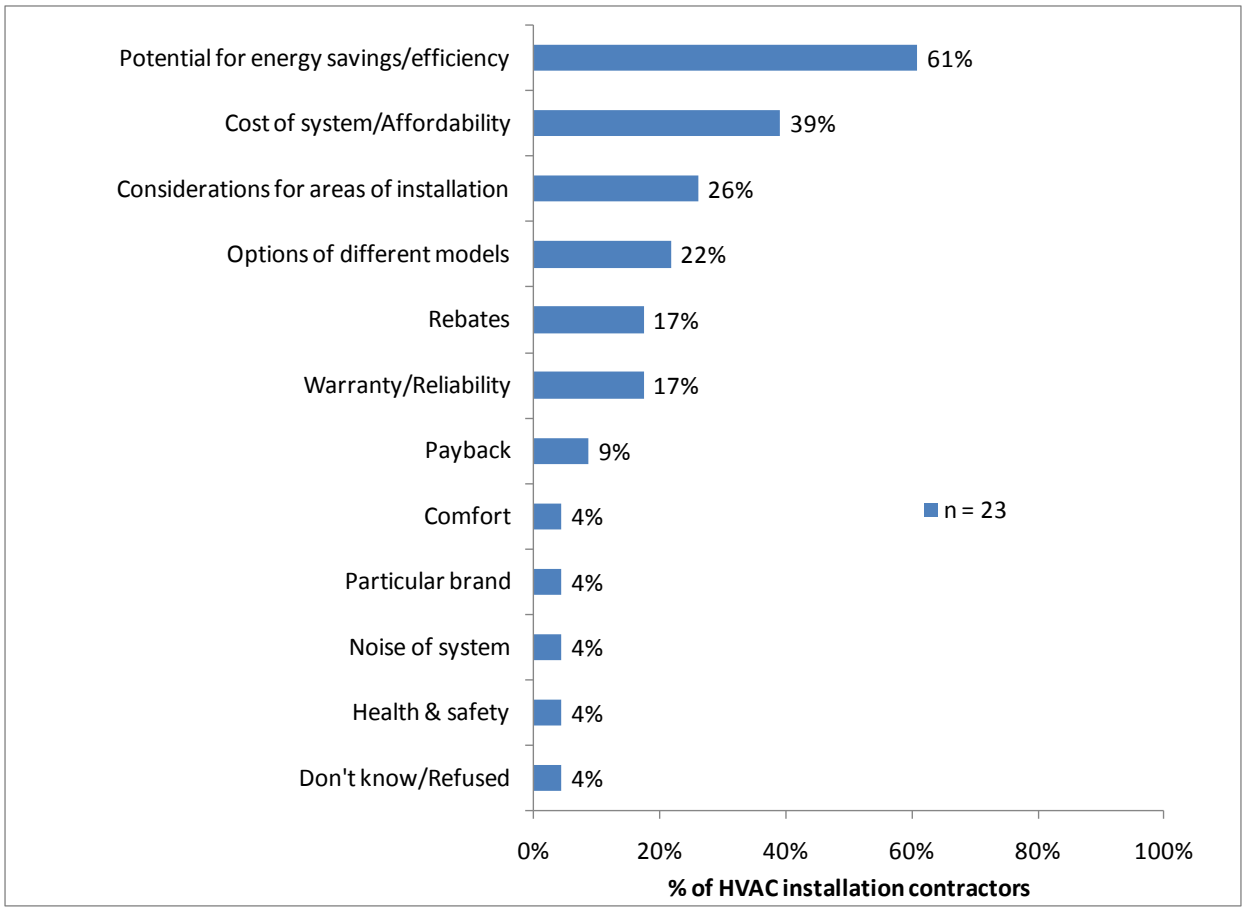


Table 3-12
Topics HVAC Contractors Discuss
with Customers When Conducting Furnace/Boiler Installations

Topic Category with Representative Quotations
▪ Potential for energy savings/efficiency ▪ "We talk about the utility savings the customer will get if they get high efficiency equipment." ▪ "I tell them the higher efficiency unit will help them save on their gas bill." ▪ "Upgrading from an 80% AFUE to a 90% is only a difference of $400. I tell them the higher efficiency unit will help them save on their gas bill."
What customer can afford ▪ "We give them the option of buying a lesser or higher energy efficiency system, depending on what they can afford." ▪ "Depends on their situation - what they are looking for and how much they are willing to pay." ▪ "Usually [discuss] different options for efficiency, what matches their needs, and cost they are willing to spend."
Payback ▪ "We always discuss their payback - the number of years it will take to recoup their costs." ▪ "[Tell customers] if you go with the high efficiency product line, you're going to get your money back."
Rebates ▪ "We let the customer know the rebates are higher for the larger AFUE levels." ▪ "We try to talk everyone into high efficiency equipment and very rarely sell anything with AFUE levels below 90% since there is not that much difference in terms of price considering rebates and tax credits."
Consideration for area of installation ▪ "We mostly promote the 95% AFUE furnaces, but rental properties will often request equipment with AFUE levels of 80%." ▪ "What is going to fit for the specific installation (flue gas restrictions) - if there are restrictions we offer the 80% AFUE, otherwise 90% AFUE and above." ▪ "I always specify the 91% AFUE unit unless there are installation restrictions in which case I specify the 80% AFUE due to flue exhaust issues."
Comfort ▪ "Talk about comfort profile."

Topic Category with Representative Quotations
Warranty   ▪ "We always discuss the warranty."

3.5 Trends in Sales and Stocking of Energy-Efficient Equipment

This section discusses trade ally perspectives on trends in sales and stocking of energy-efficient equipment.

3.5.1 Trends in Recommending Energy-Efficient Gas Equipment

We were interested in learning how the tendency to recommend high-efficiency gas equipment might have changed over time. So we asked the trade allies: "Do you more frequently recommend high efficiency furnaces or boilers than you did two years ago?" Figure 3-5 shows that 80 percent of the distributors and two thirds of the participating contractors reported an increasing frequency in recommending energy-efficient models. However, only a third of the nonparticipating contractors reported the same.

Figure 3-5
Whether HVAC Trade Allies Are Recommending EE Equipment More Frequently Than They Did Two Years Ago

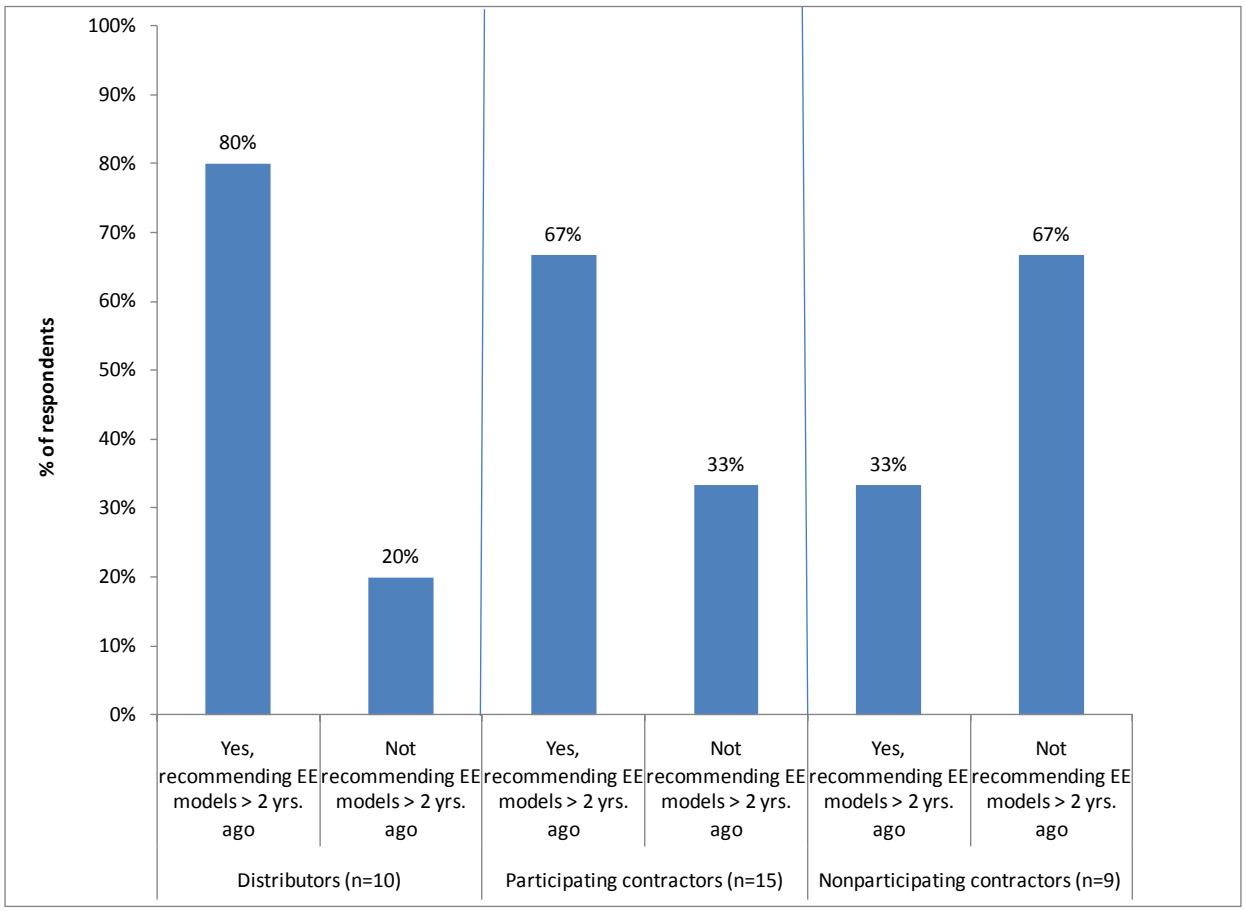


Table 3-13 shows reasons cited by trade allies for encouraging energy efficiency products more often during the last couple years. It shows that the potential to reduce energy costs and the ability to take advantage of the rebates were the two most-cited reasons for this increase in recommendations for energy-efficient equipment.

Table 3-13
Reasons Trade Allies Are Recommending
Energy Efficient Equipment More Frequently Over Past Two Years

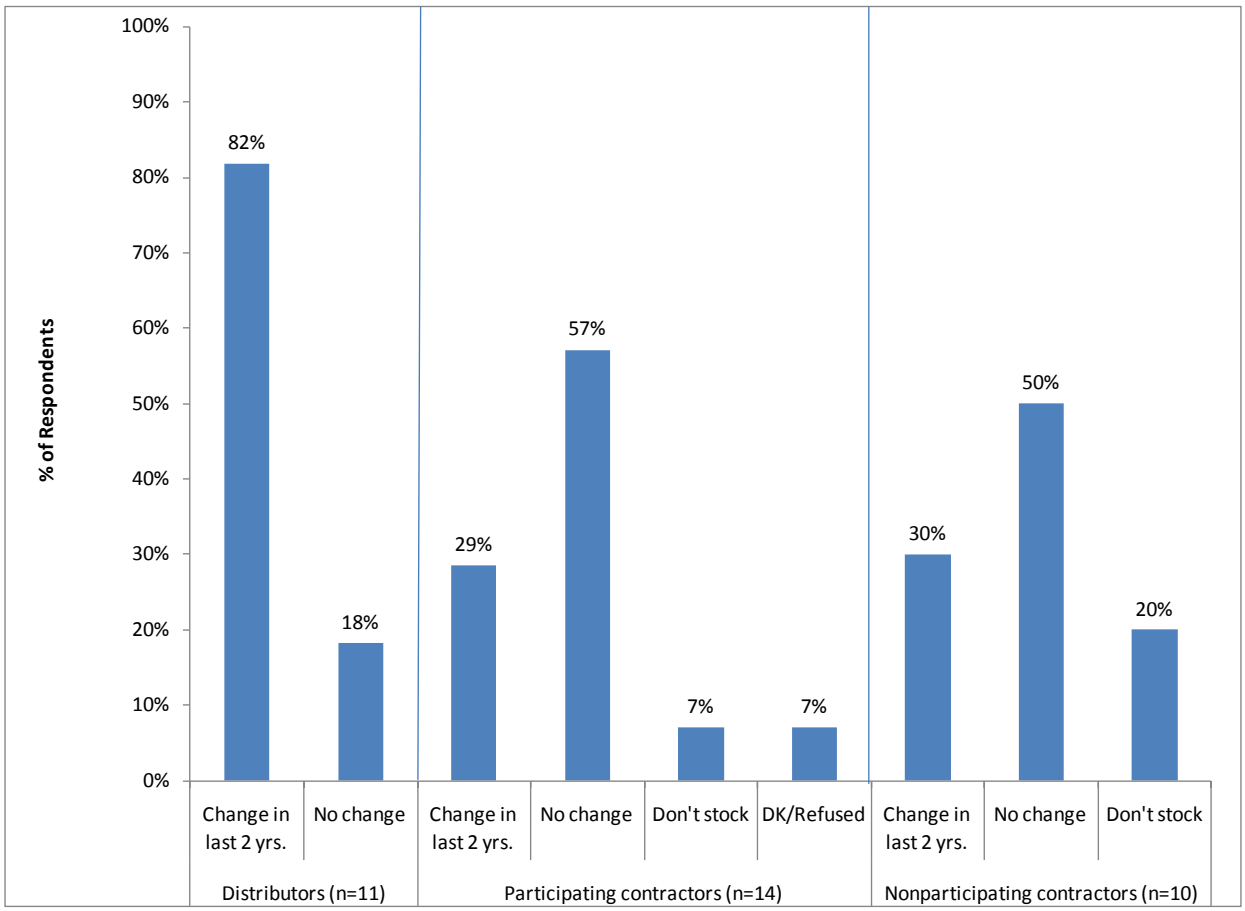
Reason Category with Representative Quotations	Number of Respondents Citing Reason
Energy savings/Price of fuel increasing ▪ "The price is going up in energy fuel, so savings is much better." ▪ "Price of oil and gas has gone up." ▪ "Everybody has been pretty cost cautious in what they are spending on their gas bills for the last several years."	7
Take advantage of rebates ▪ "We started to get into it during the rebates." ▪ "Tax credits and rebates lead us to recommend high efficiency models even more." ▪ "Furnace prices have come down due to rebates."	6
Good product for customer ▪ "It's better for the consumer - the smart money would put a higher efficiency furnace in the house." ▪ "By selling customers an 80% efficient furnace - you're not doing them any good." ▪ "We remind them the higher efficient products are going to help them sell their home faster and they're going to be more comfortable." ▪ "It's a good product - there is no reason not to [recommend]."	5
Business credo to promote energy efficient equipment ▪ "It's our bread and butter [to recommend energy efficient equipment]." ▪ "Because there are less rebates and incentives to drive the sale of these [high efficiency] units, we need to promote and market them better." ▪ "Because we believe in them, it is truly the future of the world and we're not just selling a product - we're selling energy efficiency and we promote it heavily with the people who purchase from us." ▪ "We were [promoting energy efficiency] quite a bit two years ago as well." ▪ "You are doing a world of good and service for people."	5

Higher profit margin ▪ "Better return - why make $200 when you can make $400?" ▪ "Let's face it - with higher end AFUE, they're also higher profit margin."	2
Customers more knowledgeable about energy efficiency ▪ "Customers are more knowledgeable than they were two years ago, so it is easier to recommend higher efficiency furnaces and boilers." ▪ "Energy efficient products are no longer foreign to customers - they are trying to justify upfront costs."	2

3.5.2 Trends in Stocking Energy-Efficient Equipment

We asked both distributors and contractors whether the percentage of energy-efficient equipment they have in stock is different now than it was two years ago. Figure 3-6 shows that the distributors and contractors told a very different story. Eighty-two percent of the distributors reported a change in their stocking practices compared to less than a third of the contractors. The responses of the participating and nonparticipating contractors were very similar.

Figure 3-6
Whether HVAC Trade Allies Reported Changes
in Stocking of EE Equipment Over Last Two Years



The distributors and contractors mentioned a number of factors that were either encouraging or discouraging the stocking of energy-efficient equipment. These included:

- *Increasing demand for and baseline presence of energy-efficient models:*
  - "In terms of efficiency we carry the highest that is available. It was once the 87% - now it's the 92%."
  - "Result of what the manufacturer offers and the general public is taking interest in the higher efficiency products."

- "Demand is greater - leaning towards more efficient. It's growing as opposed to declining. When the rebate program first came out there was hardly any high efficiency models - now it's more than half."
- "We change based on demand and the demand has been increasing towards the higher AFUE. Our manufacturer has more units that are 92% and above. We're stocking more of the units that are higher efficiency - already starting to plan for next year's phase-out of 80% efficiency furnaces."
- "It really was just a transition, I'll put it this way we used to carry two low efficiency boiler lines and one or two high efficiency boiler lines we never carried four or five high efficiency. And now we carry just one low efficiency boiler line now. It's more of a transition than a ramp up, we're always experiencing growth."

- *Disappearance of federal tax credit and reduced rebates have hurt sales of energy-efficient models recently:*
  - "I don't carry as many high efficiency 95% AFUE furnaces as I did two years ago because the federal tax credit is no longer available."
  - "There has been a decline in the high efficient units. The incentives from the local utilities have gone down and the federal rebate is no longer offered."
  - "A greater proportion of 80% AFUE are being stocked because they're selling more readily now than they used to due to the lack of substantive rebate which is no longer available and hence the pricing disparity."
  - "No longer a federal tax credit to off-set the cost. When the tax credit was at $1,500, we sold 500 units that were the premium 98% AFUE, but that has declined to about 100-150 units a year."
  - "The incentives from the local utilities has gone down and the federal rebate is no longer offered."

- *The impacts of the economic downturn:*
  - "We don't carry as large of an inventory [of energy-efficient products] as we used to because of the decline in the economy."
  - "Two years ago people were scared because the economy was worse, we tried offering a different less expensive product line the Goodman line it's less efficient but affordable."

3.5.3 Estimation of High Efficiency Furnaces/Boilers Receiving Federal Tax Credits

When NYSEG and RG&E expressed interest during a conference call in knowing about the impacts of the federal tax credit on sales of energy-efficient gas equipment, we added a question on this topic to the trade ally interview guide, even though over a third of the interviews had already been completed. The question we added was: "What percentage would you estimate of the high efficiency furnaces/boilers you sell/install are receiving federal tax credits?" We are able to ask this question of 22 (11 distributors and 11 contractors) trade allies who had not yet completed interviews.

The distributors estimated, on average, that 79 percent of their high efficiency equipment sales/installations were receiving the federal tax credit. In contrast, the contactors, on average, estimated that 50 percent of their high efficiency equipment sales/installations were receiving the credit. Since the contractors are closer to the actual furnace/boiler purchase we believe that their estimate is more reliable. A couple of trade allies provided separate estimates for furnaces sales/installations vs. boiler sales/installations. In both cases the furnace estimates (90-100%) were much higher than the boiler estimates (25-50%).

3.6 Trade Ally Satisfaction

This section discusses trade ally satisfaction with the NYSEG/RG&E program. Only distributors and participating contractors were asked about questions relating to satisfaction with different parts of the NYSEG/RG&E program. The scale used for program satisfaction questions ranged from one to ten, where ten means "Very Satisfied" and one means "Not at all Satisfied."

3.6.1 Satisfaction with the Marketing Support

We asked the distributors and participating contractors how satisfied they were with the marketing support provided by the NYSEG/RG&E Natural Gas Equipment Rebate Program. Many of the distributors and contractors said they had not received any marketing support or were not familiar enough with the program's marketing efforts to even provide a satisfaction rating. Eight of the distributors and five of the participating contractors were willing to provide satisfaction ratings for the program's marketing efforts. Using the ten-point scale where ten meant "very satisfied" and one meant "not at all satisfied, the average distributor satisfaction rating was 4.4 and the average contractor satisfaction rating was 6.4, for an overall average satisfaction rating of 5.2.

Reasons for distributors and participating contractors not being satisfied with the marketing support centered on wanting NYSEG and RG&E to become more involved in promoting the program:

- "Needs more marketing – [NYSEG/RG&E] attempt to bring in manufacturers and distributors are insufficient."
- "No communication with the program - only hear about it from the rebate. It would have been nicer to have that information on the front end than hear it from the customer."
- "It's easy to find the information on their website, but [NYSEG/RG&E] could do more. For instance, NYSERDA provided us $12K towards a $24K marketing campaign which featured the ENERGY STAR logo and the advantages of energy efficient product lines."
- "I don't know if someone was supposed to come here and tell us or we were supposed to look it up online."
- "It seems the only advertising you see is what contractors promote."
- "Customers don't know enough about it. The utilities leave it up to the contractors to solicit the program information instead of giving us marketing material."
- "Lack of communication from utility companies."

3.6.2 Satisfaction with the Rebate Application Forms

We asked the distributors and participating contractors whether they filled out any of the program's rebate application forms. Almost three quarters (73%) of the participating contractors said they had filled out the forms but only one of the eleven distributors (9%) had.

The contractors and distributors were generally very satisfied with the rebate application forms with an average satisfaction rating of 8.7 using the ten-point satisfaction scale. Those who gave lower satisfaction ratings (6-7) indicated dissatisfaction with program requirements that individual measures for a project such as thermostats be itemized. Some of their comments included:

- "I don't like that they want us to break up the cost of labor and material. I particularly don't like having to itemize the cost of the thermostat. I would prefer they accept it as the entire cost of the project."
- "Contactors like to give the customer one price for the equipment and the job. I feel like we're being dictated to break out the job by the equipment charges."

A couple of the contractors mentioned the possibility of the program using online forms. "If it can all be done electronically, not mailing stuff, it would be easier for everyone," said one of the contractors.

3.6.3 Satisfaction with the Rebate Reservation System

We asked the distributors and participating contractors whether they used the program rebate reservation system. Only 27 percent of the distributors said that they used this system but 60 percent of the participating contractors said that they did.

We then asked the three distributors and nine participating contractors who had experience with this system to rate their satisfaction with it. Using the ten-point satisfaction scale the average satisfaction rating was 8.8. One contractor indicated that the program's communications concerning this rebate reservation system could be improved. He wished that the program "told contractors when reservations were, instead of having to go online." Further evidence of the need for improved communications of the reservation system came from one distributor and two of the participating contractors who said that they have never heard of system.

3.6.4 Satisfaction with the Rebate Amount

We asked the distributors and participating contractors how satisfied they have been with the amount of the rebates offered by the program. Seven of the eleven distributors and fourteen of the fifteen participating contractors provided satisfaction ratings for the rebate levels.

The percentage of distributors and participating contractors who were less-than-satisfied (satisfaction ratings of 1-7) with the rebate levels was fairly high (39%). The average satisfaction rating of the distributors was 6.1 and the average satisfaction rating of the participating contractors was 8.0 for a group average of 7.4.

Some of the comments from the distributors and participating contractors for their less-than-satisfied ratings included:

- "It's been reduced by almost half and just isn't very advantageous."
- "They need to add another incentive level for the 95% [AFUE] and above units."
- "The rebates are not large enough to drive people's decisions, not a motivating factor."
- "I think the rebates are not effective at targeting the ultra high efficiency equipment, they need to increase the AFUE levels and raise the rebate to $500."
- "The rebates could be higher."
- "I'd like the customers to get more rebate money."

3.6.5 Satisfaction with the Time to Receive Rebate

According to the NYSEG/RG&E program manager, HVAC contractors are not allowed to receive rebate checks from the program unless they installed some eligible equipment in their own houses.[9] We asked the distributors and installation contractors whether they had received any rebates from the NYSEG/RG&E program. One of the distributors and four of the participating contractors claimed to have received program rebates. We asked these five trade allies to rate their satisfaction with how long it took to receive the rebates. There was a wide range of satisfaction ratings from 1 to 10 with an average rating of 7. The distributor who gave a rating of 1 said it took four months to receive his check. One of the contractors who gave a rating of 6 described the rebate payment as a "pretty slow moving process." However two of the contractors gave the rebate payment process ratings of 10.

We also asked the participating contractors if they had received complaints from their customers about rebates arriving late. Only two of the twelve (17%) contractors said that they had and both indicated that these incidents had occurred early in the program's history. "In the first year they were very slow, I think there was more demand than expected," said one of these contractors, "now I don't hear anything so it must be fine."

3.6.6 Satisfaction with Customer Service

We asked the participating HVAC contractors and two representatives of companies which were both distributor and contractors whether they had any interaction with NYSEG/RG&E staff. Nine of the sixteen respondents (56%) said that they had. We then asked the contractors and distributors/contractors who had these interactions how satisfied they were with the customer service they received from program staff. Eight of the nine (88%) said they were satisfied (satisfaction ratings of 8 or above) and six of them gave "very satisfied" ratings of 10. The average satisfaction rating was 9.1. The one dissatisfied respondent (satisfaction rating of 5) complained that it took a lot of time and trouble to find out the status of rebate payments for his customers and he remarked that "the call center is a joke."

3.6.7 Satisfaction with the Quality Control Inspection Process

One component of the NYSEG/RG&E program is the inspection of installed furnaces/boilers for purposes of installation verification and quality control. We asked the participating HVAC contractors and one distributor/contractor whether they had any of their equipment inspected by the program for quality control. Eight of the sixteen respondents (50%) said that they had. We asked these eight recipients of

[9] 1/20/12 email from Kevin Schmalz, Program Manager. Mr. Schmalz noted that these requests are handled on a case-by-case basis and must be approved by the program manager. The rebate application must meet all other program requirements, including equipment, invoicing and inspection.

program inspections to rate their satisfaction with this process. Seven of the eight provided satisfaction ratings (one did not know enough about the inspections to provide a rating). Six of the seven satisfaction raters (85%) gave the inspection process very high ratings (four 10's and two 9's). The one exception gave the inspection process a rating of 1. "They had the wrong address and never followed up with me," he said. "That day the whole process was a hassle." The average satisfaction rating was 8.4.

3.6.8 Satisfaction with the Whole Program

We asked all the participating contractors and six of the distributors who seemed fairly familiar with the NYSEG/RG&E program how satisfied they had been with the program as a whole. Twenty of the twenty-one respondents provided satisfaction ratings. Across all these twenty satisfaction raters, 75 percent were satisfied with the program (satisfaction ratings of at least 8). However, there were big differences between the satisfaction ratings of the distributors vs. the participating contractors. Only two of the six (33%) distributors were satisfied with the program compared to thirteen of the fourteen participating contractors (93%). The average satisfaction rating across all respondents was 8.5.

We asked the participating contractors and the program-familiar distributors what aspects of the NYSEG/RG&E program worked well or were helpful. The trade allies provide the following feedback on program features that work well:

- The rebates were helpful (indicated 6 times): Some representative quotes included:
  - "Had there not been a rebate in place we wouldn't have seen the percentage of sales progress into the high efficiency equipment that it is today - it's been dramatically helpful."
  - "The program [rebates] helps homeowners get interested in energy efficiency equipment. It helps us close the deal."
  - "Helps us promote and sell energy efficient equipment."
- The online rebate reservation system was useful (indicated 4 times): Some representative quotes included:
  - "Just going through the online process answers many customer questions."
  - "The reservation system is a huge incentive - it secures funds and customers know they'll get it."
  - "The reservation system is a great aspect – it's nice that we can assure customers they will get their rebate. It gives them piece of mind."
- The program works well in general (indicated 4 times): Some representative quotes included:

  - "It works well for the most part."
  - "Everything working fine. The whole program works really well"

- The program is easy to pursue (indicated 2 times)
  - "Easy to fill out forms."
  - "The program is simple."

