

FINAL REPORT

THE
CADMUS
GROUP, INC.

2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing

Volume I

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ACRONYM GLOSSARY

Acronym	Full Name
BCR	Benefit/Cost Ratio
CAC	Central Air Conditioning
DSM	Demand-Side Management
ECM	Electronically Commutated Motor
EEAC	Massachusetts Energy Efficiency Advisory Council
ER	Equipment Replacement
FR	Free-Ridership
HEHE	High-Efficiency Heating and Water Heating Equipment
NME	Net Market Effects
NTG	Net-to-Gross
PA	Massachusetts Program Administrator
QIV	Quality Installation Verification
ROF	Replace-on-Failure
SRA	Self-Report Approach
SO	Spillover

1. EXECUTIVE SUMMARY

This report summarizes net-to-gross (NTG) values, the timing of equipment replacement (ER), and the net market effects (NME) for the Cool Smart and High-Efficiency Heating and Water Heating Equipment (HEHE) programs for the 2010-2012 period. Navigant, Opinion Dynamics, and Cadmus, collectively referred to as the Evaluation Team, conducted this evaluation.

The Team based our evaluation findings, conclusions, and recommendations on results from an array of data collection activities and evaluation tasks, and report NTG, ER and NME results at the measure level.

Methodology

The Evaluation Team estimated measure-specific NTG ratios using what is commonly referred to as the Self-Report Approach (SRA). To apply the SRA method to Cool Smart and HEHE, the Team relied on surveys with HVAC and water heating distributors and contractors, as well as surveys with program participants. The research components were:

1. **NME:** NME are similar to the overall NTG impacts, and were used in this study to provide qualitative information supporting the NTG results. The key distinction between NME and NTG is that NME does not directly consider or address participant motivation (i.e., free-ridership; FR) or non-participant spillover (SO). A key recommendation from the previous HEHE evaluation was to survey distributors to obtain more accurate estimates of market-level sales by efficiency level, and the possible long-term SO.

The data captured from distributor surveys included equipment sales information, the change in sales over time, and distributor reports about how the equipment programs impacted these changes.

2. **FR:** The FR research addressed the type of equipment installed through Cool Smart and HEHE, and Quality Installation Verification (QIV), which only applies to Cool Smart.
 1. **Participant Surveys:** Program participants that received incentive-eligible measures and would have installed the same measures in the programs' absence were considered free-riders. In the self-report approach used for this study, FR is a function of the timing of purchase decisions, the quantity of measures purchased, the influence of program rebates and other features on decisions, and the likelihood of purchasing the same efficiency level in the absence of the programs.
 2. **QIV Contractor Surveys:** Those who were following QIV practices prior to getting involved with QIV for the Cool Smart Program were considered free-riders. FR occurred when QIV contractors were already performing quality installation techniques before they participated in the program.

3. **SO:** The Team used both QIV and regular contractor surveys to estimate the programs' SO, which are additional savings influenced by the programs but not captured in program records.
 - a. **Contractor Surveys:** In addition to gathering self-reported equipment sales and efficiency share information, the non-QIV contractor surveys captured data to distinguish between customers who installed equipment through the programs versus outside the programs. The Team derived SO estimates for qualifying equipment installations for which customers did not obtain an incentive.
 - b. **QIV Contractor Surveys:** The Team used these surveys to obtain SO estimates from contractors for performing QIV practices in non-QIV homes that could be traced back to Cool Smart Program training and participation.

Calculating NME, NTG, and Overall Impacts

The Evaluation Team calculated the NME estimates for the Cool Smart and HEHE equipment measures and programs by comparing Massachusetts distributors' self-reported estimates of what their market sales and efficiency shares from 2010-2012 would have been in the absence of the programs.

The Team also estimated NTG at the measure level by combining the individual FR and SO components as follows:

$$\text{NTG} = 1 - \text{FR} + \text{SO}$$

Uncertainty is explicitly taken into account by varying key parameters within the FR and SO scoring algorithms. The final set of NTG estimates for each equipment measure depends on the average of the FR and SO values, with a range of reasonable values defined by the range in FR and SO estimates.

Equipment Replacement Timing

Historically, energy efficiency industry economists have suggested that as long as equipment incentives were less than or equal to incremental equipment costs, the financial incentive was not large enough to encourage participation from those who were not already replacing failed equipment. Both Cool Smart and HEHE are in this category, as the PAs expected participation and energy savings from equipment have been based on the assumption that equipment is replaced on failure.