In addition to providing feedback on program features that work well, trade allies were also asked to identify and offer suggestions on aspects of the program they would like to see improved. Recommendations for enhancing the program focused on wanting NYSEG/RG&E to take on a more active role in marketing the program and increasing the amount of rebates/incentives. Their feedback on program improvements included:

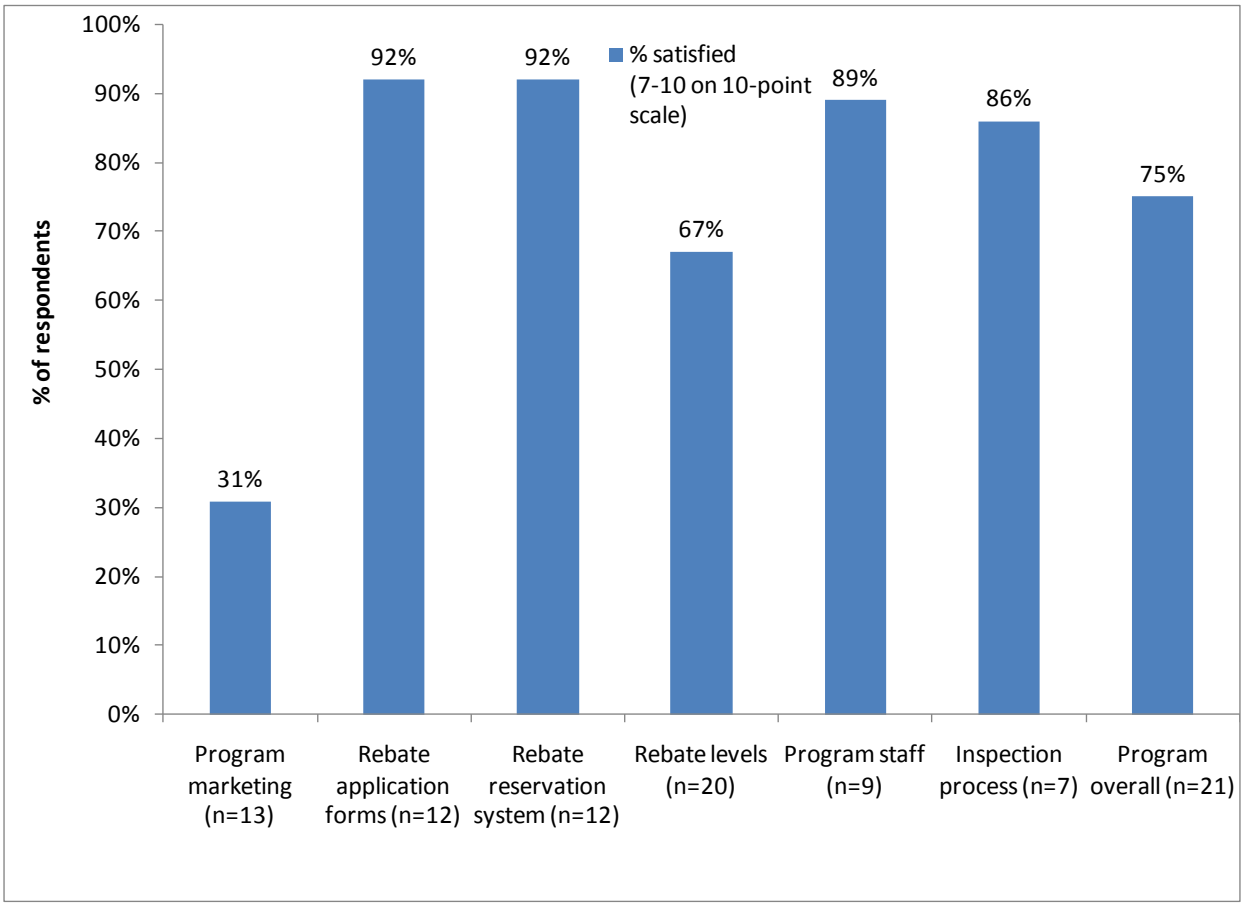
- A need for better program marketing support from NYSEG/RG&E (indicated 8 times): Some representative quotes included:
- "[Offer] more direct marketing with manufacturers and distributors. Come to our offices get us engaged in the process and provide us marketing material."
- "Reach out to distributors and get them engaged. Work with [distributor] on scenario where the distributor, contractor and utility all share the expense to market highest efficiency products available on the market."
- "Work on scenario where the distributor, contractor and utility all share the expense to market highest efficiency products available on the market."
- "[Need for] greater marketing from the utility companies about the availability of rebates."
- "Increase consumer awareness."

3.6.8.1 A desire for higher rebates (indicated 7 times): Some representative quotes included

- "Offer a 97% AFUE tier incentive."
- "Increase rebates to target the ultra high AFUE levels."
- "Increase rebate to $300-500 for the 90% AFUE furnace."

Figure 3-7 shows the satisfaction ratings for all aspects of the program.

Figure 3-7
Satisfaction Ratings for All Aspects of the Program



3.6.9 Effectiveness of Program on Increasing Sales of High Efficiency HVAC Equipment

Almost all (93%) participating contractors and over half (55%) of distributors report the program is "very effective" or "effective" in encouraging contractors and distributors to sell more efficient gas heating equipment. Over half (53%) of participating contractors report the program is "very effective" in persuading trade allies to promote high efficiency HVAC technologies and no distributor or participating contractor indicates the program is ineffective.

Even though a couple trade of allies indicate the decrease in rebate amount has negatively impacted sales, almost two thirds (62%) of distributors and participating contractors express the rebates have been helpful

in driving sales and installations of energy efficient natural gas heating equipment to residential customers. Comments relating to the rebates increasing sales and installations include:

- "The rebates make the purchases easier because it lowers the upfront costs makes the expense more tolerable."
- "It enables us to upsell with less increased costs."
- "The program helps customers buy now rather than wait until later."
- Usually the cost difference between different efficiency appliances is offset by the rebate amount. The difference in cost between the 90% equipment with no rebate is the same as a 95% with rebate - so it is pretty effective steering people in the right direction."
- "Highly encouraging - Helps out contractors a lot to tell customers that they can save money."
- "It really does push people and people definitely need a push."

Nonparticipating contractors provide mixed ratings about the effectiveness of the program in encouraging contractors and distributors to sell more efficient gas heating equipment. While some (20%) indicate the program is at least somewhat effective, others (20%) report the program is ineffective. One nonparticipating contractor states that "customers today are looking for energy efficiency equipment, but it's all about price. Customers are going to put the cheaper one in every single time."

3.7 Other Findings from the Trade Ally Interviews

We also asked the HVAC trade allies about some miscellaneous topics of interest including the prevalence of duct sealing services, the frequency with which they install Electronically Commutated Motors (ECMs), and whether they think ECMs offer their customers good value.

3.7.1 Duct-Sealing

About two thirds (64%) of distributors and over half (56%) of contractors indicate offering duct-sealing services/equipment. However, many trade allies (42%) do not offer duct-sealing services/equipment and provide the following reasons:

- Do not think there is much of a market for duct sealing (indicated 9 times)
- Business does not have equipment to perform duct sealing
- Not familiar with concept of duct sealing

3.7.2 Electronically Commutated Motors (ECMs)

All participating contractors and many (80%) distributors and nonparticipating contractors sell or install gas furnaces with ECMs. Most (81%) distributors and participating contractors (and half of nonparticipating contractors) consider gas furnaces with ECMs to be a good value for their residential customers for the following reasons:

- Cost/Energy savings (indicated 14 times)
  - "You're able to save on electricity cost with them. The gas usage is pretty much all the same on the 95% AFUE's, but with the ECM motor they're getting the electrical savings along with it."
  - "Electricity is not cheap. People don't think about electricity for gas furnaces."
  - "Fantastic value - one of the things we talk about on a regular basis is that you can make as much, if not more of an impact, with the ECM motor then by slightly bettering the AFUE. We have a cost calculator that shows the savings."
- Comfort (indicated 6 times)
  - They have more advanced features (e.g., run continuous fans and constant filtration of the air) to provide more comfort in the home."
  - "They're quieter."
  - "The ability to maintain a constant temperature."
  - "In larger homes, they help even the heat process throughout the house."

Even though the majority of trade allies deem ECMs to be a good value for their customers, some trade allies (including 40% of nonparticipating contractors) do not think highly of ECMs and note the following concerns involving increased cost and potential for system failure:

- High replacement costs (indicated 3 times)
  - "I have concerns about the replacement costs ($1,200)."
  - "It's a lot more money for repairs when they break down. It costs customers more for repairs ($500)."
  - "ECMs are very expensive when they break and can cost the customer $800-900 to fix them."

- Increased chance of system breaking down (indicated 2 times)
  - "They tend to be more complicated and there is more opportunity for failure."
  - "Trouble shooting on them is very hard. There is no specific sequence for testing or repairing. I have seen too many of them just crap out."

4. Impact Evaluation

This section describes the impact evaluation we used to estimate consumption and energy savings for the customers in the Residential Natural Gas Equipment Rebate Program. This impact evaluation used a billing analysis approach.

4.1 Methods

This section describes the methods we used for this billing analysis. We begin with a brief overview of the models developed. We next display the data used in estimating the savings, discuss the form of the models, and provide the rationale for selecting the optimal billing analysis model specification. We also explain how the model results are adjusted to estimate program level reductions in energy use for different measures. The Results and Summary sections provide the results and discussion.

The Residential Natural Gas Equipment Rebate Program impact evaluation has two purposes:

- Determine the normal year overall consumption, space heat and base load savings for an average customer, and
- Determine the savings for boilers, and furnaces.

This impact evaluation used a billing analysis approach. The billing analysis used bimonthly billing data that covered the pre- and post-installation periods. The billing analysis estimated the average change in consumption from the pre- to the post-installation periods. The estimated change in consumption was an unadjusted savings estimate that captured the change from replacing an existing system with a new, high-efficiency unit. The unadjusted savings estimate was then adjusted on an aggregate basis to produce a final adjusted savings estimate that reflects the estimated savings relative to a standard-efficiency installation.

DNV KEMA used a fixed-effects model to perform the billing analysis. Fixed-effects models are designed to study the changes within an individual.0F[10] The fixed-effects model uses gas consumption data in the historical bill series for each house to measure observed changes in pre- and post-program periods. The primary advantage of the fixed effects model approach is that it controls for all unmeasured characteristics of the program participants, so long as those characteristics do not change over time. For the characteristics that change over time, time-effects intercepts account for time trends not explained by other variables.

[10] Fixed Effects Regression Methods for Longitudinal Data Using SAS. Paul D. Allison . Cary, NC: SAS Institute, 2005.

Compared to the common site-level, PRISM-type approach, the fixed effect approach avoids the necessity of a control group while still controlling general trends affecting consumption levels. The fixed effects model also provides greater model degrees of freedom for a more robust model.

The fixed effects approach allows for the estimation of measure-specific savings as well savings for an average participant. The measures that were installed in sufficient numbers to provide separate savings estimates are boilers and furnaces with and without ECMs. Programmable thermostats were widely installed by the program. However, since they were always installed with a new furnace or boiler, it was not possible to separate the effect of thermostats from that of the furnaces or boilers. The estimates for heating equipment produced here include the effect of the new thermostat as well.

4.1.1 Data Resources Used in the Model

Data sources for the billing analysis model included the following:

- Bimonthly natural gas billing records provided by NYSEG and RG&E;
- Tracking data that include installation date, new and existing equipment capacity and efficiency;
- Hourly weather data from the National Oceanic and Atmospheric Administration (NOAA); and
- Typical meteorological year weather data from the National Solar Radiation Data Base.

4.1.1.1 Billing Data

DNV KEMA requested billing data for all participants in the Residential Natural Gas Equipment Rebate Program tracking database during the period from July 2009 to June 2010. These data were screened for a number of issues that signal exclusion from the billing analysis. These issues include:

- Missing billing data;
- No bills in the pre- or post-installation period;
- Extreme values;
- Extensive estimated reads, and
- Missing tracking data.

DNV KEMA received billing data for 10,766 households. Among these households, 3,930 households that had the measures installed after June 30, 2010 were removed because it was not possible for those households to have 12 months of consumption data in the post period. Additionally, 553 households had insufficient billing data in either the pre- or post-installation periods for other reasons and were removed from the billing regressions.

We also removed fuel-switching households from the analysis dataset. It is standard practice to assume that fuel switching is not motivated by the program incentives. Instead, the program incentive motivates the installation of the higher efficiency gas measure. The change in gas consumption for non-fuel

switching households is a good proxy for the marginal savings produced by fuel switchers. Because the tracking data identifies fuel switchers, they were simply removed from the analysis.

Table 4-1 provides the counts of households included in the billing analysis model. The table provides the population count of households billing series received, the number removed, and the total number included in the billing analysis model. The analysis data set represents approximately 70 percent of the participants in the program prior to July 2010.

Table 4-1
Participants Billing Data Disposition

Data Source	Count
Initial Count	10,766
Extreme values	43
Fuel switch	1,418
Measures Installed after 6/30/2010	3,930
No billing data in either pre- or post-installation period	553
Final Analysis Population	4,822

DNV KEMA included only actual measured bill consumptions. If a bill with an estimated meter reading was encountered, it was combined with one or more subsequent bills so that the result was based only on actual meter readings. The readings before move-in date and after move-out date were removed. In the final dataset that was used for billing analysis for an average participant there were 17.7 readings.

4.1.1.2 Tracking Data

The Residential Natural Gas Equipment Rebate Program offers rebates for six different measures: furnaces, boilers, boiler reset controls, indirect water heaters, programmable thermostats, and duct sealing. Table 4-2 summarizes the installation rate of these measures including the number of accounts and the installed measures.

Table 4-2
Count of Participants and Installed Measures

Measure	Accounts	Installed Measures
Boiler	1,124	1,229
Furnace w/o ECM	2,061	2,162
Furnace w/ ECM	7,705	8,058
Programmable Thermostat	7,642	8,087
Indirect Water Heater	304	345
Boiler Reset Control	27	32
Duct Sealing	23	31

The key points that should be noted from this table include:

- Furnaces, boilers and thermostats are the major measures that were installed. While water heaters were included in the billing analysis, the numbers were so low that the results were inconclusive. Savings were not estimated for boiler reset control or duct sealing.

- The majority of furnace and boiler installations included a new programmable thermostat. Furthermore, there was no information on whether a programmable thermostat replaced a non-programmable thermostat or not. The savings estimates for heating measures included the presence of the programmable thermostat.

- Fewer than 10 percent of participants installed multiple units.

4.1.1.2.1 Unit AFUE and Capacity

This NYSEG and RG&E Residential Gas program did an exceptional job of collecting unit information in its program tracking database. Table 4-3 summarizes average values for both efficiency and capacity for both the existing unit and the new, program-qualifying unit.

Table 4-3
Program Tracking Average AFUE and BTU
for Existing and Qualifying Program Units

Measure	Existing Unit		Program Qualifying Unit	
	AFUE	BTU (1000)	AFUE	BTU (1000)
Boiler	0.75	133.3	0.93	117.2
Furnace,	0.77	85.7	0.94	69.3
Furnace w/ ECM	0.77	88.1	0.95	70.4

The Residential Natural Gas Equipment Rebate Program requires that programmable thermostats can only be installed with new qualifying natural gas furnaces or boilers, and indirect water heaters can only be installed with a new qualifying natural gas boiler. Table 4-4 shows the installation of different measures among participant households. All 109 indirect water heaters were installed along with a new boiler, and all 3481 programmable thermostats were installed with the installation of a new boiler, or a new furnace.

Table 4-4
Measures Installed in Participant Households

Boilers	Indirect Water Heaters	Furnaces without ECM	Furnaces with ECM	Programmable Thermostats	Number of Households Installed
			1		663
			1	1	2,902
		1			381
		1		1	315
		1	1		1
		1	1	1	2
1					236
1				1	203
1			1	1	3
1		1		1	1
1	1				54
1	1			1	55

4.2 Methods

The methodological approach that was used for this evaluation includes three steps that require explanation on the specific equations and processes that were used. These steps included:

- Billing regression models;
- Aggregate adjustment to a standard efficiency savings estimate; and
- Estimation of equivalent full load hours (EFLH), the number of full hours the unit runs in an average year.

4.2.1 Billing Regression Models

The pooled, fixed-effects pre-post billing analysis approach used for this analysis models bimonthly household consumption as a function of heating degree days. The result is a single overall model that accommodates individual household baseload levels while controlling for local weather and systematic changes (economic, etc.) across all households. If a change in consumption occurs at the time of the installation, that change will be captured as an outcome of the program. This billing analysis approach is

particularly powerful because it observes changes in a large proportion of the program population. The equations for the pooled, fixed effects billing analysis appear in the appendices to this report.

The primary challenge for the billing analysis approach involves confirming that the pre-post change in usage appropriately reflects changes caused by the program. Table 4-5 provides a list of the challenges for the billing analysis and the response from the analysis.

Table 4-5
Billing Analysis Challenges

Pre-Post Change Challenge	Analysis Response
Different weather in the pre- and post- participation periods	Billing regressions control for weather. Results are calculated for a "typical" weather year.
Other system-wide effects increased or decreased usage, generally, and that could be mistaken for a program effect	The billing regression controls for effects that are shared across all sites included in the models. These "time-series" effects should control for economic changes (drops and subsequent rebounds of economic activity related to the recession).[11]
Appropriate baseline	The existing consumption is not the appropriate baseline for a measure of savings. However, the existing to qualifying unit efficiency difference can be adjusted to reflect the standard to qualifying unit efficiency difference

4.2.2 Aggregate Adjustment to Standard Efficiency

The change in consumption that is observed in a pre-post analysis is the reduction in consumption caused by moving from the existing unit to a high efficiency unit. Energy savings claimed by a program like this are designed to capture the increased savings from installing a high efficiency unit in place of a standard

[11] The time series effect is designed to measure systemic, exogenous change that occurs separate from the changes caused by program participation. This effect takes advantage of the fact that the majority of sites are not installing the measure in any given month. During June, for instance, only those sites that installed in June are changing state from existing to efficient technology. All remaining sites are in a steady state during the month of June whether at existing efficiency prior to participation or high efficiency after participation. These remaining sites inform the time series variable about ongoing systematic change that is affecting the whole population. This is repeated for each month and a well determined estimate of non-program, exogenous change is captured in that time-series effect.

efficiency unit. Thus, to estimate the savings associated with the increment from standard to high energy efficiency, the pre-post difference must be adjusted.

Engineering formulas describe the relationship between different levels of efficiency and consumption. These formulas can be used to compare the existing to efficient unit difference in consumption to the standard to efficient unit difference in consumption. The relationship provides a ratio adjustment that is applied to the billing regression results to generate a final, standard baseline estimate of savings. Specifically, the savings in moving from standard to high efficiency can be expressed as

$$SAV_{S\text{-}Q} = SAV_{X\text{-}Q} * (1/AFUE_S - 1/AFUE_Q) / (1/AFUE_X - 1/AFUE_Q)$$

where the subscripts X, S and Q indicate existing, standard and qualifying (efficiency) units, respectively. AFUE is the efficiency of the units. The variable $SAV_{X\text{-}Q}$ is the billing regression difference between the existing unit and the qualifying energy efficient unit. The variable $SAV_{S\text{-}Q}$ is the desired savings estimate based on the standard efficiency baseline.

There are three efficiency components to this equation. Qualifying efficiency, $AFUE_Q$, is the average efficiency of the units installed by the program. This value is derived from data in the tracking database. Standard efficiency is determined by the state TRM. (Evaluation of savings should be consistent with the basis on which the state calculates savings.) The one remaining component, existing unit efficiency, is the most challenging piece of this equation.

The database provided for this program tracks existing unit AFUE. This is, in fact, quite rare and provides for a substantial improvement in determining the existing unit AFUE. Almost 70 percent of unit entries record an existing unit AFUE and 83 percent have either an AFUE or a model number entry for the existing unit.

There are two limitations to the existing unit AFUE database entries that raise concerns:

- *Average existing unit AFUE may have upward bias:* Missing AFUE values are more likely to be older units where nameplate information was either limited (no AFUE displayed) or missing altogether. Because older units tend to be less efficient, it is possible that the program existing AFUE average based on complete data would be lower than the value derived from the selected subset in the program tracking database.

- *Average existing unit AFUE may have downward bias:* Determining and entering existing unit AFUE is a somewhat uncommon requirement for furnace and boiler installers and requires additional effort. There is always a level of error in these kinds of data and the important question is whether that error injects bias into the overall average or not.

The first concern is almost impossible to confirm. In general, older unit AFUE information is difficult to locate and because of the lack of either AFUE or model numbers on 17 percent of units, it is impossible to establish a reliable existing unit AFUE for the whole program

We used the available model numbers to explore this issue. We were able to do so for one major brand of both furnaces and boilers (Lennox and Weil-McClain). These brands represent 7 and 19 percent respectively of the furnaces and boilers in the program tracking database. We cross-referenced existing unit database AFUE entries with the AFUE provided by these manufacturers based on model numbers from the database. Unexpectedly, for those units with both manufacturer-provided and database AFUE values, the manufacturer-provided AFUE values were six percent higher than the program database AFUE entries for those models, for both boilers and furnaces. Manufacturer-provided AFUE values for units with model numbers but without an existing unit AFUE value in the database were similarly higher.

It's impossible to know if the results from the limited nameplate AFUE comparison extend to the remaining untested units. Despite substantial effort, we were unable to get similar data for any other brands. While limited, however, the comparison provides clear evidence of downward bias that could easily counteract the hypothesized upward bias due to possible under-representation of older models in the units with AFUE data.

A single source of secondary evidence exists that relates to the level of existing unit AFUE -- an impact evaluation report for GasNetworks' Residential High Efficiency Heating and Water Heating Equipment Program (HEHE) 1F[12] in Massachusetts, Rhode Island, New Hampshire, and Maine. The GasNetworks program did not collect existing unit AFUE. For this report, the efficiency level of the replaced equipment was obtained from contractor survey data. The HEHE report used an existing unit AFUE level that was slightly lower than the value obtained from the program tracking database for this evaluation. This secondary source provides inconclusive support for this evaluation for the reasons discussed above. On the one hand, it may support the hypothesis that a consideration of a full program population would be lower than the partial existing unit data available in the tracking data. On the other hand, though, the estimate is based on a generalized estimate of existing unit AFUE from contractors. The Lennox/McClain cross-reference analysis for this evaluation indicates that, even for specific units with available AFUE, contractors underestimated the nameplate efficiency.

[12] HEHE Process and Impact Evaluation Final, NMR Group, Inc., Cadmus Group, Inc., 2010. http://www.ma-eeac.org/docs/2011%20EM&V%20Studies/HEHE%20Process%20and%20Impact%20Evaluation%20-Final%20Volume%201%20102710.pdf

In the absence of a superior, empirically-derived existing unit AFUE value, this evaluation will use the existing unit AFUE level based on the program tracking database. The value represents 70 percent of the program units and represents the most definitive measure of existing AFUE produced for this region.

4.2.3 Equivalent Full Load Hours

EFLH value corresponds to the number of hours that a unit would have to run at full load in an average year to satisfy the building's heating needs. Another engineering formula, closely related to the formula used in the previous section, allows for EFLH to be calculated based on unit consumption, capacity and efficiency. To calculate the value for EFLH, we plug in the normalized gas usage for heating from the energy efficient unit (post-installation) obtained from the fixed-effects pre-post model and nameplate input capacity available from the program tracking database, and solve the following equation[13]:

$$EFLH^{*} = \frac{100{,}000}{\overline{CAPY}_{Q}} * \hat{T}herm_{Q}$$

where $EFLH^{*}$ = EFLH estimate using qualifying units' normalized heating usage

$\overline{CAPY}_{Q}$ = Mean capacity for installed qualifying units, in kBTU per hour

$\hat{T}herm_{Q}$ = Qualifying units' heating usage in a normal weather year

4.2.4 Billing Model Calibration

DNV KEMA developed a fixed-effects model for the billing analysis. We included premise-specific intercepts to control all unmeasured time constant characteristics, and time-effects variables to control for any system-wide effects in gas consumption behavior. We tested a large number of model specifications. Specifications range from models that capture the pre-post change in a full model that includes all different measures to reduced models that capture the savings for the three major measures only.2F[14]

[13] This approach measures the number of hours the unit would run if at full load regardless of whether it is a modulating unit or not. That is, a unit that runs full out for 30 minutes of an hour is the same as a unit running at 50 percent for the full hour. Both produce half an equivalent full load hour during that period.

[14] KEMA adopted Akaike information criterion (AIC) to determine the best model. AIC is a statistical model selection method. It is defined as AIC = - ln L + p, where L is the likelihood for an estimated model with p parameters. The index takes into account both the statistical goodness of fit and the number of parameters that have to be estimated to achieve this particular degree of fit, by imposing a penalty for increasing the number of

The models were further fitted with different degree day bases to determine an optimal heating degree base.3F[15] The final specification is the combination of parameters that meets statistical model selection criteria and delivers statistically significant measure level savings estimates in an otherwise reasonable and balanced model. For the detailed model specification, please see the appendices.

To examine the effectiveness of the selected model, DNV KEMA compared the model results across a range of heating degree bases to consumption obtained from the raw billing data. Table 4-6 displays the results of this comparison.

Table 4-6
Annual Household Savings Estimates Comparison of Different Approaches

Savings Type		Participant Households Number	Annual Pre-Usage (Therms/ Participant)
Billing data	Average Participant Pre-installation Baseload	4,354	242
	Average Participant Annual Consumption	1,741	1,016
Fixed Effects model at base 65	Average Participant Heating	4,822	972
	Average Participant Baseload	4,822	112
	Average Participant Annual Consumption	4,822	1,084
Fixed Effects model at base 58	Average Participant Heating	4,822	819
	Average Participant Baseload	4,822	262
	Average Participant Annual Consumption	4,822	1,081

All estimates of consumption are based on the observed weather during the pre-installation period. The non-model, billing data-only estimate provides a basic baseline from which to compare the model-based results. In order to obtain an accurate proxy of the annual pre-program baseload, we looked at the minimum average daily usage during the summer metering periods, and multiplied this by 365, assuming that this minimum usage would be the non-heating usage.

Some of the key findings from this table are as follows:

parameters. Lower values of the index indicate the preferred model, that is, the one with the fewest parameters that still provides an adequate fit to the data.

[15] KEMA tested a range of heating degree day bases to determine if 65 (the standard default value) is the appropriate base to use. AIC suggested that 58 would be the best base. For this evaluation, we found 59 to be the best heating degree day base.

- The model-determined annual consumptions at both heating degree day bases 65 and 58 are close to the raw billing data annual consumption. This suggests the robustness of the selected model.
- Compared to heating degree day base 58, the heating usage at base 65 increases, but the baseload drops.
- We can draw a conclusion that the difference between different heating degree day bases is how the heating usage and baseload are apportioned within the total consumption, while the annualized total consumption remains almost the same for all degree day bases.
- Heating degree day base 65 is treated as the standard default value in many other studies. DNV KEMA's study shows that the estimates based on 65 differ from the results from simple raw billing data means. Due to a combination of better insulated houses with increased internal heat gain, the optimal heating degree day base may need to be updated.
- The statistical model selection criteria AIC chose 58 as the optimal heating degree base. The estimated baseload at 58 is higher than the raw billing data decided baseload. A heating degree day base close to 58 should be considered.

For more degree day base results, see the appendices.

DNV KEMA chose several other heating degree bases that are close to 58 and compared the model results based on these heating degree bases to the results from raw billing data. A heating degree day base of 59 was chosen as the optimal heating degree day base as it gave the closest baseload estimate to the raw billing data baseload, which is shown in Table 4-7.

Table 4-7
Annual Household Savings Estimates at Base 59

Savings Type		Participant Households Number	Annual Pre-Usage (Therms/ Participant)
Billing data	Average Participant Pre-installation Baseload	4,354	242
	Average Participant Annual Consumption	1,741	1,016
Fixed Effects model at base 59	Average Participant Heating	4,822	840
	Average Participant Baseload	4,822	241
	Average Participant Annual Consumption	4,822	1,081

There is natural variation in billing data, both within households (changing consumption across the year) and between households (different sized houses, different consumption characteristics, etc). The number of households and readings per household determine the extent to which a model will overcome the natural variation. The more households and months of data available for inclusion in a model, the greater the likelihood is of producing statistically significant estimates of savings.

DNV KEMA estimated the savings based on 4,822 participant households in the final model. This large number of households achieved statistically significant results from the billing analysis.

4.3 Results

In this subsection, we first present the unadjusted savings estimates from the fixed-effects model pre-post billing analysis. These savings reflect the difference in gas consumption from removing the existing unit and replacing it with a new high efficiency unit. Next, we provide the adjusted savings that reflect moving from a new standard efficiency to a new high efficiency unit.

Table 4-8 provides the savings estimates from the fixed-effects model in weather-normalized annual heating use before and after participation, and the confidence intervals.[16]. These savings estimates measure the (weather-normalized) change in gas consumption associated with the installation of a qualifying energy efficient unit vs. an existing unit. This table also includes measure counts of each

[16] The confidence intervals indicate that if we were to repeat the model infinite times, we are 90 percent confident that the savings result would fall within these bounds. If these bounds do not include zero, then the result is statistically significantly different than zero.

installed measure group included in the billing model. The three individual measure results are savings estimates for the installation of that measure and thermostats where thermostats were included in the installation. The boiler result indicates, for example, that we are 90 percent confident that unadjusted boiler savings fall between 111 and 339 therms. Alternatively, we are 95 percent confident that unadjusted boiler savings are at least 111 therms.

Table 4-8
Unadjusted, Existing to Efficient Unit, Annual Savings Estimates

Savings Type	Count of Measures (Model)	Savings Estimate (Annual Therms/ Participant)	90 Percent Confidence Interval (+/-)
Boilers	552	225	114
Furnaces	700	139	111
Furnaces w/ ECM	3571	139	104
Indirect Water Heaters	109	-74	166

Table 4-9 provides the AFUE and capacity levels for both existing and qualifying units from the units included in the billing model. These values are combined with the standard baseline AFUE used in the New York TRM to produce the adjustment that identifies the portion of savings captured above standard AFUE. The adjustments for the furnaces are relatively small because the existing unit AFUE from the tracking database is close to the TRM baseline AFUE.

Table 4-9
Existing and Qualifying AFUE and Capacity
with Adjustment from Existing to Standard Baseline[17]

Measure	Existing Unit		Program Qualifying Unit		Standard AFUE	Adjustment
	AFUE	BTU (1000)	AFUE	BTU (1000)		
Boiler	0.75	134.4	0.93	117.4	0.80	69%
Furnace w/o ECM	0.77	91.2	0.94	73.1	0.78	92%
Furnace w/ ECM	0.77	89.6	0.95	71.4	0.78	94%

Table 4-10 applies the adjustment to the estimated difference in consumption from the billing analysis. These final estimates of savings for these measures include any savings from thermostats that were installed at the same time. The majority of heating units were installed accompanied with a new thermostat installed. This also means that the effective estimate of thermostat savings, separate from these measures, is zero.

[17] These AFUE and BTU data are for the analysis dataset.

Table 4-10
Final, Adjusted, per Measure Savings

Savings Type	Savings Estimate (Annual Therms/ Participant)	Adjustment	Savings
Boilers	225	69%	156
Furnaces without ECM	139	92%	128
Furnaces with ECM	139	94%	131

Table 4-11 combines the measure counts from the tracking data to produce an overall program heating savings estimate for 2009-2010. The non-heating measures are not included in these estimates. The other measures represent a small fraction of expected savings and this evaluation was unable to develop estimates of savings for those measures.