In recent years, the PAs increased the programs' incentive payments from approximately 50% of incremental costs to 75%, and emphasized the lifetime savings of program-qualifying equipment and benefits of early equipment replacement in program marketing efforts and contractor training. This led the PAs, EEAC, and the Evaluation Team to include customer and contractor survey questions designed to discern the timing of ER.

Study Findings

Equipment NTG and NME

The FR, SO, and NTG estimates for Cool Smart and HEHE equipment measures are shown in Table 1. These estimates reflect the average values from the alternate scoring algorithms.

Table 1. Average FR, SO, and NTG Estimates

Measure	FR	SO	NTG
Boilers, AFUE 90-95.9%	0.32	0.08	0.76
Boilers, AFUE ≥96%	0.31		0.77
Boilers, Overall	0.31		0.77
Furnaces, AFUE ≥95%	0.41	0.22	0.81
Central Air Conditioners/Heat Pumps, SEER 14.5-14.9	0.35	0.28	0.93
Central Air Conditioners, SEER ≥16	0.42		0.86
Central Air Conditioners, Overall	0.40		0.88
Ductless Mini-Splits	0.45	0.07	0.62
Storage Water Heaters, Energy Factor ≥0.67	0.13	0.13	1.00
Tankless Water Heaters, Energy Factor ≤0.94	0.37	0.26	0.89
Tankless Water Heaters, Energy Factor ≥0.95	0.28		0.98
Tankless Water Heaters, Overall	0.32		0.93
Integrated Space Heaters/Water Heaters with a Condensing Boiler	0.34	0.08	0.74

The effect of scoring algorithm uncertainty on the overall NTG estimates is shown in Table 2. As with the FR and SO values above, the average NTG values should be used for reporting purposes and cost-effectiveness analysis. However, the range of outcomes—particularly the low NTG estimates—can be used to provide guidance related to the risk of lower net savings on PA goal achievement and program cost-effectiveness.

Table 2. Equipment NTG Range

Measure	Average NTG	Low NTG	High NTG
Boilers, AFUE 90-95.9%	0.76	0.63	0.90
Boilers, AFUE ≥ 96%	0.77	0.64	0.90
Boilers, Overall	0.77	0.64	0.90
Furnaces, AFUE ≥ 95%	0.81	0.56	1.07
Central Air Conditioner/Heat Pump, SEER 14.5-14.9	0.93	0.67	1.21
Central Air Conditioner, SEER ≥ 16	0.86	0.62	1.11
Central Air Conditioners, Overall	0.88	0.63	1.14
Ductless Mini-Split	0.62	0.46	0.78
Storage Water Heater, Energy Factor ≥ 0.67	1.00	0.87	1.14
Tankless Water Heater, Energy Factor ≤ 0.94	0.89	0.67	1.05
Tankless Water Heater, Energy Factor ≥ 0.95	0.98	0.80	1.10
Tankless Water Heaters, Overall	0.93	0.73	1.08
Integrated Space Heaters/Water Heaters with a Condensing Boiler	0.74	0.59	0.88

The range of estimates is based on alternative scoring algorithms reflecting:

- Uncertainty in how self-reported questions were scaled should be reflected (e.g., a scale of 1 to 5, a 4 may be assigned as 0.5 or 0.75). There are no empirical data within the energy efficiency evaluation industry to support one scoring scale over another.
- There are legitimate differences in subject matter experts' opinions about whether the maximum or average of various FR and SO influence components should be applied.

There are also legitimate differences across subject matter experts as to whether the various FR (or SO) components used to derive the estimates in Table 2 should be averaged or multiplied together. The set of average, final NTG estimates employ the multiplication approach used in other residential and non-residential Massachusetts NTG studies conducted in the 2010-2012 period. However, the Evaluation Team acknowledges the lack of consensus on NTG algorithms, and recommends that the PAs and EEAC develop clear protocols that directly address these and other issues across all residential and non-residential program categories

The Evaluation Team's analysis of the hypothetical equipment market share data provided by distributors through self-report surveys indicates that the program-qualifying, high-efficiency shares of Cool Smart and HEHE equipment are relatively high. Although qualitative in nature due to small sample sizes and the unavailability of total Massachusetts equipment sales data, the NME estimates are generally higher than their NTG counterparts contained in Table 2.

Furthermore, a subset of distributors provided actual sales data showing that the tiered incentives in the Cool Smart and HEHE programs are apparently working as intended. Although these data are limited, there were unmistakable increases in the share of the highest efficiency shares for central air conditioners and heat pumps, and gas boilers and furnaces, as rebate levels changed during the 2010-2012 program cycle.

The qualitative NME estimates reveal the importance of obtaining actual sales data over time for all equipment efficiency levels. Sales data will allow a key NME analysis component—total sales, which now depend on equipment turnover assumptions—to be replaced with actual data and be more reliable for determining net savings.

Equipment Replacement Timing

The measures responsible for the majority of savings due to equipment installations in the HEHE and Cool Smart programs are central HVAC systems: gas boilers, gas furnaces, CAC, and heat pumps. As shown in Table 3, participants replacing equipment early (4 or more years of remaining life) represent more than 30% of boiler and 23% of furnace installations, but just 8% of central air conditioner and heat pump installations. Early replacement shares among integrated boiler/hot water units, storage water heaters, and tankless water heaters range from 20 to 33%. There is virtually no early replacement among ductless mini-split installations. More than 95% of these are either first-time cooling installations or are replacing window air conditioners. There are also a significant number of HEHE participants who are neither early nor replace-on-failure (ROF). These in-between installation estimates range from 15 to 25% across all of the program's major equipment measures.

Table 3. Equipment Replacement Timing in HEHE and Cool Smart Programs

Measure	Equipment Replacement Timing Shares			
	Early	New	ROF	In-Between
Boiler	30.6%	0.0%	44.9%	24.5%
Furnace	23.1%	0.0%	61.5%	15.4%
Central Air Conditioner / Heat Pump	8.0%	50.4%	29.2%	12.4%
Ductless Mini-Split	2.5%	95.1%	0.0%	2.5%
Integrated Boiler / Water Heater	20.0%	0.0%	55.7%	24.3%
Storage Water Heater	33.3%	0.0%	50.0%	16.7%
Tankless Water Heater	28.0%	0.0%	54.8%	17.2%

A large proportion of customers replacing boilers and furnaces early are also switching from oil to gas. More than three-fourths of early replacement boilers, and nearly two-thirds of early replacement gas furnaces, are oil-to-gas fuel conversions. This phenomenon is also present in the in-between category, with about half the installations representing oil-to-gas conversions.

These findings have profound policy implications in Massachusetts. First, the larger early or in-between energy savings in the initial set of post-installation years are not currently accounted for in programs' gross savings calculations. Second, there is no mechanism to consider or count the oil savings from early and in-between oil-to-gas fuel conversions in meeting the PAs' savings goals. Third, the non-energy emissions benefits associated with oil-to-gas conversions are not presently counted. All of these policy issues are beyond the scope of this evaluation; however, the findings do suggest that the PAs, EEAC, and other stakeholders may want to consider them in the near future.

Quality Installation Verification

In general, QIV contractors appear to be divided into two types that are contributing to free-ridership and spillover. The first type learned and practiced individual quality installation techniques prior to joining the Cool Smart program, and already viewed the techniques as best practices, and are free-riders for those techniques. However, the Evaluation Team did not detect any evidence that this type of respondent had practiced Quality Installation Verification as a formal business practice of integrated techniques.

The second type of respondent learned about quality installation techniques through the program, and view quality installations as a valuable activity that they often perform in non-QIV program HVAC installations (i.e., SO). The Evaluation Team interprets this application of QIV techniques on non-incented measures as evidence of the emergence of a specific business practice that favors energy efficiency. This division was especially pronounced for Manual J Sizing, as shown by its high levels of both free-ridership and spillover. For the other techniques, the net results were near 1.0. Table 4 provides a summary of QIV NTG values.

Table 4. Quality Installation Verification NTG

Measure	Average FR	Average SO	NTG
Manual J Central Air Conditioners and Heat Pumps	0.38	0.16	0.78
Manual J Heating	NA	0.15	NA
Airflow Testing/Duct Sealing	0.15	0.07	0.92
Refrigerant Testing	0.22	0.24	1.02
Overall QIV	0.25	0.16	0.91

The overall QIV FR, SO, and NTG estimates are based on a simple average of the Manual J central air conditioners and heat pump sizing, and airflow and refrigerant testing results. This is because the Massachusetts TRM does not break out QIV savings by measure. Additionally, the benefits associated with Manual J heating spillover primarily include equipment cost savings, which is a non-energy benefit.