Table 4-11
Program Savings for Boilers and Furnaces

Measure	Accounts	Installed Measures	Total Savings (1000 Therms)
Boiler	1,124	1,229	191.6
Furnace w/o ECM	2,061	2,162	276.5
Furnace w/ ECM	7,705	8,058	1,056.3

Two remaining results from this evaluation are useful to the program. First, Table 4-12 provides EFLH estimates derived from the post-installation usage. These estimates represent the number of full hours a furnace or boiler would need to run, given the average efficiency, capacity and consumption during the post-installation period.

Table 4-12
EFLH Estimates

Measure Type	Equivalent Full Load Hours
Boilers	800
Furnaces without ECM	858
Furnaces with ECM	911

The EFLH values in the New York TRM range from 861 in the New York City area to 1,422 upstate. Evaluation- based EFLH values are commonly below TRM values.

Table 4-13 provides ex ante estimates of savings for the program if the baseline AFUE were to be raised to 0.90. The savings do not drop as substantially as might be expected because of the substantial savings due to downsizing.

Table 4-13
Savings Estimates with 0.90 AFUE Baseline

Measure Type	Pre-Post Difference In Consumption	Standard AFUE	Adjustment	Savings
Boilers	225	0.90	13%	30
Furnaces without ECM	139	0.90	21%	29
Furnaces with ECM	139	0.90	25%	35

4.4 Summary Observations on the Model

The fixed-effects pre-post model employed in the billing analysis is robust. Among all the possible model specifications, it is the optimal model specification in terms of statistical model selection criteria and gas consumption heating and baseload level.

The heating degree base 59 used in the model is optimal. Among all heating degree days (58 to 65), based on 59, the model estimated baseload is the closest to the baseload obtained from the raw billing data. Across all heating degree days, the average participant pre-program annual consumption remains stable, while the heating load increases as heating degree day base increases. Overall, for an average participant, the pre-program weather normalized annual consumption is 1081, and the baseload is 241, which is 22% of the total gas consumption.

DNV KEMA was unable to produce savings estimates for duct sealing, boiler reset control, and water heaters. There are too few participants for the first two measures to even include them in the billing models. A water heater estimate was attempted but was not statistically significant.

It is important to note that a large majority of the participating customers had new programmable thermostats installed in conjunction with the installation of their energy-efficient furnaces or boilers. We were not able to disentangle the separate savings impacts of these programmable thermostats from the energy-efficient furnaces or boilers.

4.5 Realization Rate

The New York Evaluation Plan Guidance for EEPS Program Administrators defines the realization rate as "the ratio of project tracking system savings data (i.e., initial estimates of project savings) to savings adjusted for data errors and incorporating the evaluated or verified results of the tracked savings." Using this definition, Table 4-14 provides the realization rates for the three measures with savings estimates. The TRM savings include thermostat savings for those installations that included thermostats.[18] If thermostats contribute to the measured savings then these realization rates are appropriate if the proportion of thermostat installations remains similar in future program years. Because this analysis does not distinguish thermostat savings from heating measure savings, it is impossible to give separate realization rates.

Table 4-14
Measure-level Realization Rates, Thermostats Included

Savings Type	Estimated Savings	Full TRM savings	Realization Rate
Boilers	156	356	0.44
Furnaces without ECM	128	246	0.52
Furnaces with ECM	131	284	0.46

4.6 Net-to-Gross Ratios

We used two analytical methods to estimate the net-to-gross ratios for this program.

[18] Both heating measure and thermostat TRM savings were calculated consistent with 2010 revisions. Unless other changes are made to the savings calculations, these TRM values are valid for future program years.

1. *End user self-report method:* This method attempts to measure the direct influence of the program – e.g., the influence of the program rebate and information -- on the energy savings achieved. This method attempts to measure the influence of the rebate on four different attributes of the decision to install energy-efficient measures: 1) the likelihood of installing the energy-efficient measure; 2) the energy efficiency of the measures installed; 3) the timing of the measure installations; and 4) the quantity of measures installed.

2. *Supplier influence method:* This method assumes that the program's influence extends beyond the rebate to the kind of equipment recommendations that the HVAC contractors are making. Therefore participants who said they went with the higher efficiency equipment because their contractors recommended it may be unconsciously experiencing indirect program influence to the extent that these recommendations were program-influenced.

4.6.1 The End User Self-report Method

This end user self-report method attempts to measure the direct influence of the program – e.g., the influence of the program rebate and information -- on the energy savings achieved. This method attempts to measure the influence of the program rebate and information on four different attributes of the decision to install energy-efficient measures: 1) the likelihood of installing the energy-efficient measure 2) the timing of the measure installations; 3) the energy efficiency of the measures installed; and 4) the quantity of measures installed.

4.6.1.1 The End User Self Report Survey Questions

The participant survey questions that gathered information on these four different attributes of the decision included:

1. *The likelihood of installing the energy-efficient measure:* The survey question DAT0 attempted to measure this:

DAT0. Next, I'd like to know about the effect, if any, that <RG&E's/NYSEG's> Gas Furnace Rebate Program had on your decision to install <WORDING1/WORDING2>. [IF EQUIPMENT1 = <FURNACE/BOILER, ADD: "AND JUST TO BE CLEAR, I'M NOT TALKING ABOUT ANY FURNACE/BOILER. I'M TALKING ABOUT WORDING1] If you had not received the rebate or any other assistance or information from this <RG&E/NYSEG> program would you say that it was "very likely," "somewhat likely," "not very likely," or "not at all likely" that you would have had <WORDING1/WORDING2> installed?

WORDING1 = <IF EQUIPMENT1 = <FURNACE/BOILER>, SAY: "A <FURNACE/BOILER> THAT IS MUCH MORE ENERGY EFFICIENT THAN STANDARD MODELS.">

WORDING2 = <IF EQUIPMENT1> = <PROGRAMMABLE THERMOSTAT, INDIRECT WATER HEATER, BOILER RESET CONTROL, DUCT SEALING JOB>, SAY: "A NEW < PROGRAMMABLE THERMOSTAT/ INDIRECT WATER HEATER/ BOILER RESET CONTROL/ DUCT SEALING JOB">

2. *The timing of the measure installations:* The survey questions DAT1a and DAT1b attempted to measure this:

DAT1a. I'd like to know about the effect, if any, that the rebate from the <RG&E/NYSEG> Gas Furnace Rebate Program had on your decision to purchase <WORDING1/WORDING2> when you did. Without the rebate would you have purchased the <EQUIPMENT 1> at the same time, earlier, later, or never?

DAT1b. [IF DAT1a = 3] Approximately how many months later?

The energy efficiency of the measures installed: The survey questions DAT2a and DAT2b attempted to measure this:

DAT2a. Next, I'd like to know about the effect, if any, that program rebates had on your decision to purchase a high efficiency <FURNACE/BOILER>. Without the program would you have purchased a <FURNACE/BOILER > of the same efficiency, lesser efficiency, or greater efficiency?

DAT2b. [IF DAT2a = 2 LESSER EFFICIENCY] Without the program, would you have purchased a <FURNACE/BOILER> that was "standard efficiency on the market at that time," "slightly higher than standard efficiency", "between standard efficiency and the efficiency that you purchased," or "slightly lower than the high efficiency that was purchased?"

3. *The quantity of measures installed:* The survey questions DAT3 and DAT3a attempted to measure this:

DAT3. Finally, I'd like to know about the effect, if any, that program incentives and services had on the quantity of <PLURAL OF EQUIPMENT1> that you purchased. Without the program would you have purchased the same number of < PLURAL OF EQUIPMENT1> as you did, fewer < PLURAL OF EQUIPMENT1> than you did, more < PLURAL OF EQUIPMENT1>, or none at all?

DAT3a. [IF DAT3 = 1 same number/size or 4 none at all, SKIP TO DAT4] You purchased <QUANTITY1> <EQUIPMENT1>. If the program and its rebates did not exist, how many < PLURAL OF EQUIPMENT1> would you have purchased?

These quantity questions were not asked for furnaces or boilers.

4. *Summary of program influence:* In addition to these questions about particular aspects of the purchase decision, we also asked the participants to summarize the program influence:

DAT4_1. Please summarize in your own words how the program might have influenced the timing, efficiency, or quantity of the new [EQUIPMENT1] that you purchased.

4.6.1.2 The End User Self Report Calculation Method

Free-ridership measures the portion of the savings that would have happened in the absence of the program. The free-ridership factors for efficiency and quantity are:

- *Efficiency Free-ridership, fE:* This is the fraction of verified gross savings per unit that would have occurred without the program.
- *Quantity Free-ridership, fQ:* This is the fraction of installed units that would have been installed without the program.

The fraction of annual verified gross savings that would have occurred without the program is the product of the fraction of units that would have been installed without the program, f_Q, and the fractional unit savings that these units would have had without the program, f_E.

$f_{QE} = f_Q f_E$

For example, if two-thirds as many units would have been installed without the program ($f_Q = 2/3$), and the savings per unit would have been only half as much ($f_E = 1/2$), the portion of the savings that would have occurred without the program would be

$f_{QE} = (2/3) \times (1/2) = 1/3.$

The Simple Program Attribution (SPA) is the complement of this free rider portion.

$SPA = 1-f_{QE} = 1- f_Q f_E$

The relationship is illustrated in Figure 4-1:

Figure 4-1
Graphical Derivation of the SPA Equation

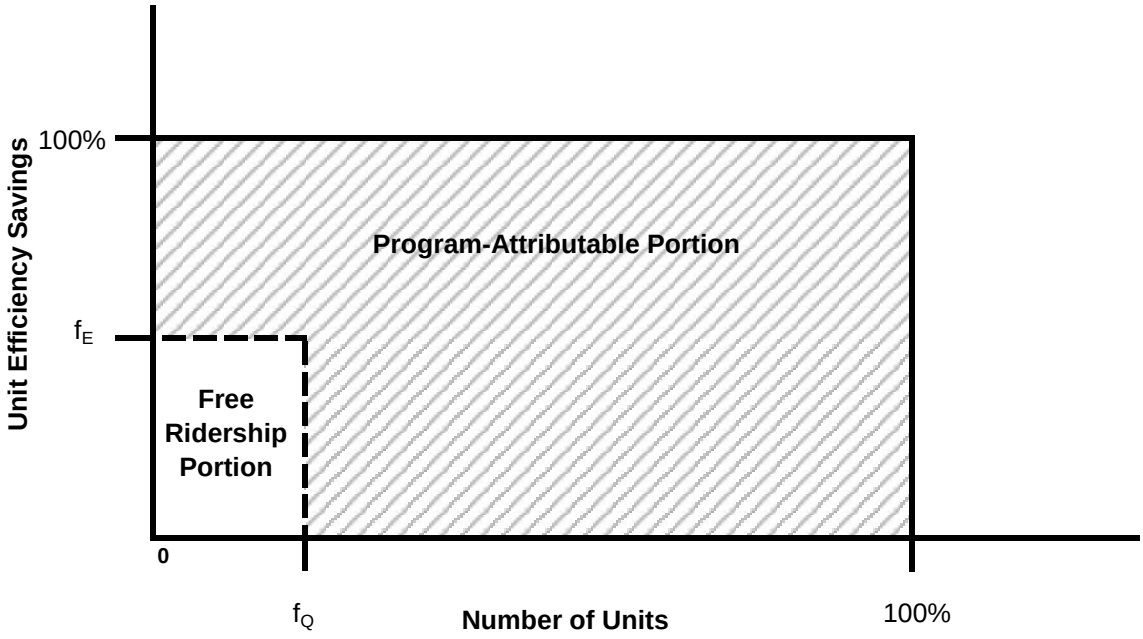


Table 4-15 shows which efficiency levels are assigned to the participant responses to the efficiency questions (DAT2a and DAT2b) given above.

Table 4-15
Efficiency Attribution Assignments

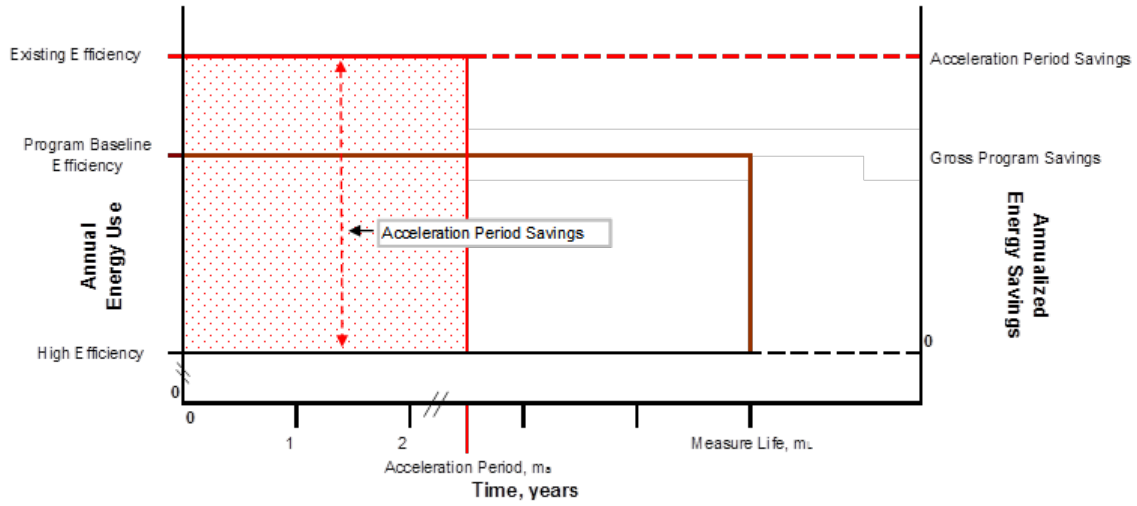
Coarse Cut (DAT2a)	Finer Cut (DAT2b)	Efficiency Attribution, E
Lesser	Standard efficiency or according to code	100%
	Slightly higher than standard efficiency	70%
	Between standard efficiency and the efficiency that was installed	50%
	Slightly lower than the high efficiency that was installed	30%
	Don't Know / Refused	Avg of above cases for meas grp
Same	*NA*	0%
Greater	*NA*	0%
Don't Know/ Refused	*NA*	Avg of all respondents for

To account for the influence of the program on the timing of the purchase, if respondents indicated that they would have installed the equipment at the same time or earlier, the acceleration period was set at zero months and there was no timing effect. If the respondent indicates that they never would have installed the equipment without the program, then the program was credited with influencing the entire project and received 100 percent program attribution (0 percent free ridership). The same effect was applied if the respondent indicated it would have been greater than four years before they would have installed the equipment without the program. If the response to DAT1a was "later" and the response to DAT1b was a number less than 48, then the acceleration period was set equal to that number of months.

For a replacement measure with acceleration, the program caused the participant to install an energy efficiency measure before they originally intended to do so. During the acceleration period, the energy savings caused by the program are the difference between the energy use of the high efficiency equipment that was installed and the energy use of the equipment that was replaced. This could also be termed as the difference between the high efficiency equipment efficiency and the existing equipment efficiency. We call this value the Acceleration Period Savings.

Figure 4-2 shows the Acceleration Period Savings superimposed over the gross program savings. The lifetime acceleration period savings are the acceleration period savings multiplied by the acceleration period, m_a.

Figure 4-2
Acceleration Period Savings



4.6.2 Results Using the End User Self-Report NTG Method

As described in the previous section, the survey asked the participants a number of questions about the influence of the program rebate and information on four different attributes of the decision to install energy-efficient measures: 1) the likelihood of installing the energy-efficient measure; 2) the timing of the measure installations; 3) the energy efficiency of the measures installed; and 4) the quantity of measures installed. Figure 4-3 shows the responses of the program participants to the likelihood question DAT0. It shows that half of the respondents said they were very likely to have purchase the energy-efficient equipment without the program rebates or information.

Figure 4-3
The Likelihood of Purchasing Energy Efficient Equipment w/o Rebate/Program

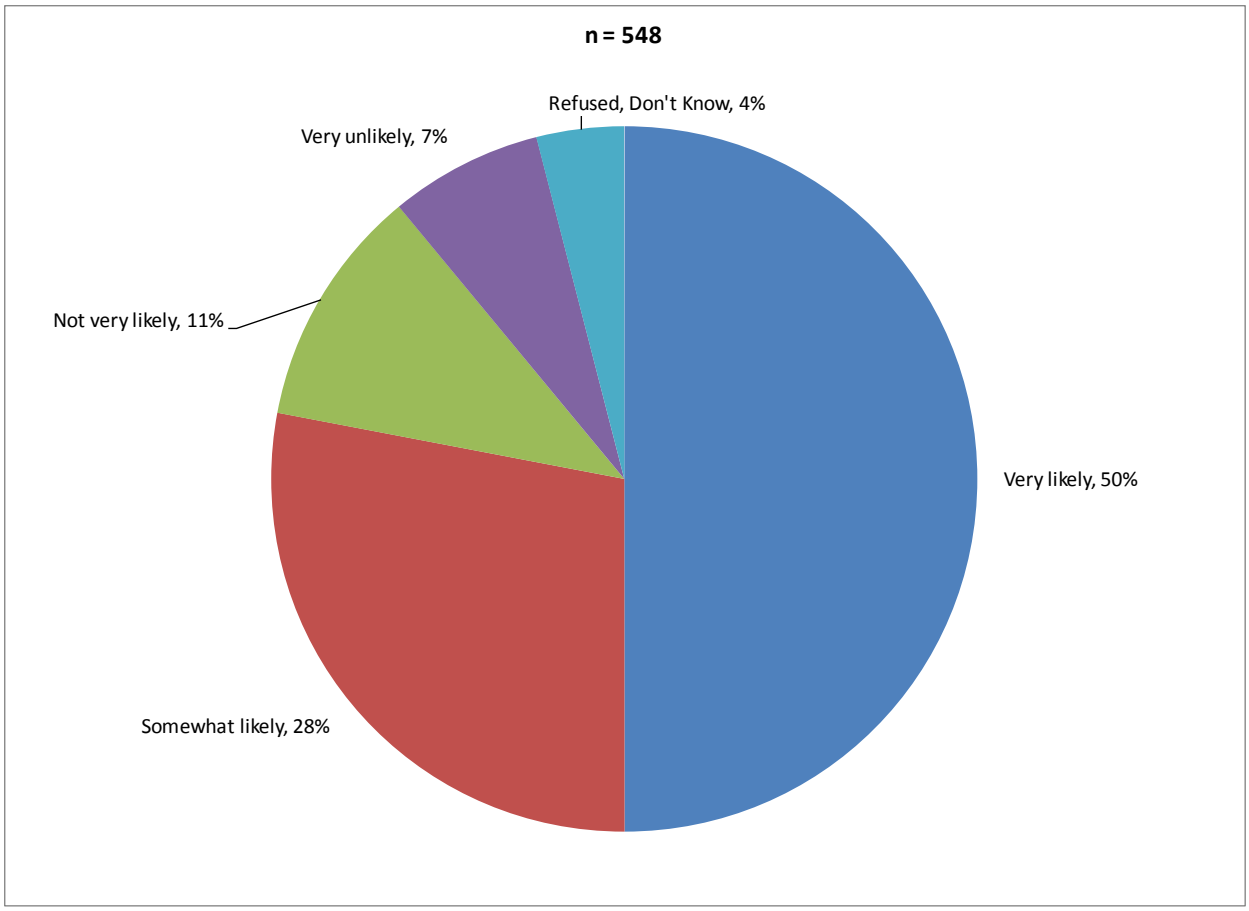


Figure 4-5 shows the responses of the program participants to question DAT1a about the influence of the program/rebate on the timing of the equipment purchase. It shows that about two thirds of the respondents said they would have purchased the energy efficient equipment at the same time in the absence of the program.

Figure 4-4
The Timing of the Equipment Purchase without the Rebate/Program

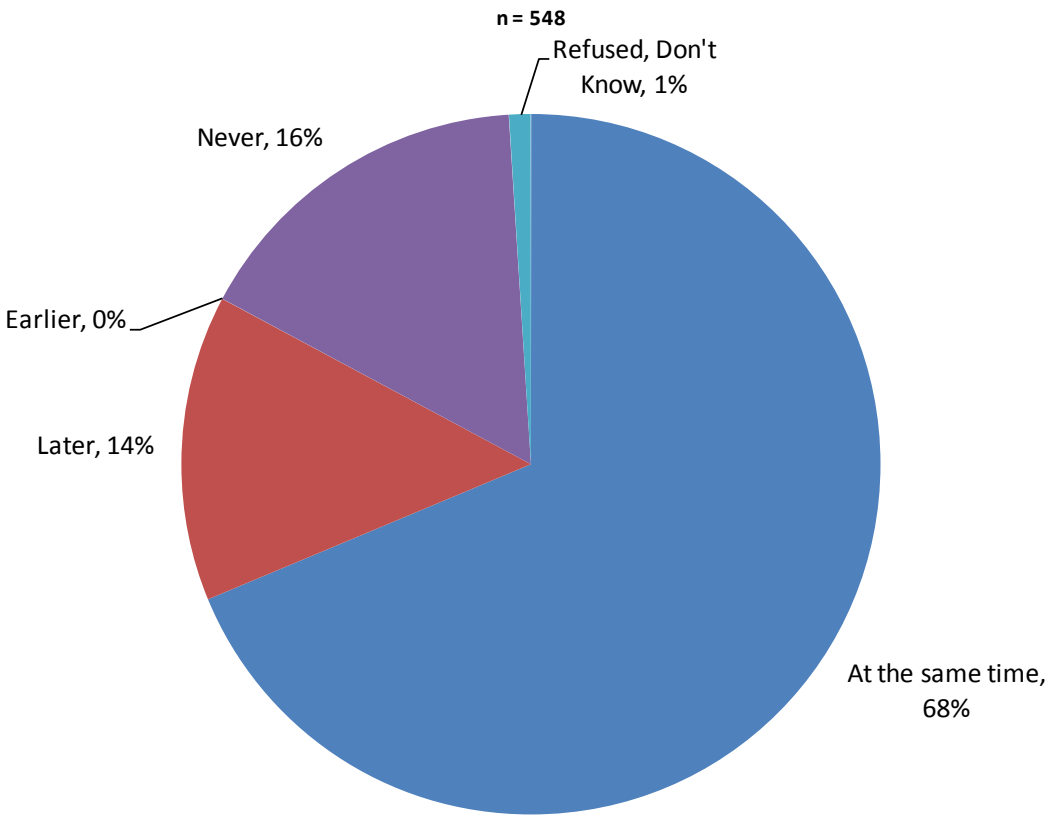
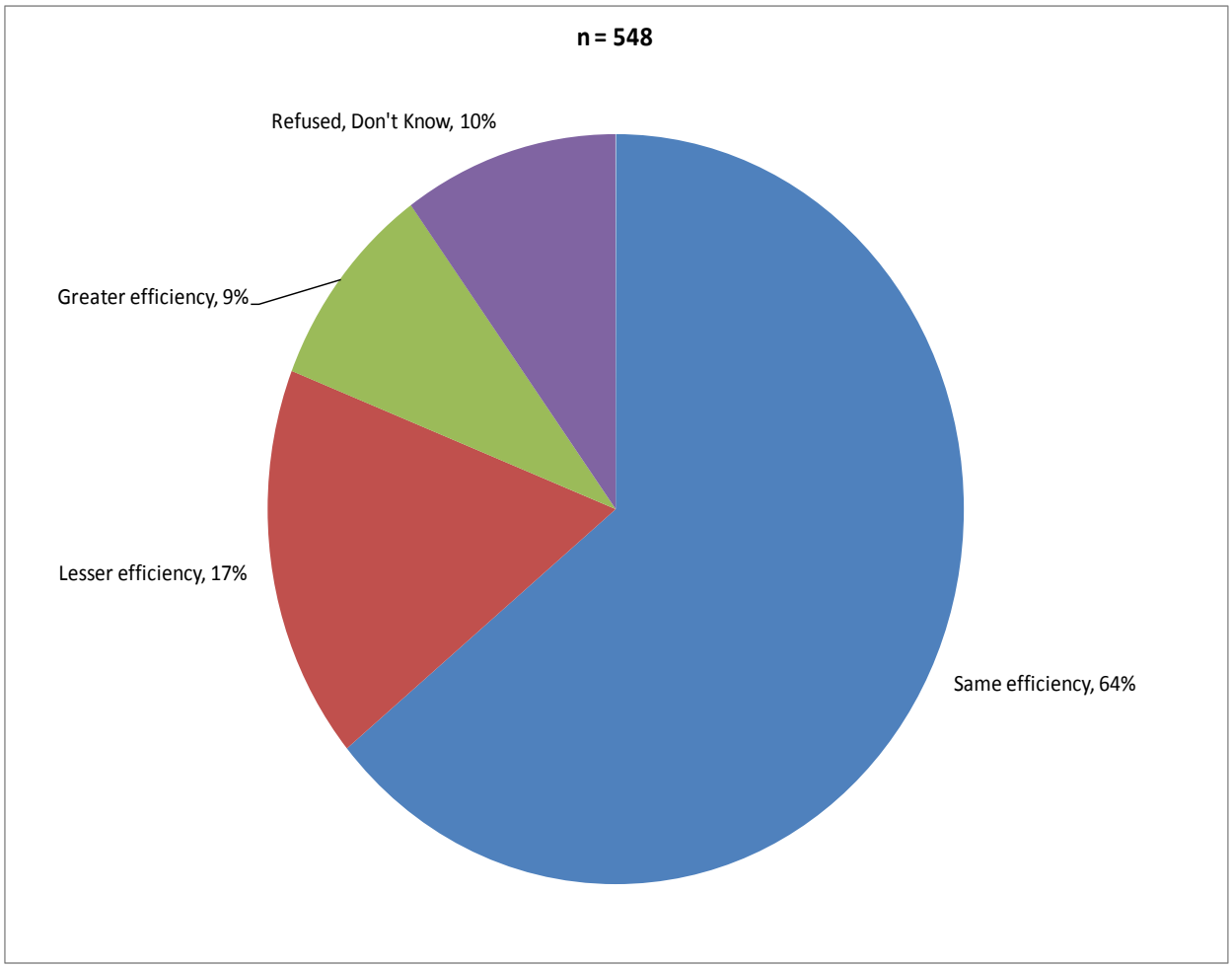


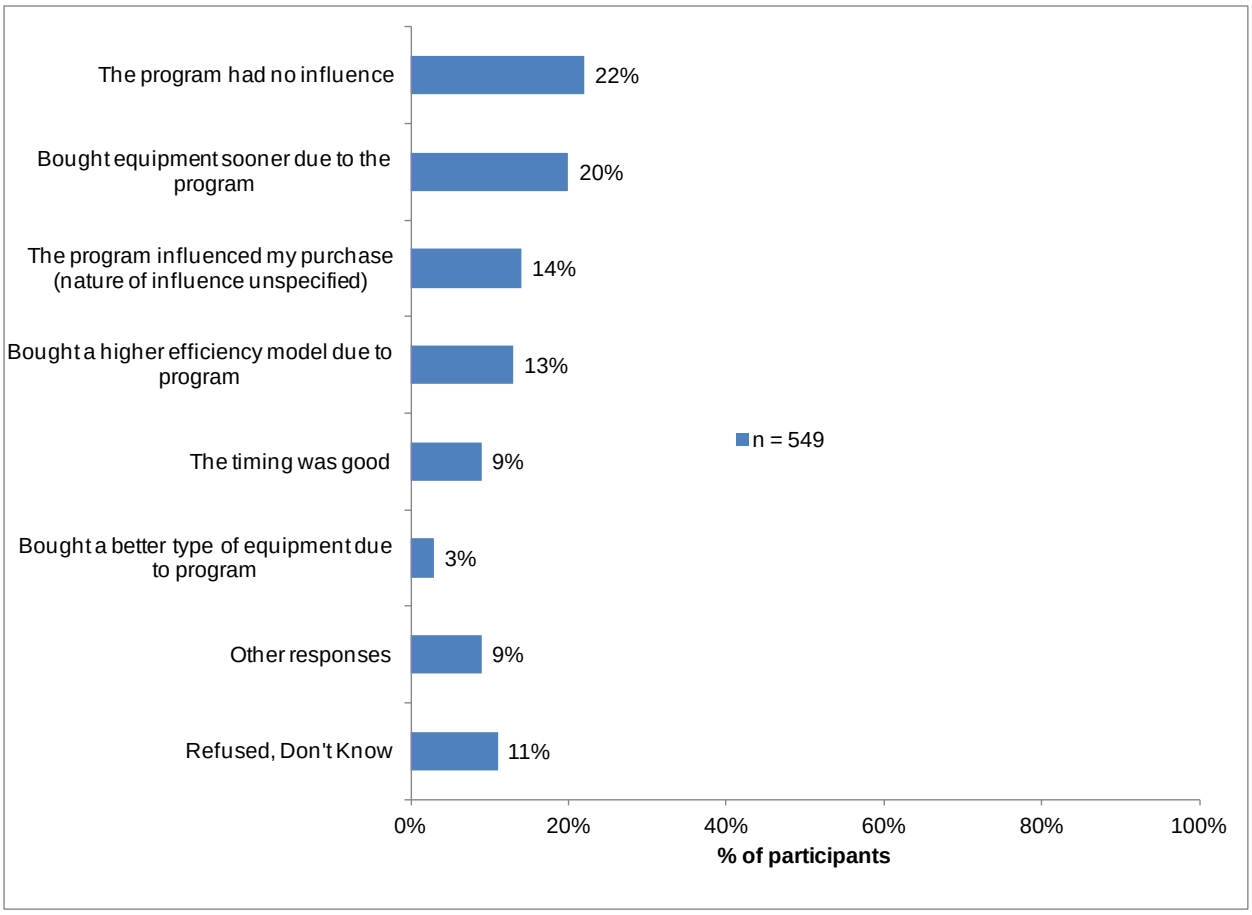
Figure 4-5 shows the responses of survey participants to the questions (DAT2A and DAT2B) concerning what the energy efficiency of the measures installed would have been in the absence of the program/rebates. It shows that about two thirds of the respondents said that the energy efficiency of their equipment would have been the same without the program/rebates.

Figure 4-5
The Likely Energy Efficiency of the Equipment w/o Rebate/Program



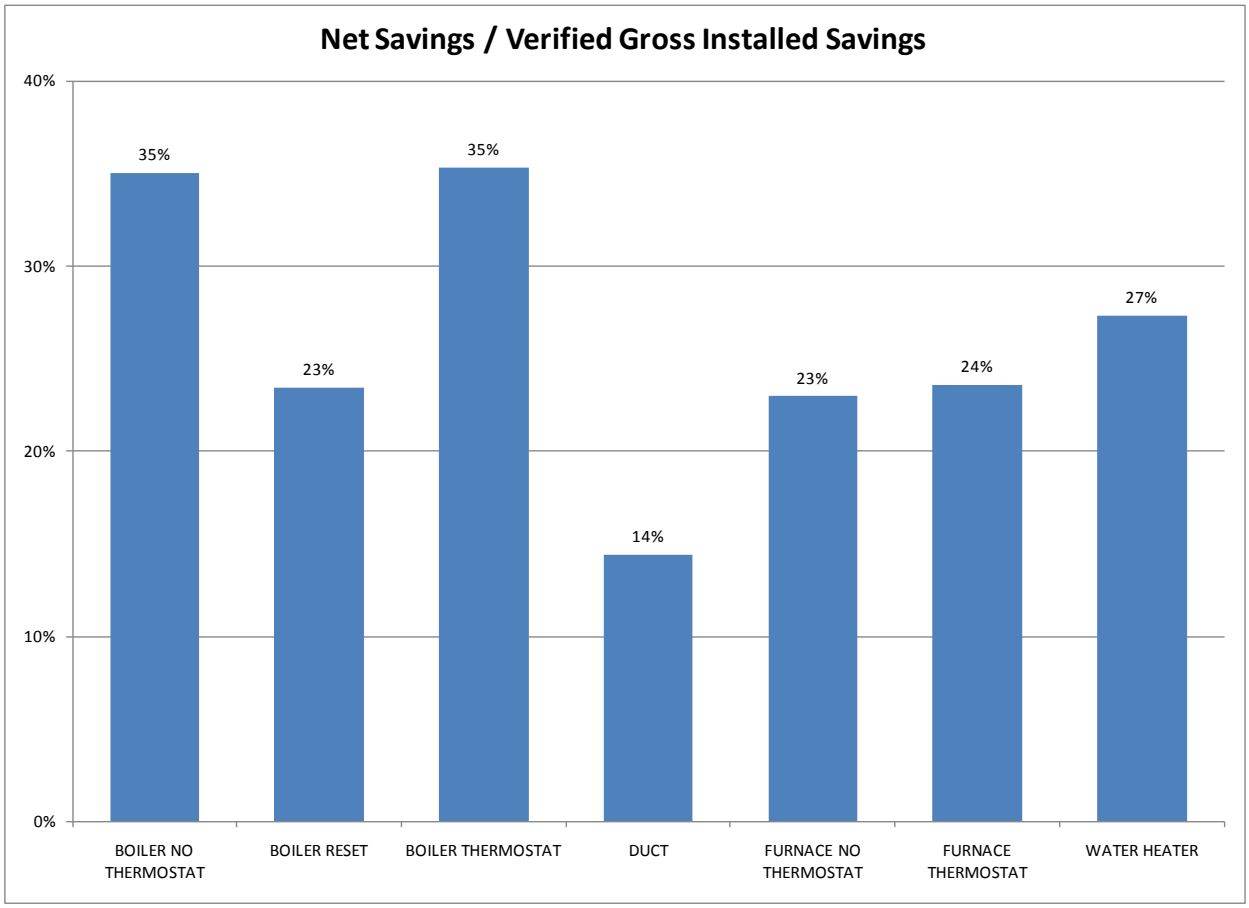
As noted above, we did not ask the questions about the program's influence on the quantity of equipment installed for those who received rebates for furnaces or boilers, which was the vast majority of program participants. We did ask all participants to summarize the responses of participants to the program influence summary question: "DAT4_1. Please summarize in your own words how the program might have influenced the timing, efficiency, or quantity of the new [EQUIPMENT1] that you purchased." Figure 4-6 shows their responses to this question. Among those who cited some influence from the program, the most frequently-cited was the program's influence on the timing of the equipment purchase.

Figure 4-6
Participant Summary Characterizations of the Program's Influence



While the charts above show the survey responses of all program participants regardless of technology, for the actual net-to-gross ratios we calculated these at the energy-efficient measure level. Figure 4-7 shows these net-to-gross ratios.

Figure 4-7
The Net-to-Gross Ratios by Equipment Type
Using the End User Self Report Method



4.6.3 The Supplier Influence Method

The supplier influence method assumes that the program's influence extends beyond the rebate to the kind of equipment recommendations that the HVAC contractors are making. Therefore participants who said they went with the higher efficiency equipment because their contractors recommended it may be unconsciously experiencing indirect program influence to the extent that these recommendations were program-influenced. This is a methodology that we first used in an evaluation of a residential natural gas rebate program in Indiana in 2009.[19]

[19] KEMA Inc., *Vectren Indiana Natural Gas DSM Program Impact Evaluation*, Madison, Wisconsin, August 18, 2009

4.6.3.1 The Method

The method first asks the program participants a number of questions about their interaction with the HVAC contractors to determine if the contractor influenced the participants' decision to purchase the furnace or boiler. Figure 4-8 shows the decision tree which we used to determine whether a given participant was supplier-influenced. It should be noted that the diagram does not represent logical filtering of the questions being asked and all of the participants were asked most of the questions in the diagram. The downward flow also does not represent the order in which the questions were asked (the question numbering does indicate this).

Figure 4-8
Decision Tree for Supplier Influence Questions

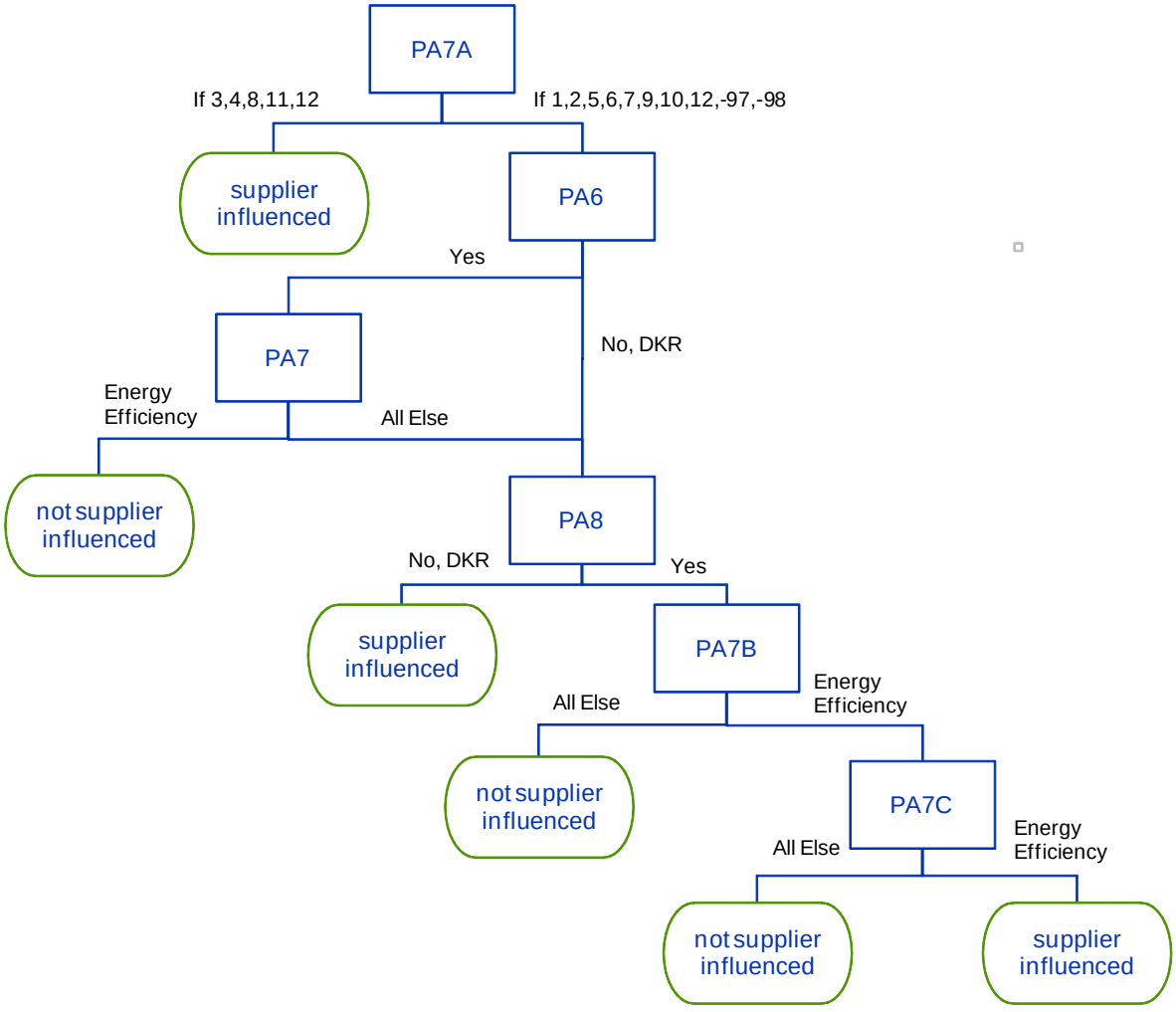


Table 4-16 shows question PA7A which was an open-ended question that asked about the role of the contractor in selecting the furnace or boiler. We classified participants as supplier-influenced if they recalled their contractor recommending a high efficiency model, a specific equipment type or brand (which would be very likely to be the high efficiency model the participant eventually chose), if the contractor helped them to estimate energy savings, or if the contractor provided them with some sort of payback or return-on-investment analysis (which are normally done to illustrate the benefits of energy savings). For responses that did not fall into the pre-coded list of response options (these were coded as "Other") we read the verbatim response to see if it indicated supplier influence. The determination of supplier influence on all other respondents was delayed until at least question PA6 if not further on in the assignment chain.

Table 4-16
The Role of the Contractor in the Selection Process

PA7A. What role, if any, did your contractor play in helping you select the <furnace/boiler> that you installed?		
1	[No role]	Sent to PA6
2	[Provided cost estimates/bids]	Sent to PA6
3	[Recommended specific equipment type/brand]	Supplier influenced
4	[Recommended high efficiency model]	Supplier influenced
5	[Identified equipment eligible for rebates]	Sent to PA6
6	[Informed us about [NYSEG/RG&E] program	Sent to PA6
7	[Encouraged us to replace equipment when we did]	Sent to PA6
8	[Helped estimate energy savings]	Supplier influenced
9	[Provided info about comfort levels of different systems]	Sent to PA6
10	[Provided info about reliability of different systems]	Sent to PA6
11	[Helped estimate Return-on-Investment (ROI) or payback]	Supplier influenced
12	[Other] [RECORD RESPONSE]	Depends on response
-97	[Don't know]	Sent to PA6
-98	[Refused]	Sent to PA6

We asked the program participants whether they had any type or model of furnace/boiler before they spoke to their heating contractor (question PA6). If they said they had, we asked them what type (question PA7). If the participants reported that they had an energy-efficient model in mind before they talked to their contractor, and they did not also recall their contractor recommending the high efficiency model in

response to question PA7A, we determined them to not be supplier-influenced. Table 4-17 shows these questions and how the participant responses were assigned.

Table 4-17
Whether the Customer Had Any Furnace/Boiler in Mind
Before Talking to the Contractor

PA6. Before speaking to your heating contractor, did you have any type or model of <furnace/boiler> in mind?		
	Yes	Sent to PA7
	No	Sent to PA8
	DK/R	Sent to PA8
PA7. What type or model of <furnace/boiler> did you have in mind?		
1	[Something similar to what he had before]	Sent to PA8
2	[An energy-efficient model]	Not supplier influenced
3	[Reliable model/ one with good warranty]	Sent to PA8
4	[A certain brand]	Sent to PA8
5	[An inexpensive model	Sent to PA8
6	[A larger model/ One with more heating capacity than we had before]	Sent to PA8
7	[A smaller model/ One with less heating capacity than we had before]	Sent to PA8
8	[A quiet model]	Sent to PA8
9	[Other] [RECORD RESPONSE]	Depends on response
-97	[Don't know]	Sent to PA8
-98	[Refused]	Sent to PA8

We asked the program participants whether their HVAC contractor presented them with multiple models of furnaces or boilers to choose from (PA8). If they said their contractor had not, then we assumed that they were supplier-influenced since the energy-efficient model that they selected was apparently the only one the contractor was promoting (Table 4-18).

Table 4-18
Whether the HVAC Contractors Presented the Customers with Multiple Models of Furnaces/Boilers to Choose From

PA8. Did the heating contractor who installed your <furnace/boiler> present you with multiple models of <furnaces/boilers> to choose from?	
Yes	Sent to PA7B
No	Supplier influenced
DK/R	Supplier influenced

We also asked the program participants what features of the furnace/boiler, if any, their contractors had emphasized (Table 4-19). If the respondents mentioned the contractors emphasizing the energy efficiency, they were deemed possibly supplier-influenced pending their response to the follow-up question PA7C: "What were the two or three features of the <furnace/boiler> that made the most difference in what you selected?" If in response to question PA7C the participants mentioned energy efficiency they were determined to be supplier-influenced.

Table 4-19
What Features of the Furnaces/Boilers the Contractor Emphasized

PA7B. What features, if any, of the <furnace/boiler> that you selected did your contractor emphasize?		
1	[No features]	Not supplier influenced
2	[Cheap, low price]	Not supplier influenced
3	[Energy efficient]	Possibly supplier influenced, sent to PA7C
4	[Quiet]	Not supplier influenced
5	[Good warranty/reliability]	Not supplier influenced
6	[Certain brand]	Not supplier influenced
7	[Easy to use]	Not supplier influenced
8	[Other] [RECORD RESPONSE]	Depends on response
-97	[Don't know]	Not supplier influenced
-98	[Refused]	Not supplier influenced

While all these participant survey questions allowed us to measure the level of the influence of the HVAC contractor on the participant's purchase decision, to gauge the level of the program's influence on the HVAC contractors, we studied the responses to the HVAC contractor interviews. We looked at a number of possible indicators of program influence on the HVAC contractors including:

- Whether participating contractors were selling more furnaces rated at 94% AFUE or greater than they were two years ago and why;
- Whether participating contractors were recommending more furnaces rated at 94% AFUE or greater than they were two years ago and why;
- What percentage of the contractor sales of furnaces rated at 94% AFUE or greater were receiving program rebates;
- Whether participating contractors were selling more furnaces 94% AFUE or greater than nonparticipating contractors; and
- Whether participating contractors were recommending more furnaces 94% AFUE or greater than nonparticipating contractors.

We summarize the HVAC contactor responses to these questions in the next section.

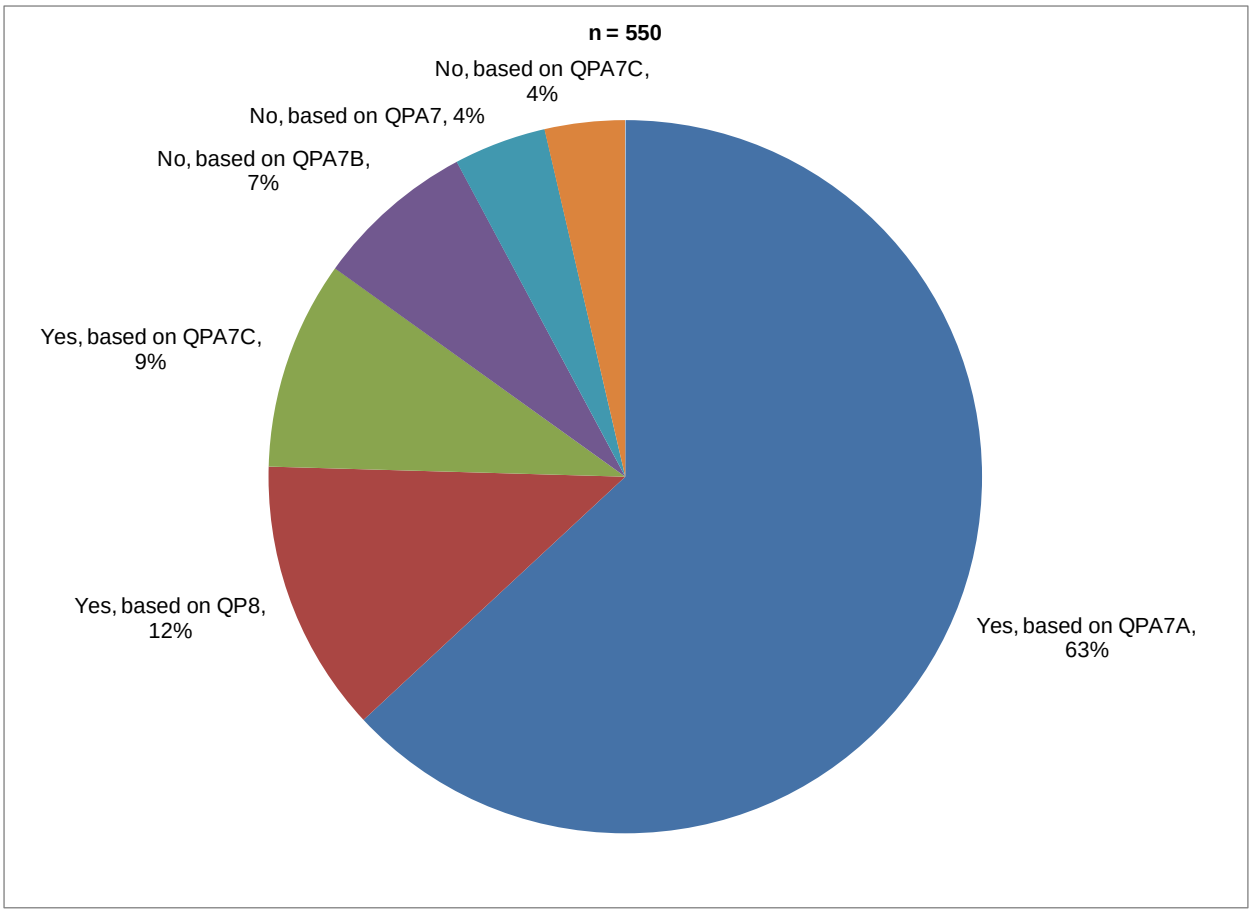
4.6.3.2 Results Using the Supplier Influence Method

This section describes the results of the supplier influence method

4.6.3.2.1 Evidence of Supplier Influence

Based on their survey responses and the method described in the previous subsection, we determined whether or not each program participant was supplier-influenced. Figure 4-9 shows that the vast majority (84%) of program participants were deemed to be supplier-influenced based on their survey responses. The responses to many of the questions that comprise the supplier influence method were already summarized in the process evaluation sections of this report including Section 2.4 (Participant Awareness and Motivations) and Section 2.5 (The Role of the HVAC Contractor in the Equipment Purchase Decision).

Figure 4-9
Whether a Participant was Supplier-Influenced



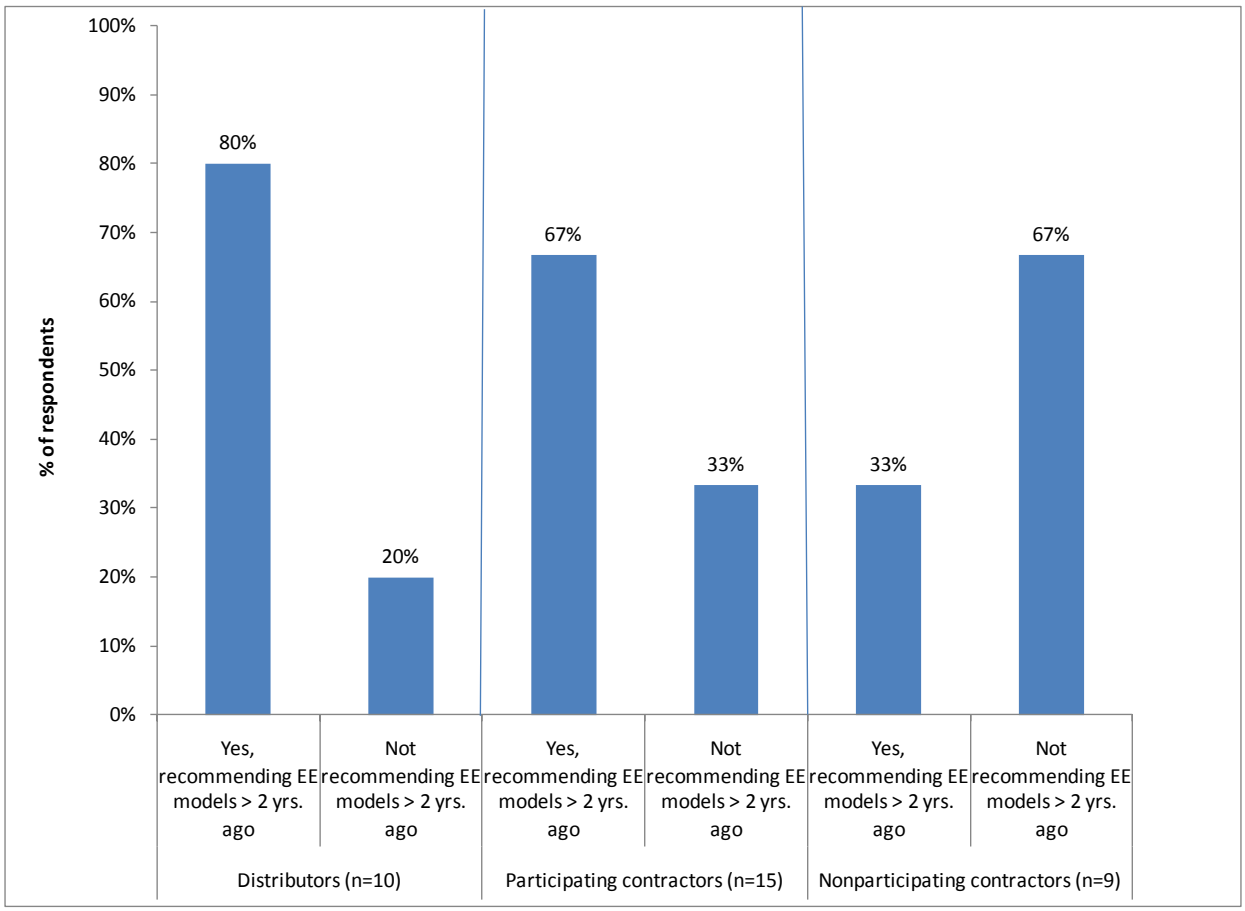
4.6.3.2.2 Evidence of Program Influence on the Suppliers

The second part of the analysis was to gauge the level of the program's influence on the HVAC contractors. As described in the previous subsection, we looked at a number of possible indicators of program influence on the HVAC contractors.

4.6.4 Possible Program Impacts on Recommending High Efficiency Furnaces

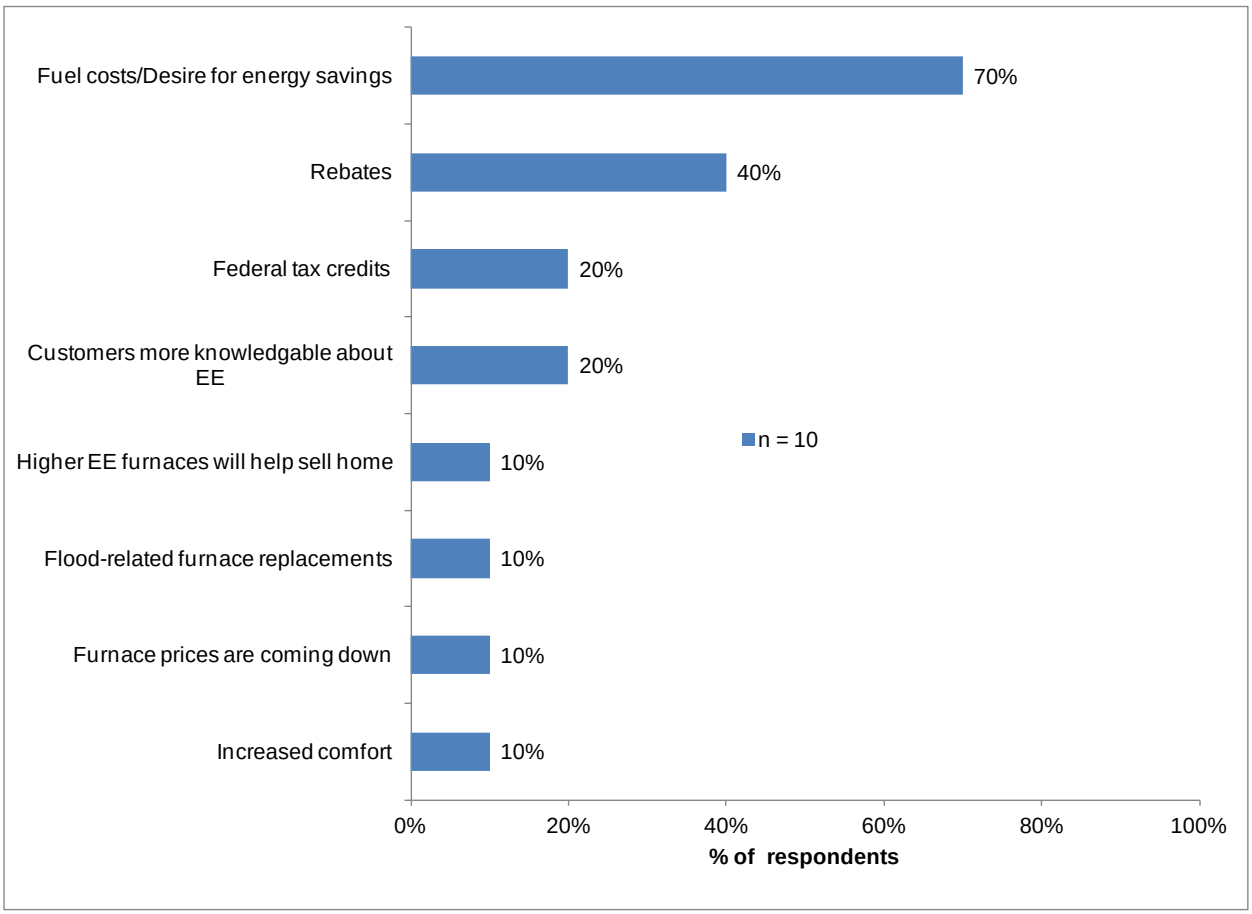
We asked the HVAC contractors and distributors: "Do you more frequently recommend high efficiency furnaces or boilers than you did two years ago?" Figure 4-10 shows some evidence that the program might be encouraging the participating HVAC contractors to recommend high efficiency equipment with greater frequency. The participating HVAC contractors were twice as likely as the nonparticipating contractors to say they were recommending more high efficiency models than they were two years ago.

Figure 4-10
Whether HVAC Trade Allies Are Recommending EE Equipment More Frequently Than They Did Two Years Ago



To more closely examine the link between the higher frequency with which the participating HVAC contractors were recommending energy-efficient equipment and the influence of the program, we reviewed the reasons why these contractors said that their recommendations increased. We asked those who said they were recommending the high efficiency equipment more than two years ago why this was so. Figure 4-11 shows that the existence of program rebates was the second-most-cited reason among participating contractors.

Figure 4-11
Why Participating HVAC Contractors Are Recommending EE Equipment More Frequently Than They Did Two Years Ago



Notes: The total percentages exceed 100% because respondents were allowed to give multiple responses.

4.6.5 Possible Program Impacts on Sales of High Efficiency Furnaces

We asked the HVAC trade allies: "Currently about what percentage of the residential gas furnaces that your company sells or installs in upstate New York have an AFUE of 94% or higher?" We then followed this up with the question: "Two years ago about what percentage of your residential furnaces sales or installations in upstate New York had AFUEs of 94% or higher?" We were expecting to see some increase in the sales penetration of these 94% AFUE or higher among the participating contractors, especially considering the increase in high efficiency recommendations during this period that was summarized in the previous subsection. However, we did not find this to be the case. Table 4-20 contains the averages – both straight average and sales-weighted average - of the responses to these sales share

questions from the participating HVAC contractors (12 respondents were able to provide estimates for both the current and past periods). The table shows no movement in sales penetration over this two year period.

Table 4-20
The Sales Penetration of 94%+ AFUE Furnaces
Current Period vs. Two Years Ago
Among Participating HVAC Contractors

Averaging Method	Average sales share of 94%+ AFUE furnaces two years ago	Average sales share of 94%+ AFUE currently*
Straight average of the responses	66%	66%
Sales-weighted average of responses	45%	45%

*The current period is January 2012 when the trade ally interviews were conducted. Percentages were only included if the respondent provided estimates for both the earlier period and the current period.

To understand why this might be so, we examined the patterns in the estimates of all the trade allies – not just the participating HVAC contractors -- and also the explanatory comments of these trade allies. Of the eight HVAC distributors who were able to provide sales penetration estimates for both time periods, five of the eight actually reported a decline during this period, two reported an increase, and one reported no change.