2. OVERVIEW OF PROGRAMS

This chapter describes the residential Cool Smart and HEHE programs and the results of the Evaluation Team's application of program theory and logic modeling. The Team's goal was to align potential NME and NTG evaluation approaches to program-specific inter-relationships between the various market actors, explain the expected influence of the programs on market actors, and describe program activities and their expected outcomes.

Cool Smart Program

The PAs began offering rebates for residential CACs and heat pumps in 2004. Originally called the ENERGY STAR® HVAC Program, Cool Smart was re-branded and designed to increase consumer awareness and the market share of ENERGY STAR-labeled CAC units, air-source heat pumps, and ductless mini-splits, and to promote quality cooling installations by HVAC technicians and contractors.

The PAs more recent focus on contractor training and quality installation practices for Cool Smart has led to the PAs and EEAC classifying it as both a traditional incentive program and as a market transformation program. The expected outcomes of the program from the elimination of structural or behavioral market barriers include increased consumer awareness, increased market share of ENERGY STAR-labeled units, and the widespread adoption of quality cooling equipment installation practices by HVAC technicians and contractors. For participating customers, the program offers rebates on efficient equipment, services such as QIV, and educational information on efficient equipment and installation contractors. For participating contractors, Cool Smart offers financial incentives for efficient equipment, QIV and other training, and marketing support.

The QIV component is focused on appropriately sizing equipment through the use of Manual J heat loss/heat gain software calculations, which account for the specific characteristics of the dwelling in determining the appropriate size of the CAC or heat pump. These dwelling characteristics include the local climate, size and type of housing, and building shell characteristics (window area and type, insulation, and air leakage). Quality installation also includes contractor training and incentives for duct sealing, ensuring appropriate air flow, digital installation, and tune-up practices that ensure an appropriate refrigerant charge.

The target markets for Cool Smart include:

- New systems for both new homes and in existing homes that did not previously have CAC, heat pumps, or ductless mini-splits.
- Replacement systems for existing homes (new equipment for old systems), including both replace-on-failure and the early retirement of existing equipment.
- QIV tune-ups on existing systems, which the Evaluation Team did not specifically focus on for this study, and did not include in our data collection and analyses.

For the purposes of this study, participants are defined as customers and contractors who received a rebate, as well as contractors who participated in program-sponsored QIV training.

The recent evaluations of Cool Smart include:

- A 2008 impact evaluation documenting the savings associated with the program in 2007. Contractors and distributors were surveyed, and cost-effectiveness tests were developed.
- A 2009 regional evaluation of residential CACs that included an assessment of the energy and demand impacts of Cool Smart. The evaluation was based on data collected from a sample of program participants during 2008.

The Evaluation Team focused this NTG study on quantifying the program FR and SO, which was not conducted as part of the previous evaluations. We used the framework offered in the Massachusetts Residential NTG Methodology Study¹ and evaluation techniques for market transformation.

High-Efficiency Heating and Water Heating Equipment Program

The Massachusetts gas PAs began offering rebates for residential gas heating and water heating equipment more than 15 years ago. Between 2010 and 2012, the current HEHE program promotes the installation of high-efficiency gas furnaces, hot water boilers, and steam boilers, as well as energy-efficient, integrated boilers and water heaters, indirect water heaters, storage water heaters, tankless water heaters, and stand-alone gas water heater equipment; programmable thermostats, and boiler reset controls.

The primary objective of the HEHE Program is to encourage consumers to install the most efficient gas heating and water heating technologies available when replacing older, less efficient equipment, and when considering equipment in new construction. The PAs designed the program to overcome market barriers and increase awareness among consumers, plumbing/heating contractors, and home builders/developers, through rebates, incentives, education, and training opportunities. The GasNetworks collaborative administers the rebates, and the electric PAs pay for the savings associated with installing an electronically commutated motor (ECM) or equivalent advanced furnace fan system.