When asked to explain the decline in sales of the high efficiency furnaces over this period, these HVAC distributors most frequently cited the disappearance of the federal tax credit:

- "When the tax credit was around that was almost all we sold at that point, this year is the first year that we have been selling 80% AFUE again."
- "This high number [the estimate for the period two years ago] is due to the tax credit, no one is really pushing the 95% now they're just going on price."
- "Once the first year of rebates from the federal government came in it kick started everything and the utilities kept it going."
- "Even though the federal rebate was in effect it took 6-12 months for the majority of our heating contractors to change their habits based on what the homeowners were asking for. Sometimes it was driven by the homeowner and not the contractor."
- "The peak was when the federal tax credit was at $1,500 we saw a tremendous spike in our top of the line 98% furnace. At that time there was utility and manufacturer rebates, it became very affordable to buy a top of the line furnace. Now last year the rebate dropped to $200 as a result

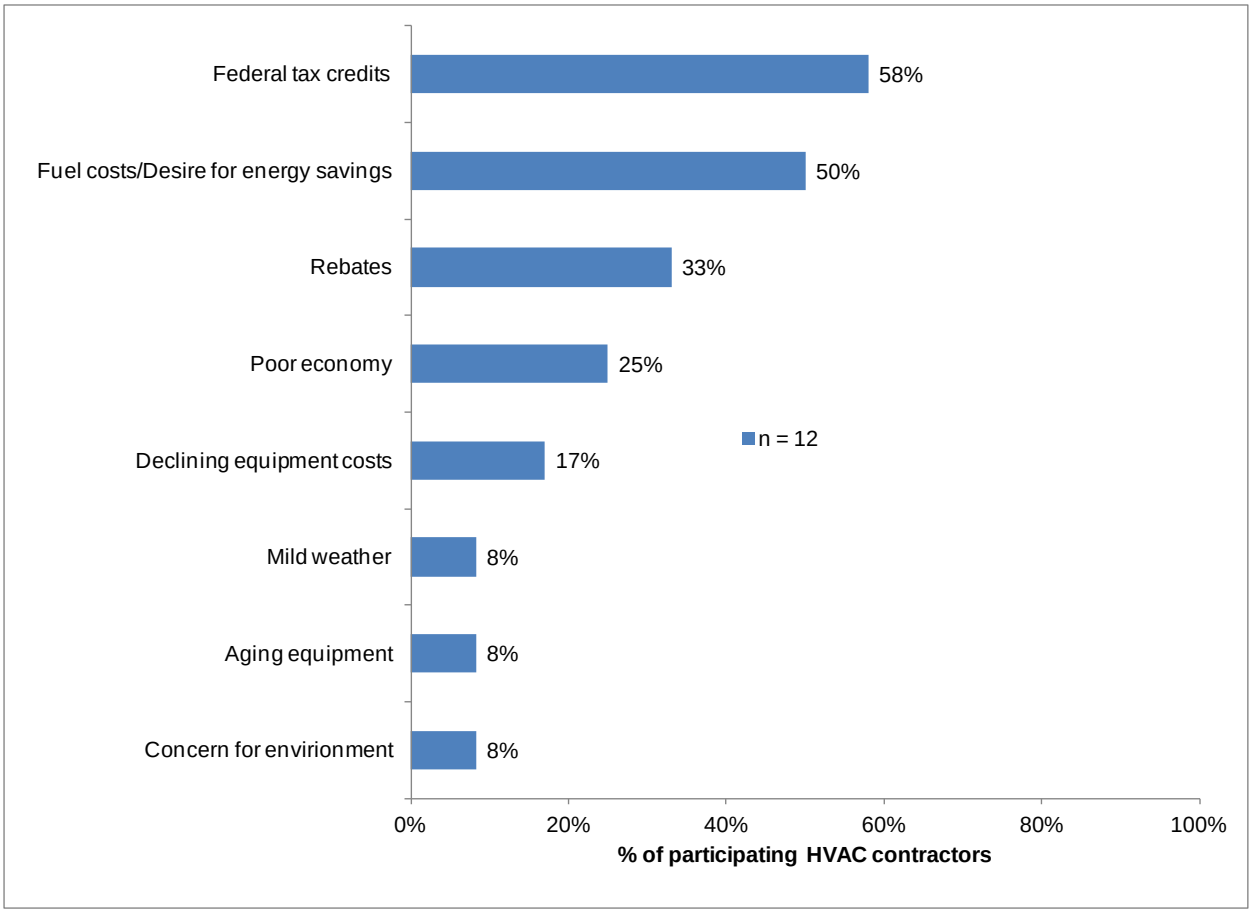
we lost about 50 percent of the business for our top of the line product. It shifted to a mid tier or entry level."

Of the 12 participating HVAC contractors who were able to provide sales penetration estimates for both time periods, three of the twelve reported a decline during this period, four reported an increase, and five reported no change. We asked the participating HVAC contractors what factors caused any trends in their sales of the 94% AFUE furnaces over the two year period. Figure 4-12 shows the different factors they cited with the federal tax credit, the consumer pursuit of fuel cost savings, and the program rebates being the top three factors.

The quotes from the HVAC distributors and Figure 4-12 all point to significant influence from the federal tax credits on the sales of the 94%+ AFUE furnaces. The tax credits likely had two effects which would explain why five of the eight HVAC distributors and three of the 12 participating HVAC contractors reported a decline in the sales penetration of these high-efficiency furnaces over the two year period. One likely effect was that the $1,500 federal tax credit, which was much larger than the NYSEG/RG&E rebates, created an enhanced demand for these high-efficiency furnaces which went away when these tax credits disappeared.

This difference in the levels of demand for these high-efficiency furnaces between the current period and the past period was likely exacerbated by the impacts of the tax credits on early equipment replacement. As discussed elsewhere in this report, most customers do not replace their furnaces or boilers upon breakdown, but rather do so because the equipment is old, expensive to maintain, and/or not performing well. In any given year a certain percentage of the installed furnaces will be in this decrepit condition. The availability of the tax credit likely encouraged owners of such suboptimal furnaces to replace the equipment sooner than they had originally planned to. This boost in early replacement rates likely had the double impact of increasing the high efficiency furnaces sales in the earlier period and decreasing them in the later period because many decrepit furnaces had been removed from the market thereby reducing early replacement sales opportunities in this later period.

Figure 4-12
Factors That Participating HVAC Contractors Cited
As Influencing Their Sales of 94%+ AFUE Furnaces
Over the Last Two Years



In our Vectren impact evaluation we used the boost in sales of energy-efficient equipment reported by participating contractors over a two year period as a key input to the calculation of the net-to-gross ratio for those participating customers who indicated they had been "supplier-influenced." However, this Vectren evaluation occurred before the confounding effects of the federal tax credit for energy-efficient furnaces. In the case of the evaluation of the NYSEG/RG&E Natural Gas Equipment Rebate program it seems clear that the effects of the federal tax credit – which was many times larger than the NYSEG/RG&E energy program rebate --- are making it very difficult to isolate and quantify the impacts of the program on the sales of energy-efficient equipment.

Another way to try to isolate the impacts of the program on participating HVAC contractors is to compare the sales penetration of the high efficiency furnaces among participating contractors vs. nonparticipating contractors. Although the sample sizes are very small, Table 4-21 shows that in the current period there

was essentially no difference in sales penetration of 94%+ AFUE furnaces for the participating vs. the nonparticipating HVAC contractors. In the earlier period the sales penetration of the high efficiency furnaces among the participating contractors was slightly higher.

Table 4-21
The Sales Penetration of 94%+ AFUE Furnaces
Participating vs. Nonparticipating HVAC Contractors

Contractor Type	Average sales share of 94%+ AFUE furnaces two years ago	Average sales share of 94%+ AFUE currently*
Participating contractors (n=12)	66%	66%
Nonparticipating contractors (n=7)	60%	67%

*The current period is January 2012 when the trade ally interviews were conducted. The averaging method was a straight average of all the responses. Percentages were only included if the respondent provided estimates for both the earlier period and the current period.

In interpreting these results we must again return to the effects of the federal tax credits. Since the nonparticipating contractors had access to these tax credits and these tax credits were so much larger than the program rebates, the tax credits likely had the effect of narrowing any normal differences in sales of energy-efficient equipment between these two groups – e.g., "a rising tide lifts all boats."

It is curious that while the participating HVAC contractors reported stagnant sales penetrations of the high efficiency equipment over this two year period, the nonparticipating contractors actually reported an increase. However, this is mostly an effect of the small sample size. Six of the seven nonparticipating contractors reported essentially stagnant sales penetrations of the high efficiency equipment over this two year period (five of the six reported no change and the sixth reported a slight increase from 98 percent to 100 percent). Yet the seventh reported a large increase (from 0% to 50%) in sales penetration. Due to the small sample size, this large increase from a single respondent had the effect of increasing the overall average in the post period. So the increase in the sales penetrations of the high efficiency equipment over the two year period for the nonparticipating contractors is largely due to a single outlier.

Another confounding factor is the presence of other HVAC rebate programs in upstate New York. Although we confirmed that the contractors that we called "nonparticipating contractors" were not participating in the NYSEG/RG&E program, two of the ten mentioned "rebates" driving sales of energy-efficiency equipment (although we never probed to find out whether these were rebates from other utility programs in the area or rebates from equipment manufacturers).

One of the nonparticipating HVAC contractors also indicated that there might be some program spillover effects. When asked to explain why he reported an increase in sales of the high efficiency equipment over

the two-year period, he said it was "Probably from sales pressure. Other places are selling it and pitching it to the customer, so it's being more requested from customers." If these other HVAC contractors the respondent is referring to were participating contractors, then the change in his behavior due to competitive pressures would be a program spillover effect.

There is also some evidence of market effects in the form of customers increasingly asking about high efficiency equipment. The previous quote from the nonparticipating contractor that high efficiency equipment "is being more requested from customers" was echoed by a few other trade allies. In explaining why they were recommending high efficiency equipment more than they were two years ago, two of the ten participating contractors who responded to this question said it was because customers were becoming more knowledgeable. In addition, one of the HVAC wholesalers said: "even though the federal rebate was in effect it took 6-12 months for the majority of our heating contractors to change their habits based on what the homeowners were asking for. Sometimes it was driven by the homeowner and not the contractor." This would help explain why, even though the participating HVAC contractors reported to be recommending the high efficiency models more frequently than their nonparticipating counterparts, they were not selling more of these high efficiency models. Some of the high efficiency equipment sales of the nonparticipating contractors were consumer-driven rather than supplier-driven.

4.6.6 Conclusion from the Supplier Influence Net-to-Gross Method

A summary of our findings from the supplier influence net-to-gross method include:

- *There was evidence that a large majority of the program participants were influenced in their equipment purchase decision by their HVAC contractor:* Eighty-four percent of program participants were deemed to be supplier-influenced based on their survey responses.

- *There was evidence that the participating HVAC contractors were more likely to be recommending the high efficiency equipment than the nonparticipating contractors and that this was driven by program rebates:* The participating HVAC contractors were twice as likely as the nonparticipating contractors to say they were recommending more high efficiency models than they were two years ago. We asked those who said they were recommending the high efficiency equipment more than two years ago why this was so. The existence of program rebates was the second-most-cited reason among participating contractors.

- *Impact of program on sales/installations of high efficiency equipment:* Trade allies were asked to use a five-point effectiveness scale where five equaled "very effective" and one equaled "not at all effective" to indicate how effective the program has been in encouraging sales of residential high efficiency gas heating equipment. Most (93%) participating contractors and over half (55%) of the distributors reported the program was "very effective" or "effective" in encouraging contractors and distributors to sell more efficient gas heating equipment, with no participating contractor or distributor indicating the program was ineffective.

- *Yet, on average, the participating HVAC contractors reported no increase in the sales penetration of their sales of 94%+ AFUE furnaces over the last two years*. There was evidence that the large federal tax credit for high efficiency furnaces had a significant impact on the market for high efficiency equipment and therefore likely dwarfed and masked normal program influences on high efficiency sales. Both the HVAC wholesalers and the participating HVAC contractors cited the federal tax credits as the number one factor in their sales of the 94%+ AFUE over this two year period. The tax credits likely had two effects which would explain why five of the eight HVAC distributors and three of the 12 participating HVAC contractors reported a decline in the sales penetration of these high-efficiency furnaces over the two year period. One likely effect was that the $1,500 federal tax credit, which was much larger than the NYSEG/RG&E rebates, created an enhanced demand for these high-efficiency furnaces which went away when these tax credits disappeared. This difference in the levels of demand for these high-efficiency furnaces between the current period and the past period was likely exacerbated by the impacts of the tax credits on early equipment replacement. The availability of the tax credit likely encouraged owners of such suboptimal furnaces to replace the equipment sooner than they had originally planned to. This boost in early replacement rates likely had the double impact of increasing the high efficiency furnaces sales in the earlier period and decreasing them in the later period because many decrepit furnaces had been removed from the market thereby reducing early replacement sales opportunities in this later period.

- *On average there was no difference between the participating and nonparticipating HVAC contractors in the sales penetration of their sales of 94%+ AFUE furnaces in the current period.* In the past period the participating HVAC contractors had only a slightly higher level of sales penetration of these high efficiency furnaces than their nonparticipating counterparts. Likely factors that would explain why there was not a bigger difference between the participating and nonparticipating contractors included the impacts of the federal tax credits, evidence that some of the nonparticipating contractors have been using rebates from other programs, and indications of a growth in consumer demand for energy-efficient products.

- *There was some limited evidence of market effects and program spillover:* When asked to explain why he reported an increase in sales of the high efficiency equipment over the two-year period, one nonparticipating contractor said it was “probably from sales pressure. Other places are selling it and pitching it to the customer, so it’s being more requested from customers.” This might be an indication of program spillover. There were also a number of HVAC contractors and distributors who reported consumers becoming more knowledgeable about high efficiency equipment and asking for it, which would be an indicator of market effects.

- *While the supplier influence net-to-growth method found evidence that the HVAC contractors were influencing consumer equipment choices and that the program was increasing the frequency with which participating contractors were promoting high efficiency equipment, we*

could not quantify these program effects due to the distorting effects of the federal tax credit. Our normal method for estimating the net-to-gross ratios using the supplier methods is to look at the increase in sales of energy-efficient equipment by participating HVAC contractors over time or by comparing their level of energy-efficient sales to those of the nonparticipating contractors. However, neither of these indicators showed evidence of program influence. As discussed above, we believe that this was due to a significant impact on the market for high efficiency equipment which likely dwarfed and masked normal program influences on high efficiency sales.

4.6.7 Conclusions and Recommendations Concerning the Interpretation of these Net-to-Gross Results

As discussed above and elsewhere in the report, there was a lot of evidence from the participant surveys and trade ally interviews that:

- The participating HVAC contractors influenced the decision of customers participating in the program to purchase the higher efficiency equipment; and
- The program was influencing the participating HVAC contractors to recommend the higher efficiency more frequently than they otherwise might have.

Therefore the full measure of program attribution – the portion of the energy savings that should be attributable to the program -- should include not only the portion of the energy savings attributable to the program rebates (which is captured by the end user self-report NTG methodology), but also the portion of the energy savings attributable to the program influencing the behavior of the contractors.

Usually we estimate the energy savings attributable to the program's influence over the contractor in two ways:

1) Looking at the difference between the frequency with which the participating contractors are selling the high-efficiency equipment and the frequency with which nonparticipating contractors – which serve as a de facto control group – are selling the high efficiency equipment; and
2) Looking at the difference between the frequency with which the participating contractors are selling the high-efficiency equipment before, or at the very beginning of, their program involvement and this frequency after a few years of their program involvement. If there is a set of nonparticipant interviews, then these can be used to control for any non-program effects that could be contributing to the differences over this time period.

However, this evaluation could not find any differences for both these comparisons.

As we discussed above and elsewhere in this report, we do not think the absence of these differences is evidence that the program was not influencing the behavior of these contractors. We think the absences of these differences was due to the temporary distorting effect of the $1,500 federal tax credit, which was cited by HVAC distributors as a major market driver, which was available to participating and nonparticipating contractors alike, which likely engendered some end user-driven consumer demand for higher efficiency equipment (which would increase nonparticipating contractor sales of the high efficiency equipment even when they were not recommending this equipment more frequently than their participating counterparts), and which was about five times larger than the NYSEG/RG&E program rebates available at the time. This tax credit likely had the confounding effect of temporarily negating the expected differences between the frequency with which participating contractors sold the high efficiency equipment and the frequency with which the nonparticipating contractors sold this equipment.[20]

Of course it could be argued that if the $1,500 federal tax credit was indeed producing this "swamping" effect on the upstate New York HVAC market, then the NYSEG/RG&E program should not get credit for the sales of energy-efficient furnaces and boilers that were significantly influenced by this tax credit. Therefore one approach would be to give the program for the 2009-2011 evaluation period only the energy savings attribution produced by the end user self report methodology, since this would represent the incremental impact of the program rebates over any endogenous factors such as the federal tax credit.

One concern we would have about this approach, however, is that based on our experience doing many net-to-gross estimations, net-to-gross ratios are often re-used for other purposes such as adjustments to *ex ante* gross energy savings estimates for the purpose of setting program savings goals, forecasting energy savings for planning purposes, and even decisions as to whether or not certain energy-efficient technologies should continue to receive incentives. Therefore while giving the NYSEG/RG&E program only "partial credit" (e.g., only credit for the rebate effects and not for the contractor effects) might be justified for the 2009-2011 evaluation period due to the federal tax credit effects, we would not want such a ratio to be used for any planning or forecasting purposes because it would represent an anomalous "snapshot" of the program's normal impacts.

In March 2013 we discussed this issue with the New York DPS staff and their consultant team during a presentation of the findings from the evaluation. The DPS staff and their consultant team generally agreed with our analysis of the confounding effects of the federal tax credits and our concerns that the program's net-to-gross ratio based on this anomalous 2009-2011 "snapshot" should not be used for future decision-making about the value or effectiveness of the NYSEG/RG&E program. However, they

[20] We say "temporarily" because while federal tax credits for efficient furnaces/boilers are still available, they are a fraction of the value of what they used to be and the eligible equipment has also been more narrowly defined than it was in the past.

insisted that the evaluators still needed to provide a net-to-gross ratio for the program for this 2010-2011 evaluation period.

Therefore we decided to use the results from the end user self-report method to calculate the net-to-gross ratio for this evaluation period. Table 4-22 shows these estimates. We weighted the overall program net-to-gross ratio based on the number of participating customers.

Table 4-22
Program Net-to-Gross Ratios
for the 2009-2011 Evaluation Period

Measure	Accounts	End User Self Report Method Net-to-Gross Ratios
Boiler	1,124	0.35
Furnace	9,766	0.24
Total	**10,890**	**0.25**

5. Engineering Review

This report section contains the review of the energy savings calculations used in the NYSEG/RG&E Residential Natural Gas Equipment Rebate Program tracking database for the program years 2009-2011. It also contains a review of New York's Technical Reference Manual (TRM) calculation methods for residential gas measures.[21]

5.1 Review of Tracking Data

This section contains a review of the energy savings calculations used in the program tracking database for the past three years. This review compared the formula specified in the TRM to the formula used in the tracking database.

5.1.1 2009 Program Year

In the 2009 program year, the program calculated savings based on the March 25, 2009 TRM for furnaces, boilers, and setback thermostats. For indirect water heaters, the program used a deemed value determined from another source. The database applied all of these calculations consistently, as shown below in Table 5-1.

Table 5-1
2009 Program Tracking Data Review

Measure	Calculation Used	Notes
Furnace/Boiler	March 25, 2009	Assuming "BTU" value output
Thermostat	March 25, 2009	Used 3.6% savings value, as shown in March 25, calculatio
Indirect WH	Deemed	

[21] The official title of the manual is the *New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs*. Prepared for the New York Department of Public Service by the New York Evaluation Advisory Contractor Team. October 15, 2010.

5.1.2 2010 Program Year

In the 2010 program year, the program calculated savings based on the March 25, 2009 TRM for furnaces, boilers, and setback thermostats, with the following exceptions:

- The furnace/boiler calculation in the TRM assumed output capacity as the furnace/boiler capacity. When the database contained output capacity, the calculation used this value. When the output capacity field was missing, the calculation multiplied input capacity by AFUE to determine output capacity.

- For setback thermostats, the program used the March 25, 2009 calculation method. In response to the TRM update from December 16, 2009, the program changed the percent savings value from 3.6 to 6.8 percent. This is reflected in the tracking data.

For indirect water heaters, the program used a deemed value determined from another source. The database applied all of these calculations consistently, as shown below in Table 5-2.

Table 5-2
2010 Program Tracking Data Review

Measure	Calculation Used	Notes
Furnace/Boiler	March 25, 2009	Used output capacity if available.
Thermostat	March 25, 2009	Used 6.8% Savings value (established for October 15, 2010 calc.) with March 15, 2009 calc. method.
Indirect WH	Deemed	

5.1.3 2011 Program Year

In the 2011 program year, the program calculated savings based on the October 15, 2010 TRM for furnaces, boilers, and setback thermostats, with the following exception:

- The furnace/boiler calculation in the TRM contained a mistake in the calculation method. The database calculation uses a corrected version provided by the PSC, which uses input capacity multiplied by AFUE rather than output capacity.

- For indirect water heaters, the program used a deemed value determined from another source. The database applied all of these calculations consistently, as shown below in Table 5-2.

Table 5-3
2011 Program Tracking Data Review

Measure	Calculation Used	Notes
Furnace/Boiler	October 15, 2010	Used input capacity rather than output capacity.
Thermostat	October 15, 2010	
Indirect WH	Deemed	

5.2 TRM Review

This section provides a review of the existing residential gas measure calculations from the Technical Reference Manual (TRM) from New York. This review includes a discussion of existing calculations, an overview of current research including billing analysis results from this evaluation, and recommendations for changes.

Per program request, we also considered energy savings for early replacement projects. Time did not permit the introduction of electric savings attributable to these gas-dominated measures, so this is not included.

5.2.1 High Efficiency Gas Furnace or Boiler

This subsection summarizes the current energy savings calculation for furnaces/boilers in the New York TRM, summarizes our literature review of energy savings estimates (and related input assumptions) from other Northeastern states, shows high-level findings from the DNV KEMA billing analysis, and then provides our recommended energy savings estimates for these measures.

5.2.1.1 The Current Energy Savings Calculation

The program currently maintains two separate measures for high efficiency gas furnaces and boilers. However, the measure entries in the TRM, including the calculation and all assumptions but one, are identical. For this reason we here combine the two measures into one.

This measure provides for the installation of new high efficiency residential furnaces and boilers (both hot water and steam). The application includes efficiency requirements, providing higher rebates for more efficient units. The application makes no requirement that the new heating system replace an existing

system, so this measure could be installed in new construction. The calculation assumes a new minimum efficiency (according to code) furnace or boiler as the baseline.

The existing calculation[22] is as follows:

$$Therms = Units \times \frac{kBtuh_{in}}{Unit} \times \left(\frac{AFUE_{ee}}{AFUE_{base}} - 1\right) \times \frac{EFLH_{heat}}{100\frac{kBtuh}{therm}}$$

where

$Therms$ = gross annual gas savings

$Units$ = number of units installed (from application)

$\frac{kBtuh_{in}}{Unit}$ = nominal heating input capacity (kBtuh/hr, from application)

$AFUE_{base}$ = average fuel utilization efficiency of baseline equipment (shown below in Table 5-4)

$AFUE_{ee}$ = average fuel utilization efficiency of new equipment (from application)

$EFLH_{Heat}$ = heating equivalent full load hours (From TRM Appendix G)

Table 5-4
Baseline AFUE for Furnaces and Boilers

Equipment	Baseline AFUE
Furnace	78%
Hot Water Boiler	80%
Steam Boiler	75%

As part of this engineering review, DNV KEMA, representatives of NYSEG and RG&E, representatives of the New York DPS, and others involved in the development and review of the New York TRM reviewed the energy savings formulae for furnaces and boilers. We discussed the use of output capacity instead of input capacity and the implications of the fact that condensing boiler peak efficiency diverges from AFUE. It was finally agreed that because EFLH derives from input capacity and input usage – this

[22] The calculation shown here is a version provided by the PSC, which corrects an error in the original TRM.

formula, using input capacity, is the correct one. A formula which uses output capacity may approximate the correct savings but would not match in all cases.

5.2.1.2 Literature Review

DNV KEMA conducted a review of recent evaluation reports, technical reference manuals and other relevant information to assess the reasonableness of the furnace/boiler formula in the TRM and make any recommendations for changes, if needed. This subsection summarizes the findings of a few of these studies that we reviewed.

5.2.1.2.1 GasNetworks HEHE Evaluation

GasNetworks sponsored a billing analysis of 1,010 gas furnace and 987 gas boiler customers in Massachusetts in 2009.[23] This is a frequently-cited study in the billing analysis community. The analysis resulted in savings as shown below in Table 5-5. The HEHE evaluation found the largest savings for 90+% AFUE hot water Boilers, and the smallest savings for 85-89% AFUE hot water boilers. This study also attempted to determine savings for early replacement.

Table 5-5
HEHE Space Heating Analysis Results

Equipment	Natural Replacement Savings (annual therms/ participant)	Early Replacement Savings (annual therms/ participant)
Furnace 92+% AFUE	118	170
Furnace 92+% AFUE with ECM Motor*	127	184
Hot Water Boiler 90+% AFUE	137	255
Hot Water Boiler 85-89% AFUE	72	149
Steam Boiler 82+% AFUE	109	203

* Average AFUE of furnaces with ECM motors in this study is 95 percent.

[23] *HEHE Process and Impact Evaluation.* Prepared for GasNetworks by the NMR Group. October 27, 2010.

5.2.1.2.2 New Jersey Billing Analysis

KEMA performed a billing analysis of 6,896 gas heating customers in New Jersey in 2009. The analysis did not distinguish between furnaces and boilers, did not set efficiency categories, and resulted in a savings estimate of 100 therms.[24] This estimate is likely higher than the actual realized savings in New Jersey, because the method made an unrealistically favorable estimate for baseline efficiency. New Jersey's climate is warmer than New York's and so one would expect lower savings in New Jersey.

5.2.1.2.3 Comparing the New York TRM to those of Other States/Regions

Table 5-6 and Table 5-7 compare input assumptions and furnace/ boiler energy savings estimates from the New York TRM with those from TRMs in other states. The efficiencies used for the furnace table are different than those used by the boiler table.

Table 5-6 shows that the New York TRM is currently estimating energy savings that are higher than those provided by all the other states or regions represented in the table. These higher savings estimates mostly stem from the higher EFLH value used by New York, which is partly due to colder weather and partly due to differences in sources and methods. Sources for EFLH from the other states included mostly personal conversations with industry experts, although the New Jersey TRM stated that it used a "utility analysis of heating customers." For baseline efficiency, code mandates 78% AFUE nationwide, but most states/regions used 80% AFUE based on experience that furnaces with efficiencies lower than 80% are rarely sold.

[24] New Jersey's *Clean Energy Program Residential HVAC Impact Evaluation and Protocol Review.* Prepared for NJ Clean Energy Programs by KEMA. June 11, 2009.

Table 5-6
Energy Savings Assumptions and Estimates for Furnaces
New York vs. Other States/Regions

State/Region	Year	Baseline Efficiency	EFLH (hours)	Savings (annual therms per participant*)		
				92% AFUE	94% AFUE	96% AFUE
Massachusetts	2010	78%	n/a	127	153	207
Mid Atlantic**	2011	80%	620	101	115	129
Ohio	2010	80%	712	93	106	119
New Jersey	2010	80%	965	126	144	161
Vermont	2009	90%	n/a	62	n/a	n/a
Average		82%	766	102	130	154
New York***	2010	78%	1,346	205	229	252

* Assumes 100,000 Btuh heating capacity

** A calculation error in the Mid Atlantic region'sTRM causes its savings here to be artificially high.

*** This is an average EFLH but the manual also offers city-specific EFLH estimates (Rochester is 1473).

Table 5-7 shows that the New York TRM is also estimating boiler energy savings that are higher than those estimated by all other states in the Northeast region. As was the case with furnaces, these higher energy savings are due to the higher EFLH value that New York uses, which is partly due to colder weather and partly due to differences in sources and methods. All the TRMs use the code minimum value of 80% AFUE for baseline efficiency.

Table 5-7
Energy Savings Assumptions and Estimates for Boilers
New York vs. Other States/Regions

State/Region	Baseline Efficiency	EFLH (hours)	Savings (annual therms per participant*)		
			85% AFUE	90% AFUE	95% AFUE
Massachusetts	80%	n/a	72	137	213
Mid Atlantic**	80%	620	46	86	122
Ohio	80%	712	42	79	112
Average	80%	666	53	101	149
New York***	80%	1,346	79	150	213

* Assumes 100,000 Btuh heating capacity
** A calculation error in the Mid Atlantic's regional TRM causes its savings here to be artificially high
*** This is an average but the manual also offers city-specific EFLH estimates (Rochester is 1473).

5.2.1.3 DNV KEMA Billing Analysis Results

As discussed elsewhere in this report, DNV KEMA conducted a billing analysis of NYSEG and RG&E customers who participated in the Residential Natural Gas Equipment Rebate Program during the 2009-2010 period. Some of the results from this analysis appear in Table 5-8.

Table 5-8
Results from DNV KEMA Billing Analysis

Savings Type	Energy Savings (annual therms per participant)	Early Savings (annual therms participant)	EFLH (hours)
Furnaces without ECM	128	139	848
Furnaces with ECM	131	139	907
Boilers	156	225	822

The table shows savings estimates for furnaces (both with an ECM and without one) and boilers, for both natural replacement and early replacement scenarios. The billing analysis did not provide further savings estimates for specific efficiency bins, or break down boiler savings into steam vs. hot water because with this additional disaggregation the sample sizes in each bin would get too small to produce statistically-significant results. The billing analysis sample size also was not large enough to allow the calculation of separate savings estimates for indirect water heaters and

setback thermostats. So the estimates shown in Table 5-8 include savings attributed to indirect water heaters and setback thermostats that were installed along with the furnace or boiler measures.

These DNV KEMA billing analysis provide savings for furnaces that are similar to those estimated by most state/regional TRMs, and similar to those found by the HEHE analysis in Massachusetts. This analysis found boiler savings that were higher than most TRMs, though comparable to the HEHE analysis results for high efficiency boilers. This is reasonable, given the high average efficiency of boilers installed under the RG&E/NYSEG program, and the fact that indirect water heater savings are included (see section 5.2.2). Compared to the New Jersey study (which combined boilers and furnaces), the savings determined by this study are on average significantly higher.

Table 5-9 shows the percentage of furnace and boiler installations in the DNV KEMA billing analysis sample frame which included setback thermostats. Table 5-10 shows the percentage of boiler installations from this sample frame which included indirect water heaters. The assumption that the energy savings for the smaller (setback thermostat and indirect water heater) measures are rolled into the larger (boiler and furnace) measures remains valid to the extent that these percentages (from the 2009-2010 program participants) remain stable over time. If the program stopped encouraging the installation of setback thermostats and indirect water heaters, energy savings for furnaces and boilers would likely change. For simplicity's sake, the numbers listed below do not include customers who installed both a furnace and a boiler.

Table 5-9
Furnace/Boiler Installations
With/Without a Setback Thermostat

Measure	Total	With Setback Tstat.	No Setback Tstat
Furnaces without ECM	696	45%	55%
Furnaces with ECM	3,565	81%	19%
Boiler	548	47%	53%
Overall	**4,809**	**72%**	**28%**

Table 5-10
Boiler Installations
With/Without an Indirect Water Heater

Measure	Total	With Indirect WH	No Indirect WH
Boiler	548	20%	80%

5.2.1.4 Recommendations

DNV KEMA recommends that the program adopt the results from the DNV KEMA billing analysis as the updated energy savings for furnaces and boilers. This results in energy savings as shown in Table 5-11.

Table 5-11
Recommended Energy Savings for Furnaces and Boilers

Savings Type	Average AFUE	EFLH (hours)	Energy Savings (annual therms per participant)	Early Replacement Savings (annual therms per participant)
Furnaces without ECM	94.3%	848	128	139
Furnaces with ECM	95.5%	907	131	139
Boilers	92.8%	822	156	225

The values listed above may be used as deemed savings, or in the formula shown in subsection 5.2.1.1 above. Note that savings for indirect water heaters and programmable thermostats are included in the deemed savings value. Using the formula from above with the new EFLH values would not include these savings.

5.2.2 Indirect Water Heaters

This subsection discusses the current energy savings calculation used by the TRM, summarizes the results of our literature review, discusses what our billing analysis found, and finally makes a recommendation concerning how to estimate energy savings for this measure.

5.2.2.1 The Current Energy Savings Calculation

This measure provides for the installation of new residential indirect (boiler-integrated) water heaters. Indirect water heaters must be installed as part of a new boiler installation. The application includes no specific boiler efficiency requirement, though it is likely that many are installed along with high-efficiency boilers which are rebated by the same application. The calculation assumes a new low-efficiency storage tank type gas water heater as the baseline.

The calculation method outlined in the 2010 TRM is excessively complicated, contains two errors, and was never put into effect. So this review introduces a new method.

5.2.2.2 Literature Review

GasNetworks performed a billing analysis[25] of 177 indirect water heating customers in Massachusetts in 2009. The analysis resulted in a deemed savings value of 80 therms per unit for natural replacement customers, with a range of 70-89 therms depending on the model used. The analysis also estimated savings for early replacement of 91 therms, with a range of 80-102 therms. An energy savings estimate of eighty therms is about 15 percent less than the savings currently claimed by RG&E and NYSEG for the Residential Natural Gas Equipment Rebate Program.

A thorough literature review search did not reveal any other significant sources of energy savings data for indirect water heaters. In addition, we were not able to find another state with a publicly-available TRM that provides savings estimates for this measure.

5.2.2.3 DNV KEMA Billing Analysis Results

The billing analysis that DNV KEMA conducted for the impact evaluation of the NYSEG/RG&E Residential Natural Gas Equipment Rebate Program did not find any meaningful results for indirect water heaters due to the small sample size. In effect, this billing analysis captures savings for indirect water heaters along with the saving estimates for boilers.

5.2.2.4 Recommendations

The analysis done for this evaluation did not provide enough information to justify a claim for independent savings for indirect water heaters. From a design perspective, indirect water heaters have the major issue of increased gas usage during the non-heating season. This calls into question the magnitude of savings claimed by the GasNetworks analysis[26]. The type of billing analysis used for furnace/boiler

[25] *HEHE Process and Impact Evaluation.* Prepared for GasNetworks by the NMR Group. October 27, 2010.
[26] On page 16 of the GasNetworks report, they indicate difficulties with this issue as well.

replacement, such as DNV KEMA's for this evaluation, or GasNetworks analysis cited above, relies on a weather-based model that often misses additional usage or savings from the non-heating season. Without a reputable source that includes summer water heating usage, DNV KEMA cannot recommend a savings estimate for indirect water heaters at this time.

DNV KEMA recommends that the program stop claiming separate savings for indirect water heaters installed as part of a new boiler system, and use the results of the DNV KEMA billing analysis which roll savings for indirect water heaters in with boiler savings.

5.2.3 Setback Thermostat

This subsection discusses the current energy savings calculation used by the TRM, summarizes the results of our literature review, discusses what our billing analysis found, and finally makes a recommendation concerning how to estimate energy savings for this measure.

5.2.3.1 The Current Energy Savings Calculation

This measure provides for the installation of new programmable (setback) thermostats. The application requires that thermostats be ENERGY STAR rated and be installed by the contractor at the same time as a furnace or boiler upgrade. However, the program is currently planning to implement a new setback thermostat measure for thermostats installed independently.

The existing calculation is as follows:

$$Therms = Units \times \frac{kBtuh_{in}}{Unit} \times \frac{EFLH_{heat}}{100\frac{kBtuh}{therm}} \times ESF_{heat}$$

$$kWh = \left(Units \times \frac{Tons}{Unit} \times \frac{12\frac{kBtuh}{Ton}}{SEER} \times ESF_{cool}\right) + \left(\frac{kBtuh_{out}}{Unit} \times \frac{EFLH_{heat}}{HSPF} \times ESF_{heat}\right)$$

where

$Therms$ = gross annual gas savings

kWh = gross annual electric savings

$Units$ = number of units installed (from application)

$\frac{kBtuh_{in}}{Unit}$ = nominal heating input capacity (kBtuh/hr, from application or use default = 90 for furnace and 110 for boiler)

$\frac{kBtuh_{out}}{Unit}$ = nominal heating output capacity (kBtuh/hr, from application or use default = 70 for heat pump and 12 for resistance heat)

$\frac{Tons}{Unit}$ = size of new cooling equipment (from application, or use default = 3)

$SEER$ = efficiency of new cooling equipment (10 Btu/W·hr)

$HSPF$ = efficiency of new electrical heating equipment (Btu/W·hr, use 6.8 for heat pump and 3.413 for resistance heat)

ESF_{heat} = thermostat heating savings (6.8%)

ESF_{cool} = thermostat cooling savings (9.0%)

$EFLH_{heat}$ = heating equivalent full load hours (From TRM Appendix G)

$EFLH_{cool}$ = heating equivalent full load hours (From TRM Appendix G)

5.2.3.2 Literature Review

Savings for the current measure are based primarily on a 2007 study done for GasNetworks in Massachusetts.[27] This study was a large billing analysis, significant in that it is cited by every other nearby state or utility which offers a setback thermostat measure. It included 415 participants and 838 nonparticipants, and found savings of 6.8 percent of total household usage for the installation of a setback thermostat, or a total of 75 therms per household for Massachusetts.

The values of 6.8 percent and 75 therms correspond to a customer installing only a setback thermostat, without also installing a new heating system. It is unclear whether this savings is applicable to customers installing a new heating system and setback thermostat together. This study did not attempt to determine savings for electric usage.

DNV KEMA found three studies which found zero heating energy savings for setback thermostats. One study was based on survey results from Wisconsin[28], one on a billing analysis from California,[29] and a third on laboratory-based behavioral research from Lawrence Berkeley National Laboratories[30].

[27] *Validating the Impact of Programmable Thermostats*. Prepared for the GasNetworks by the RLW Analytics. January 2007.

[28] *Energy and Housing in Wisconsin: a Study of Single-Family Owner-Occupied Homes.* Energy Center of Wisconsin, 2000.

5.2.3.2.1 Comparing the New York TRM to those of Other States/Regions

Table 5-12 below shows savings estimates for other TRMs from nearby states and regions. As discussed above, all nearby states/regions which offer setback thermostat measures for gas savings use the value of 6.8 percent savings found by the GasNetworks study.[31] None of these states/regions found defensible sources for cooling savings, so they do not claim any.

Table 5-12
Energy Savings Assumptions and Estimates for Boilers
New York vs. Other States/Regions

State/Region	EFLH (hours)	Savings*	
		%	annual therms per participant
Mass	n/a	6.8	77
Mid Atlantic	501	6.8	34
Ohio	712	6.8	48
Average	607	6.8	53
New York**	1346	6.8	92

* Assumes 100,000 Btuh heating capacity

** This is an average but the manual also offers city-specific EFLH estimates (Rochester is 1473).

Here we see that the savings estimates of other states are generally lower than those used by New York. While New York's colder climate explains some of this, the much higher estimates of EFLH used by New York are out of proportion to the difference in climate. For instance, New York's climate has, on average, seven percent more heating degree days (HDD) than Massachusetts (7,015 HDD compared to 6,524 for Mass.), but the savings estimate used is 19 percent higher.

None of these states/regions distinguish between thermostats installed along with new heating systems and those installed independently. However, the Mid Atlantic states require that the thermostat be installed and programmed by a professional.

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[29] *2004/2005 Statewide Residential Retrofit Single-Family Energy Efficiency Rebate Evaluation.* Prepared for California's Investor-Owned Utilities by Itron, Inc., 2007.

[30] *Measuring the Usability of Programmable Thermostats.* Lawrence Berkeley National Laboratories. From CS Week: April 25, 2011.

[31] *Validating the Impact of Programmable Thermostats*. Prepared for the GasNetworks by the RLW Analytics. January 2007.

5.2.3.3 DNV KEMA Billing Analysis Results

The billing analysis performed for this evaluation did not find any meaningful results for setback thermostats due to the limited sample size of customers who installed furnaces and boilers but did not install setback thermostats. In effect, the billing analysis captures savings for setback thermostats along with furnaces / boilers.

5.2.3.4 Recommendations

All of the state/regional TRMs listed above, including New York, rely on the same 2007 GasNetworks billing analysis for their savings estimates for the setback thermostats. However, several issues call into question the accuracy of the 2007 GasNetworks study and its applicability to the NYSEG/RG&E program as currently used.

5.2.3.4.1 Questions about the accuracy of the 2007 GasNetworks study

Regarding the study's accuracy, we see two issues that call the study's savings into question.

1. *There are self-selection effects that the GasNetworks analysis is not accounting for.* Those customers who purchase a setback thermostat represent a group of people seeking a setback thermostat. It is likely that such people are more likely to pay attention to heating energy usage than those who are not seeking setback thermostats Therefore the net energy savings produced by the GasNetworks billing analysis is likely a combination of savings attributable to the use of the new setback thermostat along with savings resulting from the fact that people who seek such thermostats are likely more energy-conscious to begin with than those who do not seek such thermostats.

2. *While the GasNetworks study found a considerable energy savings for this measure (75 therms and 80 therms if one adjusts for New York weather differences)*[32]*, others studies mentioned in our literature review did not find any savings for this measure.* The DNV KEMA billing analysis found savings of 97-99 therms for furnaces and setback thermostats combined and it is unlikely that the thermostats account for 80 percent of these savings. The studies cited do not provide any evidence that savings differ between thermostats installed with a new heating system versus those installed independently.

5.2.3.4.2 Questions about the applicability of the 2007 GasNetworks study

[32] This value comes from adjusting the GasNetworks study results (75 therms per unit based on Massachusetts' climate) to match New York's climate. New York State, on average, experiences seven percent more heating degree days (HDD) than Massachusetts (7,015 HDD compared to 6,524 for Mass.), thus warranting the higher value.

Concerning the applicability of this study to NYSEG/RG&E, two issues arise.

1. *This study dealt with customers who got a setback thermostat that had not been installed along with a furnace/boiler upgrade.* This creates problems for applying these savings estimates to the NYSEG/RG&E program scenario where all the participants had their setback thermostats installed with the furnace/boiler upgrade for the following reasons:
   - People who choose to get a setback thermostat on their own accord (the GasNetworks participants) are likely different in terms of their willingness to use a setback thermostat in an energy-saving manner than those who got a setback thermostat because it was installed along with their furnace/boiler upgrade (RG&E/NYSEG program participants).
   - The GasNetworks analysis is not accounting for any interactive effects, such as takeback, between the setback thermostats and the new furnace/boiler. However, the NYSEG/RG&E program must account for these interactive effects.
2. *Since the 2007 GasNetworks study, setback thermostats have become more commonly installed.* For example, in a recent Michigan energy efficiency program evaluation we completed we found that the percentage of participants who said that their rebated setback thermostat replaced an existing setback thermostat increased from 35 percent in 2010 to 56 percent in 2011. Similarly the percentage of NYSEG/RG&E participants who reported replacing a setback thermostat with a setback thermostat increased from 49 percent for the 2009-2010 program participants to 59 percent for the 2010-2011 program participants.

5.2.3.4.3 Conclusion

For these reasons, DNV KEMA recommends that the program stop claiming separate savings for setback thermostats installed along with a new furnace or boiler, and use the results of the billing analysis which roll savings for setback thermostats in with furnace /boiler savings. The analysis done for this evaluation did not provide enough information to justify a claim for independent savings for setback thermostats, either installed by themselves or along with a furnace or boiler.[33] We do not mean to suggest that no savings exist, only that the conflicting nature of the data and of other studies prevents us from making an accurate estimate.

Since no other state/regional TRMs claim cooling savings, and no studies could be found which suggest cooling savings are to be had in northern climates, we recommend that the program abandon the cooling energy savings portion of this calculation. In addition, data reviewed from 2009-2011 do not show any

[33] It is extraordinarily difficult to tease out thermostat savings independent from heating system savings when installed simultaneously, so there may never be a billing analysis-determined savings value for thermostats installed with new heating systems.

setback thermostats controlling heat pumps or electric resistance heating. Since none of these measures were installed, we did not attempt to determine electrical heating energy savings.

In the future, DNV KEMA recommends that the program consider initiating a study designed to overcome the selection bias and account for the replacement of existing setback thermostats with new. The program may also consider rebating the new self-programming thermostats currently on the market, which attempt to overcome some of the behavior limitations of existing thermostat replacement programs identified by the studies listed above. Savings for these thermostats would also have to be justified, however.

5.2.4 Boiler Reset Controls

Only four customers installed boiler reset measures in 2010-2011. Therefore this measure does not warrant review at this time.

5.3 Duct Insulation and Sealing

No customers implemented this measure in 2010-2011. Therefore this measure does not warrant review at this time.

A. Participant Survey Sampling Plan

Acrobat Document

B. Participant Survey Instrument

INTRODUCTION

Intro 1. Hello, this is _____, calling on behalf of [New York State Electric & Gas/ Rochester Gas & Electric]. According to our records in [PROGRAM YEAR] your household purchased a <EQUIPMENT1> and [IF APPLICABLE] <EQUIPMENT2> <EQUIPMENT3> <EQUIPMENT4>which received a rebate/rebates from a [NYSEG/RG&E] program that provides rebates for energy efficient furnaces, boilers, water heaters, and thermostats. May I please speak to a person who is familiar with the purchase of that/those <EQUIPMENT1> and [IF APPLICABLE] <EQUIPMENT2> <EQUIPMENT3> <EQUIPMENT4>?

1	[[IF CONTACT FAMILIAR WITH EQUIPMENT PURCHASE IS ONE ANSWERING PHONE]	Intro2
2	[[IF CONTACT FAMILIAR WITH EQUIPMENT PURCHASE IS IDENTIFIED, BUT IS NOT ONE ANSWERING PHONE]	Intro3
3	[IF NO CONTACT FAMILIAR WITH EQUIPMENT PURCHASE IS IDENTIFIED	[THANK AND TERMINATE]
-98	[Refused]	Intro4

Intro.2 [NYSEG/RG&E] periodically surveys participants in its energy efficiency programs to learn how to improve them. So I would like to ask you a few questions about the rebate program you participated in. [IF RESPONDENT CONSENTS, SKIP TO NEXT SECTION]

[IF CUSTOMER ASKS] “This survey will take less than 15 minutes to complete”]

Intro3. Could I speak with <PERSON IDENTIFIED IN Intro1> **now?**

1	[Yes]	Intro1
2	[No]	Intro4
-97	[Don’t know]	Intro4
-98	[Refused]	Intro4

Intro4. When is a good time I could call back to reach <PERSON IDENTIFIED IN Intro1>**?**

	[RECORD DAY and TIME]	Call back later
-98	[Refused]	Call back later
-97	[Don’t know]	Call back later

VERIFICATION OF EQUIPMENT INSTALLED

First I would like to ask you a few questions about the replacement of your <EQUIPMENT1>

[PROGRAMMER NOTE: THIS BATTERY OF V QUESTIONS SHOULD BE REPEATED FOR EACH EQUIPMENT TYPE THE RESPONDENT RECEIVED A REBATE FOR]

V1. [NYSEG/RG&E] records show that <QUANTITY1> <EQUIPMENT1> **was installed at your home sometime around** <DATE1>**. Is this correct**

1	[Yes]	V4
2	[No]	V2
-97	[Don't know]	V4
-98	[Refused]	V4

V2. What is incorrect about this information? [ALLOW MULTIPLE RESPONSES]

1	[Equipment was never installed]	V3
2	[Incorrect quantity] RECORD CORRECT QUANTITY HERE	V4 once all corrections for V2 have been recorded.
3	[Incorrect date] RECORD CORRECT DATE HERE	V4 once all corrections for V2 have been recorded.
4	[Other incorrect information] RECORD RESPONSE	V4 once all corrections for V2 have been recorded.
-97	[Don't know]	V4
-98	[Refused]	V4

V3. Why wasn't this <EQUIPMENT1>**installed?**

1	[RECORD RESPONSE]	V4
-97	[Don't know]	V4
-98	[Refused]	V4

V4. Do you know the approximate age of the <EQUIPMENT1> **you replaced?**

1	[Yes]	V5
2	[No]	V6
-97	[Don't know]	V6
-98	[Refused]	V6

V5. About how many years old was it?

1	[RECORD AGE]	V6
-97	[Don't know]	V6
-98	[Refused]	V6

V6. [ASK ONLY IF <EQUIPMENT1> = FURNACE OR BOILER OR WATER HEATER ELSE SKIP TO V7] **Which of the following best describes the condition of your**

<FURNACE/BOILER/WATER HEATER> **before it was replaced?** [READ UNBRACKETED RESPONSES ONLY]

1	Not functioning at all?	V6A
2	Still functioning but with significant performance or maintenance problems?	V6A
3	Still functioning well but old enough that you wanted to replace it before it became unreliable or cost too much to operate?	V6A
4	Functioning well	V6A
5	[Other] [RECORD RESPONDENT"s ALTERNATIVE VERBATIM DESCRIPTION]	V6A
-97	[Don't know]	V6A
-98	[Refused]	V6A

V6A. In terms of its heating capacity, was your previous <FURNACE/BOILER/WATER HEATER> **larger, smaller, or about the same size as the** <FURNACE/BOILER/WATER HEATER> **you recently had installed?**

1	[Larger]	V7
2	[Smaller]	V7
3	[About the same size]	V7
-97	[Don't know]	V7
-98	[Refused]	V7

V7. According to our information you are currently using natural gas as your primary heating fuel, is that correct?

1	[Yes]	V8
2	[No] What fuel are you currently using as your primary heating fuel? [RECORD RESPONSE]	V8
-97	[Don't know]	V8
-98	[Refused]	V8

V8. Before you had your <EQUIPMENT> **replaced, was natural gas your primary heating fuel?**

1	[Yes]	• IF OTHER REBATED EQUIPMENT= FURNACE, BOILERS, OR WATER HEATERS, REPEAT V1-V6A, • IF OTHER REBATED EQUIPMENT = PROGRAMMABLE THERMOSTATS, BOILER RESET CONTROL, OR DUCT SEALING JOB REPEAT V1-V3. • IF NO OTHER
2	[No] What fuel were you previously using as your primary heating fuel? [RECORD RESPONSE]	
-97	[Don't know]	

		REBATED EQUIPMENT, SKIP TO PA1
-98	[Refused]	

PROGRAM AWARENESS, PRELIMINARY ATTRIBUTION

PA1. Were you aware that you received a rebate from the [NYSEG/RG&E] Residential Natural Gas Equipment Program for <EQUIPMENT1, EQUIPMENT2, ETC.>**?**

1	[Yes]	PA2
2	[No]	PA5
-97	[Don't know]	PA5
-98	[Refused]	PA5

PA2. How did you first become aware of these [NYSEG/RG&E] rebates for residential natural gas equipment? [ONLY ALLOW ONE RESPONSE]

1	[Heating/plumbing/HVAC contractor]	PA3
2	[Word of mouth (neighbor, friend, relative, etc)].	PA3
3	[Utility website]	PA3
4	[Utility mailing]	PA3
5	[Newspaper]	PA3
6	[Radio/TV]	PA3

7	[Other] (Specify:_____)	PA3
-97	[Don't know]	PA4
-98	[Refused]	PA4

PA3. What were some other ways you heard about these rebates? [ALLOW MULTIPLE RESPONSES]

1	[No other ways]	PA3A
2	[Heating/plumbing/HVAC contractor]	PA3A
3	[Word of mouth (neighbor, friend, relative, etc)].	PA3A
4	[Utility website]	PA3A
5	[Utility mailing]	PA3A
6	[Newspaper]	PA3A
7	[Radio/TV]	PA3A
8	[Other] (Specify:_____)	PA3A
-97	[Don't know]	PA3A
-98	[Refused]	PA3A

PA3A. [IF PA2 ≠ -97, -98 AND PA3 ≠ 1, -97, -98] You cited [RESPONSE FROM PA2] **and** [RESPONSE(S) FROM PA3] **as ways you heard about these rebates. Which of these sources of information was most influential in encouraging you to take advantage of these rebates?** [ALLOW ONLY ONE RESPONSE].

1	[Heating/plumbing/HVAC contractor]	PA4
2	[Word of mouth (neighbor, friend, relative, etc)].	PA4
3	[Utility website]	PA4
4	[Utility mailing]	PA4
5	[Newspaper]	PA4
6	[Radio/TV]	PA4
7	[Other] (Specify:_____)	PA4
-97	[Don't know]	PA4
-98	[Refused]	PA4

PA4. [SKIP TO DAT0 IF FURNACE = 0 AND BOILER = 0. SKIP TO PA5 IF PA2 = 1] **Were you aware of these [NYSEG/RG&E] rebates before you contacted a contractor about getting your <furnace/boiler> replaced?**

1	[Yes]	PA5
2	[No]	PA5
-97	[Don't know]	PA5

-98	[Refused]	PA5

PA5. Why did you have your <furnace/boiler> replaced? [DONT READ RESPONSES BUT ALLOW MULTIPLE REASONS]

1	[It was not functioning at all]	PA6
2	[It was still functioning but with significant performance or maintenance problems]	PA6
3	[It was too expensive to operate/Not energy efficient]	PA6
4	[Our HVAC contractor/plumber recommended it]	PA6
5	[We were doing a major renovation in our house]	PA6
6	[Other] [RECORD RESPONSE]	PA6
-97	[Don't know]	PA6
-98	[Refused]	PA6

PA6. Before speaking to your heating contractor, did you have any type or model of <furnace/boiler> in mind?

1	[Yes]	PA7
2	[No]	PA7A
-97	[Don't know]	PA7A

-98	[Refused]	PA7A

PA7. What type or model of <furnace/boiler> did you have in mind? [DON'T READ. ALLOW MULTIPLE RESPONSES]

1	[Something similar to what he had before]	PA7A
2	[An energy-efficient model]	PA7A
3	[Reliable model/ one with good warranty]	PA7A
4	[A certain brand]	PA7A
5	[An inexpensive model	PA7A
6	[A larger model/ One with more heating capacity than we had before]	PA7A
7	[A smaller model/ One with less heating capacity than we had before]	PA7A
8	[A quiet model]	PA7A
9	[Other] [RECORD RESPONSE]	PA7A
-97	[Don't know]	PA7A
-98	[Refused]	PA7A

PA7A. What role, if any, did your contractor play in helping you select the <furnace/boiler> that you installed? [DON'T READ. ALLOW MULTIPLE RESPONSES]

1	[No role]	PA7B
2	[Provided cost estimates/bids]	PA7B
3	[Recommended specific equipment/brand]	PA7B
4	[Recommended high efficiency model]	PA7B
5	[Identified equipment eligible for rebates]	PA7B
6	[Informed us about [NYSEG/RG&E] program	PA7B
7	[Encouraged us to replace equipment when we did]	PA7B
8	[Helped estimate energy savings]	PA7B
9	[Provided info about comfort levels of different systems]	PA7B
10	[Provided info about reliability of different systems]	PA7B
11	[Helped estimate Return-on-Investment (ROI) or payback]	PA7B
12	[Other] [RECORD RESPONSE]	PA7B
-97	[Don't know]	PA7B
-98	[Refused]	PA7B

PA7B. What features, if any, of the <furnace/boiler> that you selected did your contractor emphasize? [DON'T READ. ALLOW MULTIPLE RESPONSES]

1	[No features]	PA7C
2	[Cheap, low price]	PA7C
3	[Energy efficient]	PA7C
4	[Quiet]	PA7C
5	[Good warranty/reliability]	PA7C
6	[Certain brand]	PA7C
7	[Easy to use]	PA7C
8	[Other] [RECORD RESPONSE]	PA7C
-97	[Don't know]	PA7C
-98	[Refused]	PA7C

PA7C. What were the two or three features of the <furnace/boiler> that made the most difference in what you selected? [DON'T READ. ALLOW MULTIPLE RESPONSES]

1	[No features]	PA8
2	[Cheap, low price]	PA8
3	[Energy efficient]	PA8
4	[Quiet]	PA8

5	[Good warranty/reliability]	PA8
6	[Certain brand]	PA8
7	[Easy to use]	PA8
8	[Other] [RECORD RESPONSE]	PA8
-97	[Don't know]	PA8
-98	[Refused]	PA8

PA8. Did the heating contractor who installed your <furnace/boiler> present you with multiple models of <furnaces/boilers> to choose from?

1	[Yes]	PA9
2	[No]	PA10
-97	[Don't know]	PA10
-98	[Refused]	PA10

PA9. Did the heating contractor who installed your <furnace/boiler> present you with price quotes for these various options?

1	[Yes]	PA10
2	[No]	PA10
-97	[Don't know]	PA10

-98	[Refused]	PA10

PA10. Do you know the average cost difference between the high efficiency <furnace/boiler> you had installed and a standard efficiency model?

1	[Yes]	PA11
2	[No]	PA12
-97	[Don't know]	PA12
-98	[Refused]	PA12

PA11. What is the average cost difference between your high efficiency model and the standard efficiency model? [Interviewer note: Keep in mind we want the difference in price between high efficiency and standard efficiency model – **NOT** the estimated purchase price of either model]

1	[RECORD RESPONSE IN DOLLARS] $____	PA12
2	[No]	PA12
-97	[Don't know]	PA12
-98	[Refused]	PA12

PA12. You had a [furnace/boiler] installed that was much more energy-efficient than standard models. What were some reasons why you chose to go with this high efficiency <furnace/boiler>? [DON'T READ OPTIONS BUT ALLOW MULTIPLE RESPONSES]

1	[Our HVAC contractor/plumber recommended it]	PA13

2	[We wanted to reduce our utility/energy bills]	PA13
3	[We wanted a rebate from [NYSEG/RG&E]]	PA13
4	[We wanted to help the environment/ Reduce global warming]	PA13
5	[Other] [RECORD RESPONSE]	PA13
-97	[Don't know]	DAT0
-98	[Refused]	DAT0

PA13. [IF THEY NAMED ONLY 1 REASON IN RESPONSE TO QPA12, SKIP TO NEXT SECTION] **You cited multiple reasons for doing this including** [READ RESPONSES FROM PA12]. **Which of these reasons would be your most important?**

1	[Our HVAC contractor/plumber recommended it]	PA14
2	[We wanted to reduce our utility/energy bills]	PA14
3	[We wanted a rebate from [NYSEG/RG&E]]	PA14
4	[We wanted to help the environment/ Reduce global warming]	PA14
5	[Other] [RECORD RESPONSE]	PA14
-97	[Don't know]	DAT0
-98	[Refused]	DAT0

PA14. [IF THEY CITED ONLY 2 REASONS IN RESPONSE TO QPA12, SKIP TO NEXT SECTION] **Which of these reasons would be your most second-most important reason** [IF NECESSARY READ LIST OF REASONS FROM PA2]**?**

1	[Our HVAC contractor/plumber recommended it]	DAT0
2	[We wanted to reduce our utility/energy bills]	DAT0
3	[We wanted a rebate from [NYSEG/RG&E]]	DAT0
4	[We wanted to help the environment/ Reduce global warming]	DAT0
5	[Other] [RECORD RESPONSE]	DAT0
-97	[Don't know]	DAT0
-98	[Refused]	DAT0

DIRECT ATTRIBUTION

[PROGRAMMER NOTE: THIS BATTERY OF DAT QUESTIONS SHOULD BE REPEATED FOR EACH EQUIPMENT TYPE THE RESPONDENT RECEIVED A REBATE FOR]

WORDING1 = <IF EQUIPMENT1 = <FURNACE/BOILER>, SAY: "A <FURNACE/BOILER> THAT IS MUCH MORE ENERGY EFFICIENT THAN STANDARD MODELS.">

WORDING2 = <IF EQUIPMENT1> = <PROGRAMMABLE THERMOSTAT, INDIRECT WATER HEATER, BOILER RESET CONTROL, DUCT SEALING JOB>, SAY: "A NEW < PROGRAMMABLE THERMOSTAT/ INDIRECT WATER HEATER/ BOILER RESET CONTROL/ DUCT SEALING JOB">

[NOTE TO PROGRAMMER: IF RESPONDENT HAD BOTH BOILER/FURNACE AND PROGRAMMABLE THERMOSTAT INSTALLED, REPEAT DAT SEQUENCE FOR EACH ONE OF THESE MEASURES]

DAT0. Next, I'd like to know about the effect, if any, that <RG&E's/NYSEG's> Gas Furnace Rebate Program had on your decision to install <WORDING1/WORDING2>. [IF EQUIPMENT1 = <FURNACE/BOILER, ADD: "AND JUST TO BE CLEAR, I'M NOT TALKING ABOUT ANY FURNACE/BOILER. I'M TALKING ABOUT WORDING1] **If you had not received the rebate or any other assistance or information from this <RG&E/NYSEG> program would you say that it was "very likely," "somewhat likely," "not very likely," or "not at all likely" that you would have had <WORDING1/WORDING2> installed?**

1	Very unlikely	DAT1a
2	Not very likely	DAT1a

3	Somewhat likely	DAT1a
4	Or very likely	DAT1a
-97	[Don't know]	DAT1a
-98	[Refused]	DAT1a

TIMING

DAT1a. I'd like to know about the effect, if any, that the rebate from the <RG&E/NYSEG> Gas Furnace Rebate Program had on your decision to purchase <WORDING1/WORDING2> when you did. Without the rebate would you have purchased the <EQUIPMENT 1> at the same time, earlier, later, or never?