HEHE Program rebates are provided to customers to help offset the marginal cost of their investments in high-efficiency heating and water heating equipment. The program is managed collaboratively by the sponsoring PAs. The program implementer is ICF International (ICF), whose staff include an overall project manager and account managers/project coordinators. One of the account managers' functions is to be a circuit rider, regularly visiting trade allies to provide program marketing and support. ICF contracted with Lockheed Martin for the services of one additional circuit rider.

The first impact and process evaluation of the HEHE Program was completed in October 2010, and included FR estimates. The study revealed a high range of FR depending on equipment: from 50% for integrated boilers and water heaters to 73% for boilers with AFUE between 85% and 89%. The previous NTG study results for measures relevant to this study are listed in Table 5.

¹ Nexus Market Research Group, Inc., et al. "Cross-Cutting Net to Gross Methodology Study for Residential Programs – Suggested Approaches." Prepared for Massachusetts Program Administrators, July 20, 2011.

Table 5. NTG Results from Previous HEHE Program Evaluation

Measures	2007 – 2009 NTG
Boilers, AFUE 90-95.9%	60% to 61%
Furnaces, AFUE \geq 95%	66% to 67% (92+ AFUE)
Tankless Water Heaters, Energy Factor \leq 0.94	59% to 68% (\geq 0.82 EF)
Integrated Space Heating/Water Heater with a Condensing Boiler	50%

Source: Nexus Market Research Group and The Cadmus Group, Inc. "HEHE Process and Impact Evaluation." Prepared for GasNetworks. October 27, 2010.

The estimates for the previous impact and process evaluation of the HEHE Program were calculated by applying a simple NTG algorithm, using data obtained from participant surveys. The initial FR scores were adjusted for contractor-reported FR for participants that indicated some level of contractor influence. Finally, a key recommendation from the previous HEHE evaluation was to survey distributors to obtain more accurate estimates of market-level sales by efficiency level and the possible long-term SO.

The Evaluation Team focused this 2010-2012 NTG study on expanding and, more precisely, targeting NTG information. While HEHE was not designated as a market transformation program, we followed the 2010 recommendation to consider market share effects in developing a greater understanding of program SO and FR.

Theory of Market Change/Logic Model

The basic theory of market change begins with barriers. Supply-side barriers, such as the lack of efficient equipment availability and lack of QIV training for contractors, combined with demand-side barriers, such as a lack of customer awareness of energy-efficiency benefits, prevent market actor behavior change that would allow for a greater adoption of qualifying cooling and heating measures.

The PAs developed the Cool Smart and HEHE programs to overcome these barriers. Figure 1, Figure 2, and Figure 3 at the end of this chapter show details of the Cool Smart and HEHE program logic. However, a full understanding of the impacts requires a careful analysis of FR and SO among Massachusetts residential customers.

Free-Ridership and Spillover Among Cool Smart and HEHE Participants

In the context of both the Cool Smart and the HEHE programs, a free-rider is a program participant who had the opportunity to choose from a range of cooling or heating equipment efficiency options, was aware of that opportunity, and would have purchased qualifying equipment regardless of the program incentive for more efficient options. To determine which participants are free-riders (including partial free-riders), the Evaluation Team first confirmed that the trade allies are offering efficient options. We then examined the following two criteria:

- The degree to which the participant was aware of the range of qualifying and non-qualifying equipment.
- The extent to which the participant was motivated to purchase qualifying equipment without the influence of program incentives or marketing efforts.

Only the intersection of both criteria can bound the extent of FR. For example, if a participant had been willing to purchase qualifying equipment without an incentive, but the program influenced changes in the market structure (e.g., reduced availability of standard equipment) or market actor behavior (e.g., HVAC contractors favoring qualifying equipment in their sales offers), that participant's capacity for FR is constrained or eliminated.

Unlike FR, non-participant equipment purchases can contribute to SO.² Other than the absence of a program incentive, the key criteria for determining SO are:

- The degree to which the program influenced non-participants to make un-incented purchases of like equipment.
- The extent to which the program increased the availability or attractiveness of like energy-efficient equipment.

As opposed to FR being the *intersection* of the criteria listed after the first paragraph in this section, SO is the *union* of these two criteria. It does not matter whether the energy-efficient equipment was purchased based on program influence (incentive or marketing) or based on the program reducing the number of inefficient options. In either case, the program altered the market structure to favor more efficient equipment. The result is an increasing degree of NME over time.