1	At the same time	DAT1a_conf_1
2	Earlier	DAT1a_conf_1
3	Later	DAT1a_conf_1
4	Never	DAT1a_conf_1
-97	[Don't know]	DAT1a_conf_1
-98	[Refused]	DAT1a_conf_1

NOTE: DAT1a_conf1 and DAT1a_conf2 are confirmation questions to clarify why a respondent gave contradictory responses to DAT0 and DAT1a

DAT1a_conf1. [IF DAT0 = 4 very unlikely AND DAT1a = 1 same time ELSE SKIP TO DAT1a_conf2] **I'd just like to confirm, you said that without the program, you were very unlikely to purchase an** <WORDING1/WORDING2> **at all and, if you had, you would have done it at about the same time as you actually did? Is that correct?**

1	[Yes]	DAT1b
2	[No]	DAT0
-97	[Don't know]	DAT0
-98	[Refused]	DAT0

DAT1a_conf2. [IF DAT0 = 1 very likely AND DAT1a = 4 never ELSE SKIP TO DAT1b] **I'd just like to confirm, you said that without the program, you were very likely to purchase** <WORDING1/WORDING2>**? Is that correct?**

1	[Yes]	DAT1b
2	[No]	DAT0
-97	[Don't know]	DAT0
-98	[Refused]	DAT0

DAT1b. [IF DAT1a ≠ 3, SKIP TO DAT2a] **Approximately how many months later?**

	[RECORD # months]	**DAT2a**
-97	**[Don't know]**	**DAT2a**

-98	**[Refused]**	**DAT2a**

DAT2a. [SKIP to DAT3 if <EQUIPMENT1><EQUIPMENT2>OR<EQUIPMENT3>OR<EQUIPMENT4> = PROGRAMMABLE THERMOSTAT, INDIRECT WATER HEATER, BOILER RESET CONTROL, OR DUCT SEALING JOB>**] Next, I'd like to know about the effect, if any, that program rebates had on your decision to purchase a *high efficiency* <FURNACE/BOILER>.**

Without the program would you have purchased a <FURNACE/BOILER > **of the same efficiency, lesser efficiency, or greater efficiency?**

1	[Same efficiency]	DAT2a_O
2	[Lesser efficiency]	DAT2a_O
3	[Greater efficiency]	DAT2a_O
-97	[Don't know]	DAT2b
-98	[Refused]	DAT2b

DAT2a_O. Why do you say that?

	[RECORD RESPONSE VERBATIM]	**DAT2b**
-97	**[Don't know]**	**DAT2b**
-98	**[Refused]**	**DAT2b**

DAT2b. [IF DAT2a ≠ 2 LESSER EFFICIENCY, SKIP TO DAT3] **Without the program, would you have purchased a** <FURNACE/BOILER> **that was**

"standard efficiency on the market at that time,"

"slightly higher than standard efficiency",

"between standard efficiency and the efficiency that you purchased,"

or "slightly lower than the high efficiency that was purchased?"

1	**[Standard efficiency on the market at time]**	**DAT3**
2	**[Slightly higher than standard efficiency]**	**DAT3**
3	**[Between standard efficiency and what purchased]**	**DAT3**
4	**[Slightly lower than the high efficiency purchased]**	**DAT3**
-97	**[Don't know]**	**DAT3**
-98	**[Refused]**	**DAT3**

DAT3. [IF EQUIPMENT1 = FURNACE/BOILER SKIP TO DAT4] Finally, I'd like to know about the effect, if any, that program incentives and services had on the quantity of <PLURAL OF EQUIPMENT1> that you purchased. Without the program would you have purchased the same number of < PLURAL OF EQUIPMENT1> as you did, fewer < PLURAL OF EQUIPMENT1> than you did, more < PLURAL OF EQUIPMENT1>, or none at all?

1	**[Same number/size]**	**DAT4**
2	**[Fewer/smaller]**	**DAT3a**
3	**[More/larger]**	**DAT3a**
4	**[None at all]**	**DAT4**
-97	**[Don't know]**	**DAT4**

-98	**[Refused]**	**DAT4**

DAT3a. **[**IF DAT3 = 1 same number/size or 4 none at all, SKIP TO DAT4] **You purchased <QUANTITY1> <EQUIPMENT1>. If the program and its rebates did not exist, how many < PLURAL OF EQUIPMENT1> would you have purchased?**

	[RECORD NUMBER]	**DAT4**
-97	**[Don't know]**	**DAT4**
-98	**[Refused]**	**DAT4**

DAT4. We've just discussed the different effects that the program had on your decisions regarding the purchase of <EQUIPMENT1>. Please summarize in your own words how the program might have influenced the timing, efficiency, or quantity of the new <EQUIPMENT1> that you purchased.

	[RECORD RESPONSE VERBATIM]	**B1**
-97	**[Don't know]**	**B1**
-98	**[Refused]**	**B1**

Possible Behavioral Changes, Housing Changes

B1. Since you had the new <FURNACE/BOILER> **installed, have you made any major changes in your home such as new additions, major renovations, new windows or insulation, etc.?** [NOTE: IF

THE RESPONDENT ASKS WHY WE ARE ASKING THIS QUESTION, EXPLAIN THAT MAJOR CHANGES IN A HOME CAN IMPACT ENERGY CONSUMPTION PATTERNS.]

1	[Yes]	B2
2	[No]	B3
-97	[Don't know]	B3
-98	[Refused]	B3

B2. Please briefly describe these changes to your home?

	[RECORD RESPONSE VERBATIM]	**B3**
-97	**[Don't know]**	**B3**
-98	**[Refused]**	**B3**

B3. Since you had the new <FURNACE/BOILER> **installed, have there been any changes in the number of people living in your home at least three months of the year?** [NOTE: IF THE RESPONDENT ASKS WHY WE ARE ASKING THIS QUESTION, EXPLAIN THAT CHANGES IN A HOME'S OCCUPANCY LEVELS CAN IMPACT ENERGY CONSUMPTION PATTERNS.]

1	[Yes]	B4
2	[No]	B5
-97	[Don't know]	B5
-98	[Refused]	B5

B4. Has the number of people living in your house increased or decreased?

1	[Increased]	B5
2	[Decreased]	B5
-97	[Don't know]	B5
-98	[Refused]	B5

B5. Since you installed the new <FURNACE/BOILER>**, have you changed the way you set your thermostat at your home during the heating season?**

1	[Yes]	B6
2	[No]	B11
-97	[Don't know]	B11
-98	[Refused]	B11

B6. Overnight, would you say you set the temperature warmer, cooler, or about the same as you did before installing the new <FURNACE/BOILER>**?**

1	[Warmer]	B7
2	[Cooler]	B7
3	[About the same]	B7

-97	[Don't know]	B7
-98	[Refused]	B7

B7.During the daytime when the building is occupied, would you say you set the temperature warmer, cooler, or about the same as you did before installing the new <FURNACE/BOILER>**?**

1	[Warmer]	B8
2	[Cooler]	B8
3	[About the same]	B8
-97	[Don't know]	B8
-98	[Refused]	B8

B8. During the daytime when the building is unoccupied, would you say you set the temperature warmer, cooler, or about the same as you did before installing the new <<FURNACE/BOILER>>**?**

1	[Warmer]	B9
2	[Cooler]	B9
3	[About the same]	B9
-97	[Don't know]	B9
-98	[Refused]	B9

B9. On average, would you say you set the temperature warmer, cooler, or about the same as you did before installing the new <<FURNACE/BOILER>>**?**

1	[Warmer]	B10
2	[Cooler]	B10
3	[About the same]	B11
-97	[Don't know]	B11
-98	[Refused]	B11

B10.Why did you change the way you set your thermostat?

1	Got a new/programmable thermostat	B11
2	[New setting/temperature felt the same as the old setting	B11
3	[Our new furnace/boiler costs less to run so we can keep temperature higher]	B11
4	[Natural gas costs less now]	B11
5	[Other] [RECORD REASON]	B11
-97	[Don't know]	B11
-98	[Refused]	B11

B11. [IF EQUIPMENT1 OR EQUIPMENT2 OR EQUIPMENT3 OR EQUIPMENT4 = PROGRAMMABLE THERMOSTAT ELSE SKIP TO WH1] **You had a programmable thermostat installed through this rebate program. Was your previous thermostat a programmable thermostat also?**

1	[Yes]	B12
2	[No]	B12
-97	[Don't know]	B12
-98	[Refused]	B12

B12. [IF EQUIPMENT1 OR EQUIPMENT2 OR EQUIPMENT3 OR EQUIPMENT4 = FURNACE WITH ECM ELSE SKIP TO WH1] **During the heating season do you run your furnace fan all the time?**

1	[Yes]	B13
2	[No]	B13
-97	[Don't know]	B13
-98	[Refused]	B13

B13. Did you run your furnace fan all the time with your previous furnace?

1	[Yes]	WH1
2	[No]	WH1
-97	[Don't know]	WH1

-98	[Refused]	WH1

INDIRECT WATER HEATERS

WH1. [IF EQUIPMENT 1 OR EQUIPMENT 2 OR EQUIPMENT3 OR EQUIPMENT4 = INDIRECT WATER HEATER ELSE SKIP TO S0] **Was your previous water heater a conventional water heater with a tank?**

1	[Yes]	WH3
2	[No]	WH2
-97	[Don't know]	WH3
-98	[Refused]	WH3

WH2. What kind of water heater was it?

1	[A tankless water heater]	WH3
2	[A solar water heater]	WH3
3	[A heat pump water heater]	WH3
77	[Other] Specify	WH3
-97	[Don't know]	WH3
-98	[Refused]	WH3

WH3. What fuel did your previous water heater use?

1	[Natural gas]	WH4
2	[Electricity]	WH4
3	[Propane]	WH4
4	[The sun/solar]	WH4
77	[Other] Specify	WH4
-97	[Don't know]	WH4
-98	[Refused]	WH4

WH4. How hard was it to find a contractor or store that carried the indirect water heater you had installed? Would you say it was very difficult, somewhat difficult, somewhat easy, or very easy?

1	[Very difficult]	S0
2	[Somewhat difficult]	S0
3	[Somewhat easy]	S0
4	[Very easy]	S0
-97	[Don't know]	S0
-98	[Refused]	S0

PROGRAM SATISFACTION

S0. Next I have some questions about how satisfied you are with different aspects of the [NYSEG/RG&E] Residential Natural Gas Equipment Program. For all of these questions, use a 5 point scale where 5 means very satisfied and 1 means very *dis*satisfied

S1. How satisfied or dissatisfied are you with the <EQUIPMENT1> you had installed? [REPEAT QUESTION FOR EACH TYPE OF REBATE EQUIPMENT INSTALLED]

1	Not at all satisfied	S1b
2		S1b
3		S1b
4		S2
5	Very satisfied	S2
-97	[Don't know]	S2
-98	[Refused]	S2

S1b. Why do you say that? [REPEAT QUESTION FOR EACH TYPE OF REBATE EQUIPMENT INSTALLED]

	[RECORD VERBATIM]	S2
-97	[Don't know]	S2
-98	[Refused]	S2

S2. How about the dollar amount of the rebate? [REPEAT SCALE IF NECESSARY]

1	Not at all satisfied	S2b
2		S2b
3		S2b
4		S3
5	Very satisfied	S3
-97	[Don't know]	S3
-98	[Refused]	S3

S2b. Why do you say that?

	[RECORD VERBATIM]	S3
-97	[Don't know]	S3

-98	[Refused]	S3

S3. How satisfied were you with the timeliness of the rebate payment?

1	Not at all satisfied	S3b
2		S3b
3		S3b
4		S4
5	Very satisfied	S4
-97	[Don't know]	S4
-98	[Refused]	S4

S3b. Why do you say that?

	[RECORD VERBATIM]	S4
-97	[Don't know]	S4
-98	[Refused]	S4

S4. How about the rebate application forms and other paperwork?

0	[Did not fill out rebate paperwork]	S5
1	Not at all satisfied	S4b
2		S4b
3		S4b
4		S5
5	Very satisfied	S5
-97	[Don't know]	S5
-98	[Refused]	S5

S4b. Why do you say that?

	[RECORD VERBATIM]	S5
-97	[Don't know]	S5
-98	[Refused]	S5

S5. How satisfied are you with the program as a whole?

1	Not at all satisfied	S5b

2		S5b
3		S5b
4		S6
5	Very satisfied	S6
-97	[Don't know]	S6
-98	[Refused]	S6

S5b. Why do you say that?

	[RECORD VERBATIM]	S6
-97	[Don't know]	S6
-98	[Refused]	S6

S6. What, if anything, could <NYSEG/RG&E> do to get more people to participate in the rebate program?

	[RECORD VERBATIM]	S7
0	[No suggestions]	S7
-97	[Don't know]	S7

-98	[Refused]	S7

S7. [IF <EQUIPMENT1 = BOILER/ FURNACE ELSE SKIP TO D1] Since having your new [BOILER/FURNACE] have you noticed any reductions in your heating bills?

1	[Yes]	D1
2	[No]	D1
-97	[Don't know]	D1
-98	[Refused]	D1

PARTICIPANT DEMOGRAPHICS

My final questions are about your home and household.

D1. Do you own or rent your home?

1	[Own]	D2
2	[Rent]	D2
-97	[Don't know]	D2
-98	[Refused]	D2

D2. Is your home a single-family house not attached to other houses?

1	[Yes]	D2B
2	[No]	D2A
-97	[Don't know]	D2B
-98	[Refused]	D2B

D2A. How would you describe your home? Stop me when I reach the description that best matches your home [READ ONLY UNBRACKETED RESPONSES]

1	A duplex or other kind of single-family house	D2B

	connected to other houses	
2	A mobile home	D2B
3	A building with 2 apartments	D2B
4	A building with 3 or 4 apartments	D2B
5	A building with 5 or more apartments	D2B
-77	[Other (specify)]	D2B
-97	[Don't know]	D2B
-98	[Refused]	D2B

D2B. Approximately what year was your home built? [READ LIST IF NECESSARY]

1	2005 - 2011 [NEW HOME]	D2C
2	1996 – 2004	D2C
3	1980 – 1995	D2C
4	1960 – 1979	D2C
5	Before 1960	D2C
-97	[Don't know]	D2C
-98	[Refused]	D2C

D2C. Approximately how many square feet in your home are heated? [READ LIST IF NEEDED]

1	1000 square feet or less	D2D
2	Over 1000 to 2000 square feet	D2D
3	Over 2000 to 3000 square feet	D2D
4	Over 3000 to 4000 square feet	D2D
5	Over 4000 square feet or more	D2D
-97	[Don't know]	D2D
-98	[Refused]	D2D

D2D. Do you own any Energy Star appliances?

1	[Yes]	D2E
2	[No]	D3
-97	[Don't know]	D3
-98	[Refused]	D3

D2E. What types of Energy Star appliances do you own? [ALLOW MULTIPLE RESPONSES]

1	[Refrigerator]	D3
2	[Dishwasher]	D3

3	[Clothes Washer]	D3
4	[Clothes Dryer]	D3
-77	[Other (specify)]	D3
-97	[Don't know]	D3
-98	[Refused]	D3

D3. How many months per year is your home occupied?

	[RECORD #]	D4
-97	[Don't know]	D4
-98	[Refused]	D4

D4. Including yourself, and children how many people live in your home at least 6 months per year?

	[RECORD #]	D5a
-97	[Don't know]	D5e
-98	[Refused]	D5e

D5a. How many people are 65 or older?

	[RECORD #]	D5b
-97	[Don't know]	D5b
-98	[Refused]	D5b

D5b. How many people are 19 to 64?

	[RECORD #]	D5c
-97	[Don't know]	D5c
-98	[Refused]	D5c

D5c. How many people are 5 to 18?

	[RECORD #]	D5d
-97	[Don't know]	D5d
-98	[Refused]	D5d

D5d. How many people are less than 5?

	[RECORD #]	D5e
-97	[Don't know]	D5e
-98	[Refused]	D5e

[CHECK THAT SUM OF D5A TO D5D = D4. IF NOT, REPEAT D4 TO D5D.]

D5e. What is *your* age?

	[RECORD #]	D6
-97	[Don't know]	D6
-98	[Refused]	D6

D6. What is the highest level of education you have completed?

1	No schooling	D7
2	Less than high school	D7
3	Some high school	D7
4	High school graduate or equivalent (e.g., GED)	D7
5	Trade or technical school	D7
6	Some college	D7
7	College degree	D7
8	Some graduate school	D7
9	Graduate degree	D7
77	Other (specify_____)	D7
-97	[Don't know]	D7

-98	[Refused]	D7

D7. Which of the following best represents your annual household income from all sources in 2010, before taxes? Was it . . . .?

1	Less than $20,000 per year,	D8
2	$20,000 to less than $50,000,	D8
3	$50,000 to less than $75,000,	D8
4	$75,000 to less than $100,000,	D8
5	$100,000 to less than $150,000,	D8
6	$150,000 to less than less than $200,000 or	D8
7	$200,000 or more?	D8
-97	[Don't know]	D8
-98	[Refused]	D8

D8. RECORD GENDER [DO NOT ASK.]

1	Male	END_1
2	Female	END_1
-97	[Don't know]	END_1

C. Trade Ally Interview Guide

Contact Name:

Company:

Address:

City, State,

Telephone:

Fax Number:

Interview Date:_____ Interview Time: _____

Lead In

Hi, my name is _____ calling on behalf of New York State Electric & Gas and Rochester Gas & Electric. We are talking to contractors and distributors who sell and install residential heating equipment in upstate New York. This is part of an assessment of the NYSEG/RG&E Natural Gas Equipment Rebate Program. May I please speak to the person at this firm who is most familiar with your business affairs, such as an owner or manager?

[IF CORRECT PERSON, CONTINUE]

Name: _____

Title: _____

Phone: _____

[IF NOT] Who would that person be?

Name: _____

Title: _____

Phone: _____

[WHEN CORRECT PERSON]

I would like to ask you some questions about your recent experiences and views on sales of residential heating systems in upstate New York. NYSEG/RG&E will use this information to improve energy efficiency programs for distributors, contractors and consumers. The information we gather will be kept confidential and will not be associated with you or your company in any way.

[IF THEY ASK] The conversation will take about 15 minutes.

SC. SCREENING

SC1. First, I'd just like to confirm, has your business sold at least ten gas-fired boilers or furnaces in upstate New York in the last couple of years.

Yes 1

No 2 [T&T1]

[DON'T KNOW] -97[T&T1]

[REFUSED] -98[T&T1]

[IF RESPONDENT HAS SOLD AT LEAST 10 GAS BOILERS OR FURNACES THEN CONTINUE; OTHERWISE T&T1]

SC2. [FOR INTERVIEWEES FROM THE "NONPARTICIPANT SAMPLE FRAME"] Have you ever sold or installed residential gas heating equipment that received rebates from Rochester Gas and Electric (RG&E) or New York State Electric & Gas (NYSEG)?

Yes 1 [CONTINUE SURVEY ONLY IF QUOTA OF PARTICIPANTS HAS NOT BEEN REACHED. TREAT RESPONDENT AS PARTICIPANT. OTHERWISE GO TO T&T1A]

No 2 [CONTINUE SURVEY. TREAT RESPONDENT AS NONPARTICIPANT]

[DON'T KNOW] -97 [CONTINUE SURVEY. TREAT RESPONDENT AS NONPARTICIPANT]

[REFUSED] -98 [CONTINUE SURVEY. TREAT RESPONDENT AS NONPARTICIPANT]

T&T1. THANK & TERMINATE SCRIPT

"I'm sorry, but we've been asked to interview contractors or distributors that have sold at least 10 gas furnaces or boilers in upstate New York in the last couple of years.. Thank you for your time."

T&T1A. THANK & TERMINATE SCRIPT

"I'm sorry, but we've been asked to interview contractors or distributors that have not participated in the NYSEG and RG&E Natural Gas Equipment Rebate Program. Thank you for your time."

FG. General company information and Firmographics

Next, I'd like to ask for some general information about your company's operations at this location.

FG1. First, what is your job title?

Sales Manager 1

President/CEO 2

General Manager 3

Other [SPECIFY]_____ 4

[DON'T KNOW] -97

[REFUSED] -98

FG2. About how many full-time equivalent (FTE) employees does your company employ at this location?

[RECORD RESPONSE:]_____

FG3. Besides [city mentioned in D&B or tracking data], from what other locations does your firm operate in upstate New York? [INTERVIEWER WILL ALSO CONFIRM ADDRESS FROM D&B OR TRACKING DATA IS CORRECT AT START OF SURVEY.]

[RECORD RESPONSE:]_____

FG3A. [IF MULTIPLE LOCATIONS MENTIONED IN RESPONSE TO FG3] You mentioned your company has multiple locations in upstate New York. Do these locations act independently in terms of their sales and bidding decisions? Or are sales and bidding decisions made at a higher or corporate level? [NOTE: THERE MAY BE OTHER SCENARIOS BESIDES THESE TWO – E.G. SOME DECISIONS ARE MADE LOCALLY WITH OTHERS MADE BY CORPORATE. SO PROBE FOR NUANCES]

FG4. What type of work does your business perform from this location?

[RECORD RESPONSE:]_____

FG4A. Which of the following best describes your firm? [READ LIST. ACCEPT ONLY ONE.]

HVAC contractor? 1

HVAC products distributor? 2

Other [SPECIFY]_____ 3

FG4B. [IF THEY SAID THEY WERE A DISTRIBUTOR IN RESPONSE TO FG4A] Of the following, which best describes your firm's business?

Independent HVAC equipment distributor.....1

Manufacturer-owned or franchise distributor.....2

Independent manufacturers' representative.....3

Other [SPECIFY: _____].....4

Don't know.....-97

Refused.....-98

FG4C. Has your business done any installations of HVAC equipment in upstate New York over the last couple of years?

Yes 1

No 2

[DON'T KNOW]. -97

[REFUSED]. -98

FG5. In the past year about what percent of your revenues from this location came from sales or installations of residential heating equipment?

[ENTER PERCENT] ____

[DON'T KNOW] -97

[REFUSED] -98

FG6. Which of the following residential heating products does your business sell or install from this location? [READ LIST OF UNBRACKETED OPTIONS; ACCEPT MULTIPLE RESPONSES]

Gas Furnaces 1

Gas Water Boilers 2

Gas Steam Boilers 3

Indirect Water Heating Systems 4

Boiler Resets 5

Programmable Thermostats 6

[DON'T KNOW] -97

[REFUSED] -98

FG7. Approximately how many residential gas furnaces did your company sell or install from this location in the past year? [IF NEEDED: YOUR BEST ESTIMATE IS FINE.]

[ENTER AMOUNT] ____

[DON'T KNOW] -97

[REFUSED] -98

FG8. About how many residential gas boilers? [IF NEEDED: YOUR BEST ESTIMATE IS FINE.]

[ENTER AMOUNT] ____

[DON'T KNOW] -97

[REFUSED] -98

FG9. [IF THEY DON'T SELL INDIRECT WATER HEATERS, FG6 ≠ 4] I noticed that you said that you don't sell/install indirect water heaters. Why don't you?

RECORD RESPONSE:]_____

FG10. Does your company offer duct-sealing services or sell duct-sealing equipment?

[Yes] [SKIP TO NEXT SECTION] 1

[No] 2

[DON'T KNOW]. [SKIP TO NEXT SECTION]-97

[REFUSED] [SKIP TO NEXT SECTION]-98

FG11. Why not?

[ENTER RESPONSE]_____ ____

[DON'T KNOW] -97

[REFUSED] -98

EE. The Energy Efficiency of Gas Heating Equipment

Now I'm going to ask you some questions about the energy efficiency of the equipment you sell or install.

EE1. For the following gas equipment types, what **Annual Fuel Utilization Efficiency,** or AFUE levels do you consider to be high efficiency for residential applications?

a. Gas Furnaces: [RECORD RESPONSE]:_____[ENTER -97 FOR DK, -98 FOR REFUSED]

b. Gas Hot Water Boilers [RECORD RESPONSE]: _____[ENTER -97 FOR DK, -98 FOR REFUSED]

c. Gas Steam Boilers [RECORD RESPONSE]: _____ [ENTER -97 FOR DK, -98 FOR REFUSED]

EE2.

a. Currently about what percentage of the residential gas furnaces that your company sells or installs in upstate New York have an AFUE of 90% or higher? [FILL RESPONSES IN TABLE BELOW]

b. About what percent of these 90% AFUE furnace received rebates from either RG&E or NYSEG? [FILL RESPONSES IN TABLE BELOW]

c. Two years ago about what percentage of your residential furnaces sales or installations in upstate New York had AFUEs of 90% or higher? Your best estimate is fine. [FILL RESPONSES IN TABLE BELOW]

EE3.

a. Currently about what percentage of the residential gas furnaces that your company sells or installs in upstate New York have an AFUE of 92% or higher? [FILL RESPONSES IN TABLE BELOW] [NOTE: THE % OF FURNACES WITH AFUEs OF 92+% SHOULD BE A SUBSET

OF THE % OF FURNACES WITH AFUEs OF 90+%, SO THE % GIVEN FOR EE3A SHOULD BE SMALLER THAN THAT GIVEN FOR EE2A. IF THIS IS NOT TRUE THEN THE INTERVIEWER SHOULD EXPLAIN THE DISCREPANCY TO THE RESPONDENT AND GET THE CORRECT ANSWER]

b. About what percent of these 92% AFUE furnace received rebates from either RG&E or NYSEG? [FILL RESPONSES IN TABLE BELOW]

c. Two years ago about what percentage of your residential furnaces sales or installations in upstate New York had AFUEs of 92% or higher? Your best estimate is fine. [FILL RESPONSES IN TABLE BELOW. THE % GIVEN FOR EE3C SHOULD BE SMALLER THAN THAT GIVEN FOR EE2C]

EE4.

a. Currently about what percentage of the residential gas furnaces that your company sells or installs in upstate New York have an AFUE of 94% or higher? [FILL RESPONSES IN TABLE BELOW] [NOTE: THE % OF FURNACES WITH AFUEs OF 94+% SHOULD BE A SUBSET OF THE % OF FURNACES WITH AFUEs OF 90+% AND 92+%, SO THE % GIVEN FOR EE3A SHOULD BE SMALLER THAN THAT GIVEN FOR EE2A AND EE3A. IF THIS IS NOT TRUE THEN THE INTERVIEWER SHOULD EXPLAIN THE DISCREPANCY TO THE RESPONDENT AND GET THE CORRECT ANSWER]

b. About what percent of these 94% AFUE furnace received rebates from either RG&E or NYSEG? [FILL RESPONSES IN TABLE BELOW]

c. Two years ago about what percentage of your residential furnaces sales or installations in upstate New York had AFUEs of 94% or higher? Your best estimate is fine. [FILL RESPONSES IN TABLE BELOW. THE % GIVEN FOR EE4C SHOULD BE SMALLER THAN THAT GIVEN FOR EE3C]

	a. % of current sales/ installations that are __% AFUE	b. % of current sales/installations that got RG&E/NYSEG rebates	% sales/installations from 2 years ago that are __% AFUE
EE2. 90% AFUE or higher	____% DK Refused	____% DK Refused	____% DK Refused
EE3. 92% AFUE or higher	____% DK Refused	____% DK Refused	____% DK Refused
EE4. 94% AFUE or higher	____% DK Refused	____% DK Refused	____% DK Refused

EE4A. [IF RESPONSES TO EE2-EE4 INDICATED THAT SALES OF ENERGY-EFFICIENCT FURNACES HAVE INCREASED (E.G. EE2A IS > EE2C)] What do you think has caused this change? [PROBE IF NECESSARY: CHANGES IN AWARENESS, ENERGY/MONEY CONCERNS, ENVIRONMENTAL CONCERN, CHANGE IN COSTS, CHANGES IN TECHNOLOGIES, OTHER] [DO NOT READ; ACCEPT MULTIPLE RESPONSES]

NYSEG/RG&E Rebate Program [PROBE: WHY DO YOU SAY THAT?] 1

NYSERDA Rebate Program [PROBE: WHY DO YOU SAY THAT?] 2

Cost of electricity 3

Demand for higher quality equipment 4

Lower cost of equipment/new tech 5

Rebates/deals from manufacturer 6

Concern/awareness of saving energy 7

Concern for Environment 8

New technologies give better performance 9

Better/more advertising 10

Changes in building codes, other legal changes 11

Federal Tax Credits 12

State Tax Credits 13

Other [SPECIFY: _____] 14

[DON'T KNOW] 97

[REFUSED]. 98

EE5. Does your company sell or install gas furnaces with ECMs?

Yes 1

No [SKIP TO EE8] 2

[DON'T KNOW]. -97 [SKIP TO EE8]

[REFUSED] -98 [SKIP TO EE8]

EE6. Do you consider gas furnaces with ECMs to be a good value for your residential customers?

Yes 1

No [SKIP TO EE8] 2

[DON'T KNOW]. -97 [SKIP TO EE8]

[REFUSED] -98 [SKIP TO EE8]

EE7. Why do you say that?

[RECORD RESPONSE]:_____

[DON'T KNOW]. -97

[REFUSED] -98

EE8. Is the mix of HVAC equipment that you have in stock different now than it was two years ago?

Yes 1

No [SKIP TO NEXT SECTION] 2

[DON'T KNOW]. -97 [SKIP TO NEXT SECTION]

[REFUSED] -98 [SKIP TO NEXT SECTION]

EE9. [IF EE8 = YES] How are your stocking practices different now than they were two years ago? [IF NOT ALREADY MENTIONED, PROBE FOR STOCKING OF EE EQUIPMENT]

[RECORD RESPONSE:]_____

[DON'T KNOW]. -97 [SKIP TO NEXT SECTION]

[REFUSED] -98 [SKIP TO NEXT SECTION]

EE10. What has caused this change in stocking practices?

[RECORD RESPONSE:]_____

[DON'T KNOW]. -97 [SKIP TO NEXT SECTION]

[REFUSED] -98 [SKIP TO NEXT SECTION]

EEM. ENERGY EFFICIENT MARKETING

Now I'm going to ask you some questions about your marketing and sales practices.

EEM1: How does your company advertise its services? [ALLOW MULTIPLE RESPONSES]

TV 1

Newspaper 2

Newsletter 3

Flier/postcard/mailer 4

Website 5

Word of Mouth 6

Phone book 7

Home shows 8

Billboard 9

Other 10

[DON'T KNOW]. -97

[REFUSED]. -98

EEM2. Is energy efficiency featured in any of these advertisements? [IF YES] How so?

[RECORD RESPONSE:]_____

_____ [ENTER -97 FOR DK, -98 FOR REFUSED]

EEM3: [IF THEY INDICATED THEY DO INSTALLATIONS / FG4C=Yes] When you are discussing with a customer their options for replacing a furnace or boiler, what options or factors do you typically mention?
[RECORD RESPONSE:]_____ [ENTER -97 FOR DK, -98 FOR REFUSED]

EEM4: [IF ENERGY EFFICIENCY NOT ALREADY MENTIONED in EEM3] Is energy efficiency ever mentioned in this discussion? [IF YES] How so? / [IF NO] Why not?

[RECORD RESPONSE:]_____ [ENTER -97 FOR DK, -98 FOR REFUSED]

EEM5. Do you more frequently recommend high efficiency furnaces or boilers than you did two years ago?

a. [IF YES] Why are you recommending these high efficiency models more frequently?

[RECORD RESPONSE:]_____ [ENTER -97 FOR DK, -98 FOR REFUSED]

EEM6: [IF THEY INDICATED THEY DO INSTALLATIONS / FG4C =Yes] When you are replacing a furnace or boiler in a residential home, in about what percentage of the situations would you say that the furnace/boiler is: [ENTER PERCENT, -97 FOR DK, -98 FOR REFUSED]

Not functioning at all? .....____

Still functioning but just barely or with significant performance or maintenance issues? .....____

Still functioning well ___? .....____

TOTAL.....100%

EEM7. [IF THEY INDICATED THEY DO NOT DO INSTALLATIONS / FG4C = No] For the HVAC installation contractors that you work with, what factors do they consider when choosing to promote high efficiency versus standard efficiency residential furnaces and boilers?

[RECORD RESPONSE:]_____

PA. PROGRAM AWARENESS

PA1. Are you aware of the NYSEG/RG&E Natural Gas Equipment Rebate Program?

Yes 1

No 2 [SKIP TO NEXT SECTION]

[DON'T KNOW]. -97 [SKIP TO NEXT SECTION]

[REFUSED]. -98 [SKIP TO NEXT SECTION]

PA2. Has your marketing included RG&E and NYSEG programs over the past year?

Yes 1

No 2

[DON'T KNOW]. -97

[REFUSED]. -98

PA3. Do you know what types of energy efficient equipment residential heating equipment this program rebates? [IF YES] Which types? [CHECK ALL THAT APPLY]

Furnace AFUE ≥ 90..	
Furnace AFUE ≥ 92 with ECM.	

Furnace AFUE ≥ 94 with ECM.	
Water Boiler AFUE ≥ 85	
Water Boiler AFUE ≥ 90	
Steam Boiler AFUE ≥ 82	
Boiler Reset Control1	
Indirect Water Heater	
Programmable Thermostat	
[Other] [SPECIFY]	
[Other] [SPECIFY]	

PA4: [IF THEY IDENTIFIED REBATED EQUIPMENT IN PA3] Do you know what rebate levels the NYSEG/RG&E program offers for this energy-efficient equipment [IF NECESSARY, REPEAT THE EQUIPMENT TYPES THEY IDENTIFIED IN PA3]? [IF YES] What levels?

[RECORD RESPONSE:]_____

EE Measure	**Actual Rebate Levels (for surveyor's reference only)**	**Respondent's Guess**
Furnace AFUE ≥ 90..	**$115**	
Furnace AFUE ≥ 92 with ECM.	**$225**	

Furnace AFUE ≥ 94 with ECM.	**$340**	
Water Boiler AFUE ≥ 85	**$280**	
Water Boiler AFUE ≥ 90	**$560**	
Steam Boiler AFUE ≥ 82	**$280**	
Boiler Reset Control1	**$56**	
Indirect Water Heater	**$170**	
Programmable Thermostat	**$15**	
[Other] [SPECIFY]		
[Other] [SPECIFY]		

PA5. How did you hear about the NYSEG/RG&E Natural Gas Equipment Rebate Program? [DO NOT READ OPTIONS]

[Attended Trade Ally Meeting] 1

[Information brochure] 2

[Web site] 3

[Media (Newspaper/Radio)] ……4

[Customer alerted me] 5

[Bill stuffers] 6

[Trade group referral] 7

Other 1[SPECIFY: _____] 8

Other 2[SPECIFY: _____] 9

[DON'T KNOW]. -97

[REFUSED] -98

PA6. What has been the nature of your involvement with this program? [ALLOW MULTIPLE RESPONSES]

[Recommend/sell rebated equipment to installation contractors] 1

[Install rebated equipment] 2

[Cooperative advertisement] 3

[Other] ……4

[I have not been involved with this program] 5

[DON'T KNOW]. -97

[REFUSED] -98

PA7. [If PA6 INDICATES SOME PROGRAM INVOLVEMENT] When did you first become involved in the NYSEG/RG&E Natural Gas Equipment Rebate Program?

Month/Year [ACCEPT ESTIMATE]: _____

PA8. Have you received any marketing support through the program?

Yes 1

No 2[SKIP TO PA10]

[DON'T KNOW]. -97[SKIP TO PA10]

[REFUSED] -98[SKIP TO PA10]

PA9. What marketing support have you received? [DO NOT READ; PROBE IF NECESSARY]

Attended Trade Ally Meeting 1

Information brochure 2

Web site 3

Media (Newspaper/Radio) ……4

Customer Service/Hotline 5

Bill stuffers to customers 6

Other 1 [SPECIFY: _____] 7

Other 2 [SPECIFY: _____] 8

None 9

[DON'T KNOW] -97

[REFUSED] -98

PA10. On a scale of 1 to 5, where 5 is "Very Effective" and 1is "Not at all Effective," how effective do you think the NYSEG/RG&E Natural Gas Equipment Rebate Program has been in encouraging heating and cooling contractors and distributors to sell more efficient gas heating equipment for residential applications?

Not at all effective 1

Somewhat ineffective 2

Neither effective nor ineffective 3

Somewhat effective 4

Very effective 5

[DON'T KNOW] -97[SKIP TO PA12]

[REFUSED] -98[SKIP TO PA12]

PA11. Why do you say that?

[RECORD RESPONSE:]_____

PA12. What business advantages do you perceive in promoting energy efficient HVAC technologies in residential applications?

[RECORD RESPONSE:]_____

PA13. What disadvantages, if any, do you see in promoting energy efficient HVAC equipment?

[RECORD RESPONSE:]_____

PA14 [ASK OF DISTRIBUTORS ONLY] When recommending ENERGY STAR qualifying equipment to residential contractors, do you mention the NYSEG/RG&E Natural Gas Equipment Rebate Program?

Yes 1

No 2

[We don't recommend this type of equipment] 3

[DON'T KNOW]. -97

[REFUSED]. -98

PA15. [ASK OF DISTRIBUTORS ONLY] Has your company helped contractors participate in a NYSEG/RG&E Natural Gas Equipment Rebate Program?

Yes/RG&E 1 Yes/NYSEG 2

No.. 3

[DON'T KNOW]. -97

[REFUSED] -98

PA16. [ASK OF DISTRIBUTORS ONLY] Have the residential contractors who you supply mentioned participating in any other heating rebate programs besides the NYSEG/RG&E Natural Gas Equipment Rebate Program?

Yes 1

No 2[SKIP TO PA18]

[DON'T KNOW]. -97[SKIP TO PA18]

[REFUSED] -98[SKIP TO PA18]

PA17. [ASK OF DISTRIBUTORS ONLY] What other heating rebate programs have your contractors/customers said they participated in?

[DO NOT READ. ALLOW MULTIPLE RESPONSES]

[Contractors do not mention which ones] 1

[NYSERDA] 2

[Manufacturer] [SPECIFY: _____] 3

[Retailer] [SPECIFY: _____] 4

[Federal Tax Credit] 5

[State Tax Credit] 6

Other 1 [SPECIFY: _____] 7

Other 2 [SPECIFY: _____] 8

[DON'T KNOW]. -97

[REFUSED]. -98

PA18. Are you aware of any other programs besides the NYSEG/RG&E program to encourage residential customers to purchase energy efficient gas furnaces?

Yes 1

No 2 [SKIP TO PS1]

[DON'T KNOW]. -97 [SKIP TO PS1]

[REFUSED]. -98 [SKIP TO PS1]

PA19. Which programs are these?

[RECORD RESPONSE:]_____

_____

PA20. Have you participated in these other rebate programs?

Yes 1

No 2 [SKIP TO PS1]

[DON'T KNOW]. -97 [SKIP TO PS1]

[REFUSED]. -98 [SKIP TO PS1]

PA21. How do these other programs compare to the NYSEG/RG&E program/

[RECORD RESPONSE:]_____

_____

PS. PROGRAM SATISFACTION

[ASK ONLY IF PROGRAM PARTICIPANT]

PS1. On a scale of 1 to 10 where 10 means 'Very Satisfied' and 1 means 'Not at all Satisfied': How satisfied were you with the marketing support provided by the NYSEG/RG&E Natural Gas Equipment Rebate Program? [DO NOT READ]

Not at all satisfied 1

Very satisfied 10

[DON'T KNOW] -97 [SKIP TO PS2]

[REFUSED] -98 [SKIP TO PS2]

PS1B. [IF PS1 = 1-7] Why do you say that?

[RECORD RESPONSE:]_____

PS2. Have you filled out any rebate application forms for the NYSEG/RG&E Natural Gas Equipment Rebate Program?

Yes 1

No 2 [SKIP TO PS3]

[DON'T KNOW]. -97[SKIP TO PS3]

[REFUSED] -98[SKIP TO PS3]

PS2A. On a scale of 1 to 10 where 10 means 'Very Satisfied' and 1 means 'Not at all Satisfied': How satisfied are you with the program's rebate application forms?

Not at all satisfied 1

Very satisfied 10

[DON'T KNOW] -97 [SKIP TO PS3]

[REFUSED] -98 [SKIP TO PS3]

PS2B. [IF PS2A = 1-7] Why do you say that?

[RECORD RESPONSE:]_____

PS3. [If PS2=Yes] Have you made use of the program's rebate reservation system?

Yes 1

No 2[SKIP TO PS3C]

[DON'T KNOW]. -97[SKIP TO PS4]

[REFUSED] -98[SKIP TO PS4]

PS3A. How satisfied have you been with the rebate reservation system? [REPEAT SCALE IF NECESSARY]

Not at all satisfied 1

Very satisfied 10

[DON'T KNOW] -97 [SKIP TO PS4]

[REFUSED] -98 [SKIP TO PS4]

PS3B. [IF PS3A = 1-7] Why do you say that?

[RECORD RESPONSE:]_____

PS3C. [If PS3=No] Why haven't you used the program's rebate reservation system?

[RECORD RESPONSE:]_____

PS4. How satisfied are you with the amount of the rebates offered by the program? [REPEAT SCALE IF NECESSARY]

Not at all satisfied 1

Very satisfied 10

[DON'T KNOW] -97 [SKIP TO PS5]

[REFUSED] -98 [SKIP TO PS5]

PS4A. [IF PS4 = 1-7] Why do you say that?

[RECORD RESPONSE:]_____

PS5. Have you received any rebates from the NYSEG/RG&E Natural Gas Equipment Rebate Program?

Yes 1

No 2 [SKIP TO PS6]

[DON'T KNOW]. -97 [SKIP TO PS6]

[REFUSED] -98 [SKIP TO PS6]

PS5A. "How satisfied are you with the time it takes to receive the rebate?" [REPEAT SCALE IF NECESSARY]

Not at all satisfied 1

Very satisfied 10

[DON'T KNOW] -97 [SKIP TO PS5]

[REFUSED] -98 [SKIP TO PS5]

PS5B. [IF PS5A = 1-7] Why do you say that?

[RECORD RESPONSE:]_____

PS5C. [If PS5=No] Have you received any complaints from customers about rebates arriving late?

[RECORD RESPONSE:]_____

PS6. Did you have any interaction with NYSEG or RG&E program staff?

Yes 1

No 2 [SKIP TO PS7]

[DON'T KNOW]. -97 [SKIP TO PS7]

[REFUSED] -98 [SKIP TO PS7]

PS6A. How satisfied are you with the customer service you received from program staff? [REPEAT SCALE IF NECESSARY]

Not at all satisfied 1

Very satisfied 10

[DON'T KNOW] -97 [SKIP TO PS5]

[REFUSED] -98 [SKIP TO PS5]

PS6B. [IF PS6A = 1-7] Why do you say that?

[RECORD RESPONSE:]_____

PS7. Did you have any of your equipment inspected for quality control?

Yes 1

No 2[SKIP TO PS8]

[DON'T KNOW]. -97 [SKIP TO PS8]

[REFUSED] -98 [SKIP TO PS8]

PS7A. How satisfied were you with the quality control inspection process? [REPEAT SCALE IF NECESSARY]

Not at all satisfied 1

Very satisfied 10

[DON'T KNOW] -97 [SKIP TO PS8]

[REFUSED] -98 [SKIP TO PS8]

PS7B. [IF PS7A = 1-7] Why do you say that?

[RECORD RESPONSE:]_____

PS8. How satisfied have you been with the program as a whole, considering all the things we talked about? [REPEAT SCALE IF NECESSARY]

Not at all satisfied 1

Very satisfied 10

[DON'T KNOW] -97 [SKIP TO PS5]

[REFUSED] -98 [SKIP TO PS5]

PS9. What aspects of the NYSEG/RG&E Natural Gas Equipment Rebate Program have you found work well, or are helpful?

[RECORD RESPONSE:]_____

PS10. What aspects of the NYSEG/RG&E Natural Gas Equipment Rebate Program would you change/improve upon if you could?

[RECORD RESPONSE:]_____

PS11. Were you aware that the NYSEG/RG&E rebate program suspended activities from July to October in 2010?

Yes 1

No 2 [SKIP TO PS12]

[DON'T KNOW]. -97 [SKIP TO PS12]

[REFUSED]. -98 [SKIP TO PS12]

PS11A. Did the break in the program service affect your ability to market and sell the eligible equipment?"

Yes 1

No 2

[DON'T KNOW]. -97

[REFUSED] -98

PS11B. Why do you say that? Please be specific.

[RECORD RESPONSE:]_____

PS12. Finally before now were you aware of new federal requirements that will increase the minimum AFUE for furnaces and boilers?

Yes 1

No 2 [T & T2]

[DON'T KNOW]. -97[T & T2]

[REFUSED] -98 [T & T2]

[IF THEY ASK WHAT THIS NEW STANDARD IS:

FURNACES: "IN THE NORTH, MOST FURNACES WILL BE REQUIRED TO HAVE AN AFUE OF 90%.THE 80% AFUE STANDARD FOR THE SOUTH AND SOUTHWEST WILL REMAIN UNCHANGED AT 80%. OIL FURNACES WILL BE REQUIRED TO HAVE AN AFUE OF 83% IN ALL THREE REGIONS. THE AMENDED STANDARDS WILL BECOME EFFECTIVE IN MAY

2013 FOR NON-WEATHERIZED FURNACES AND IN JANUARY 2015 FOR WEATHERIZED FURNACES."]

BOILERS: Standards going into effect in September 2012

Boiler Type	AFUE (%)	Design Requirements
Gas Hot Water	82	No constant burning pilot, automatic means for adjusting water temperature
Gas Steam	80	No constant burning pilot
Oil Hot Water	84	Automatic means for adjusting temperature
Oil Steam	82	None
Electric Hot Water	None	Automatic means for adjusting temperature

PS12A. What do you think will be the impact of these new federal requirements on the HVAC market?

[RECORD RESPONSE:]_____

T&T2. THANK AND TERMINATE Those are all the questions I wanted to ask. Thanks again for your participation.

D. Billing Regressions

D.1 General Billing Regression

The basic billing regression is the simplest form of fixed-effects model. Across multiple households, each with household specific intercept, and multiple time periods, this specification provides a general estimate of the relationship between average daily therm usage and heating degree days. DNV KEMA started with this specification for ease of explanation in developing the final billing regression specification.

The equation is:

$$E_{im} = \mu_i + \lambda_m + \beta_H H_{im}(\tau_H) + \varepsilon_{im}$$

where

E_{im}	=	Therms used per day during month m for customer i;
$H_{im}(\tau_H)$	=	Average heating degree-days at the heating base temperature τ_H during month m, based on daily average temperatures, for customer i's meter reading period;
μ_i	=	Premise-specific base usage estimate for customer i;
λ_m	=	Month-specific time period effect for month m;
β_H	=	Heating coefficients, determined by the regression;
τ_H	=	Heating degree-day base temperature, determined by choice of the optimal regression; and
ε_m	=	Regression residual.

In this equation, gas usage is a function of a household-specific constant (baseload μ_i) and average daily HDD $H_{mi}(\tau_H)$. Monthly bill readings divided by the number of days in the billing period provide the daily therm usage, represented by E_{im}. Average daily degree days for the billing period are calculated by dividing the sum of daily HDD by the number of days in the billing period. Because the data provided was bimonthly usage data by bill period and not all customers are on the same bill cycle, heating degree-days vary over customers i. Finally, the time period coefficients λ_m account for time trends not explained by the other variables.

The household-specific intercept and month-specific time period terms are referred to as fixed effects. The fixed-effects parameter estimates provide household- and month-specific information in this model where multiple households and months are combined in a single model. This approach separates out household-specific, non-heating gas usage that occurs across all time periods. Non-heating gas usage can include water heat, cooking, and other gas appliances. The fixed-effect model also attempts to separate out time-specific changes in gas usage that occur across all households. Because of the rolling nature of meter reading, the billing regression time-period effects are inherently unclear. They still, however, control for time-specific changes in gas usage. These changes can be due to economic factors, natural disasters (i.e., earthquakes), or unusual weather.

D.2 Fixed-Effects Model Pre-Post Billing Regression

To estimate the savings, the basic fixed effects model must be enhanced to account for change in consumption from the pre- to post-installation periods. The simplest version of the pre-post model is

$$E_{im} = \mu_i + \lambda_m + \beta_1 H_{im}(\tau_H) + \beta_2 * G_{im} + \beta_3 H_{im}(\tau_H) * G_{im} + \varepsilon_{im}$$

where

G_{im}	=	An indicator variable equal to zero prior to installation of the furnace and one after the installation of the furnace
β_1- β_3	=	Estimated coefficients

The parameter β_1 represents pre-program heating consumption. The parameters β_2 and β_3 represent two components of change in consumption in the post period, with and without heating degree day.

The above pre-post fixed-effects model has to control the variation in gas consumption due to the installation of different measures. To decide which measures and which interactions we include in the model, a model selection process was conducted. DNV KEMA started with a full model specification that includes all the installed measure indicators, pre- post-installation period indicator, heating degree days, and the interaction among these variables. The full fixed-effects model is:

$$E_{im} = \mu_i + \lambda_m + \beta_1 H_{im}(\tau_H) + \beta_2 * G_{im} + \beta_3 H_{im}(\tau_H) * G_{im} + \sum_j \beta_{Aj1} H_{im}(\tau_H) * A_{ij} + \sum_j \beta_{Aj2} * G_{im} * A_{ij} + \sum_j \beta_{Aj3} H_{im}(\tau_H) * G_{im} * A_{ij} + \varepsilon_{im}$$

where

j = 1, …, 7, with 1 indicating furnaces without ECM, 2 furnaces with ECM, 3 boilers, 4 indirect water heater, 5 boiler reset control, 6 programmable thermostats, and 7 duct sealing.

A_{ij} = An indicator variable equal to one if measure j for household i was installed, zero otherwise.

The parameter β_{Aj1} represents the pre-program difference in heating consumption for households with a specific measure installed. The parameters β_{Aj2} and β_{Aj3} represent the two components of change in consumption in the post period, with and without heating degree-day, for those households with a specific measure installed relative to all other households.

We tested the full model and reduced models across a range of degree day bases. Across these models, Akaike's Information Criterion (AIC) provides a statistically robust way to find the optimal (maximum likelihood) combination of model specification and heating degree day base. If the final optimal combination of model specification and heating degree day base includes heating variables that are not statistically significant, that model specification is removed and the next optimal model specification and heating degree day base is considered. This effectively finds the best theoretical but practically meaningful model specification and heating degree day base. The optimal heating degree day base selected is 58, and the best model specification is:

$$E_{im} = \mu_i + \lambda_m + \beta_1 H_{im}(\tau_H) + \beta_2 * G_{im} + \beta_3 H_{im}(\tau_H) * G_{im} + \sum_j \beta_{Aj1} H_{im}(\tau_H) * A_{ij} + \sum_j \beta_{Aj2} H_{im}(\tau_H) * G_{im} * A_{ij} + \beta_{A3} * G_{im} * A_{i4} + \varepsilon_{im}$$

where

j = 1, …, 3.

Note that j equals 1, 2 and 3, which means only furnaces with or without ECM, and boilers are included in the model. Due to the small number of boiler reset controls and duct sealing measures, those measures were not included in the optimal model specification. Programmable thermostats were highly collinear with furnaces. Because of the multicollinearity, the effects of furnaces and thermostats cannot be separated. To solve this problem, one of these two measures has to be dropped from the model. In the final optimal model specification, programmable thermostats were removed from the model. Since 84% of the furnaces come with a thermostat, and thermostats have small ignorable savings, the effects of furnaces can be treated as the effects coming from both furnaces and thermostats. (Likewise for boilers.)

The time period effects are kept in the optimal model, which shows their particular importance in the pre-post billing regression. The fixed effects model relies on the time-period effects to pick up any general trends in usage. Where the survey indicated changes in usage, that change was controlled for explicitly. Other household-specific usage changes add to the variation in the estimates but will not generally affect the levels of the estimated parameters. Actions that potentially change a household's usage occur throughout the time span of the analysis and can increase or decrease usage. To affect the savings-related parameter estimates, changes would have to be correlated with participants in the post-program period but not be related to the program, as well as having a meaningful positive or negative effect on average.

KEMA further checked the final statistically decided model against the raw billing data. We compared the model estimated average participant annual consumption and baseload to that obtained from raw billing data. The average participant annual consumption for raw billing data is the average of the annualized consumption across the participants that have six bimonthly bill periods. In finding the annual baseload, we looked at the minimum average daily usage during the summer metering periods, and multiplied this by 365, assuming that this minimum usage would be the non-heating usage. We found that 58 was not the optimal heating degree base when compared to the raw billing data-decided baseload. Thus, we searched more heating degree day bases. The results are shown in Appendix Table D-1. We decided to use heating degree base 59 as the optimal base since the baseload based on 59 is the closest to the baseload from raw billing data.

Appendix Table D-1 Annual Household Usage Comparison of Different Heating Degree Day Bases

Savings Type		Participant Households Number	Annual Pre-program Usage (Therms/ Participant)
billing data	Average Participant Pre-installation Baseload	4354	242
	Average Participant Annual Consumption	1741	1016
Fixed Effects model at base 58	Average Participant Heating	4822	819
	Average Participant Baseload	4822	262
	Average Participant Annual Consumption	4822	1081
Fixed Effects model at base 59	Average Participant Heating	4822	840
	Average Participant Baseload	4822	241
	Average Participant Annual Consumption	4822	1081
Fixed Effects model at base 60	Average Participant Heating	4822	860
	Average Participant Baseload	4822	221
	Average Participant Annual Consumption	4822	1081
Fixed Effects model at base 61	Average Participant Heating	4822	882
	Average Participant Baseload	4822	200
	Average Participant Annual Consumption	4822	1081
Fixed Effects model at base 62	Average Participant Heating	4822	904
	Average Participant Baseload	4822	178
	Average Participant Annual Consumption	4822	1082
Fixed Effects model at base 63	Average Participant Heating	4822	926
	Average Participant Baseload	4822	156
	Average Participant Annual Consumption	4822	1082
Fixed Effects model at base 64	Average Participant Heating	4822	949
	Average Participant Baseload	4822	135
	Average Participant Annual Consumption	4822	1083
Fixed Effects model at base 65	Average Participant Heating	4822	972
	Average Participant Baseload	4822	112

	Average Participant Annual Consumption	4822	1084

D.3 Overall Average Participant and Measure Level Results

Model parameter estimates are program average effects for the combined variables. Heating degree days enter into the fit values as normal annual degree days to put all results on a typical day basis. Indicator variables enter into the fit values in one of two ways:

- As a one, if marginal measure results are required,
- As the percentage of the population installing that measure, if average participant results are required.

Marginal savings estimates for installations of furnaces with or without ECMs, or boilers, for instance, are calculated with the following equation:

$$\Delta_A = \quad 365 * \hat{\beta}_2 + \hat{\beta}_3 * \overline{H}_{im}(\tau_H) + \ \hat{\beta}_{A2} * \overline{H}_{im}(\tau_H) * \vec{A}_i$$

where

□□ = Reduction in average annual therms consumption.

$\vec{A}_i$ = One, to indicate a furnace or boiler installation.

$\overline{H}_{im}(\tau_H)$ = Normal annual heating degree-days at the heating base temperature □H.

For an average participant household, overall savings estimates are calculated with the following equation:

$$\Delta_A = \quad 365 * \hat{\beta}_2 + \hat{\beta}_3 * \overline{H}_{im}(\tau_H) + \sum_j \hat{\beta}_{Aj2} * \overline{H}_{im}(\tau_H) * \vec{A}_{ij}$$

where:

$\vec{A}_{ij}$ = Percentage of the population installing measure j.

D.4 Final Regression Results

The final fixed-effects model specification included variables for the installation of furnaces with or without ECM, boilers, and indirect water heaters. Appendix Table D-2 provides the key parameter estimates from the model.

Appendix Table D-2 Key Parameters

Variable Combination	Parameter Estimate	P-Value*
hdd	-1.4578	<.0001
post	-0.0644	0.8072
hdd * post	1.4826	<.0001
hdd *boiler	1.6819	<.0001
hdd * post *boiler	-1.5221	<.0001
hdd *furnace without ECM	1.6037	<.0001
hdd * post * furnace without ECM	-1.5052	<.0001
hdd *furnace with ECM	1.6081	<.0001
hdd * post * furnace with ECM	-1.5052	<.0001
post * water heater	0.2020	0.4694

*Shaded P-Values indicate individual parameter estimates statistically significant at the 95 percent level. We combined two parameter estimates for each measure type (i.e. hdd*post and hdd*post*boiler). The final reported measure-level confidence intervals reflect that combination.

The regression results reflect the expected strong heating signal in all measures. Furnaces with or without ECM, and boilers all have positive significant parameter estimates, which indicates a large amount of heating usage in gas consumption. For all measures, the post variables are all also highly significant, except for indirect water heaters. This shows that the savings coming from all of these measures except indirect water heaters are significantly different from zero at the 95 percent level.