Another aspect related to SO is the application of QIV cooling, heating, and water heating installations. This evaluation accounts for SO where the program influenced contractors to implement quality installation techniques for un-incented cooling or any heating equipment.

Premise for Study

The previous evaluation of the HEHE Program revealed a high degree of FR and very limited SO. In the 2010 evaluation, HEHE FR values ranged from 50% to 73% depending on the measure. To date, there have been no efforts to quantify Cool Smart FR or SO. In response to these HEHE findings, and in the absence of findings for Cool Smart, the programs' rebate levels were lowered or eliminated for lower efficiency tiers, and increased for higher efficiency tiers.

Given this context, and the fact that program marketing and outreach efforts were significantly expanded in 2010-2012, the previous NTG estimates no longer appeared relevant for BCR analysis purposes. Additionally, a full understanding of net program impacts required input from relevant market actors per a defined program logic. To explore this idea, the Evaluation Team developed a testable market change hypothesis, logic model, and appropriate data collection approaches.

Hypothesis

The changes in rebate levels and tiers were designed to move the HVAC and water heating market to higher efficiency levels and reduce FR. While Cool Smart (Figure 1) and, to a lesser

² Although participant spillover is possible, the PAs, EEAC, and the Evaluation Team thought the impacts would be minimal; therefore, the data collection efforts in this study focused on SO occurring in non-participating households.

extent, HEHE (Figure 2) also targeted the supply sides of their respective markets, both programs included consumer marketing that stimulated demand for program offerings. In this context, the combined Cool Smart and HEHE programs (Figure 3) influenced changes in market structure and market actor behavior that have, in turn, limited the availability of less efficient cooling and heating equipment. This limitation reduces the FR among participants and increases non-participant SO.

Barriers

The Evaluation Team's interviews with program managers revealed four barriers to any naturally occurring trends in the programs' markets towards an increased adoption of program offerings. The first supply-side barrier, the lack of capacity to perform quality installations, is relevant only to Cool Smart, although overcoming this barrier may affect the efficiency of gas heating installations. The second and third supply-side barriers, the lack of equipment availability and low contractor awareness, apply to both programs. The final barrier applies to the demand for both programs: lack of customer awareness.

Activities and Outputs

Based on input from the program managers, the Evaluation Team grouped the programs' activities into seven categories: five supply side and two demand side. The programs directed these activities to three audiences: HVAC contractors, HVAC distributors, and customers. The PAs designed the programs' outputs for each of these activities to overcome the programs' barriers.

Short-Term Outcomes

The program managers indicated that all four of the short-term program outcomes listed below should have already taken place and can be observed:

- The first short-term outcome is relevant to the Cool Smart training activity: trained technicians successfully install qualifying equipment. This outcome was the proof of concept that if trained, HVAC technicians can apply what they learned in order to satisfy their customers.
- The combination of working relationships between distributors and contractors results in the second short-term outcome: the regular availability of qualifying equipment. This regular availability, as opposed to contractors placing special orders, was not a foregone conclusion at the start of either program, but resulted from planned outreach activities to both markets.
- The third short-term outcome is the successful installation of qualifying equipment due to outreach to contractors, as well as the successful administration of incentives.
- The final short-term outcome is increased customer awareness of the programs' offerings.

Intermediate Outcomes

The program managers hypothesized the following three intermediate program outcomes that had either already occurred or were in the process of occurring, and can be observed:

- The first intermediate outcome is a broadening adoption of quality installations as the Cool Smart Program matures and expands.
- Similarly, the second intermediate outcome is the increased availability of qualifying equipment due to distributor and contractor participation in the programs. Quantifying this outcome would serve as the basis for estimating NME.
- The third intermediate outcome is the first concrete example of demand creation. Customers ask for program offerings because of both program-sponsored marketing and contractors' promotion of qualifying equipment.

Long-Term Outcomes

The three long-term outcomes have not been fully realized, but this evaluation did uncover progress towards each of them. All three outcomes address incorporating program offerings into standard practice, but further program support is still required. The PAs may want to consider more frequent assessments, preferably annually, of market progress indicators. These assessments could take the form of sales data, participant and trade ally surveys, or a series of Delphi panels to track perceptions of qualified market observers.

Table 6, which follows the three logic model diagram figures below, summarizes these outcomes and their indicators.

Figure 1. Cool Smart Logic Model Diagram

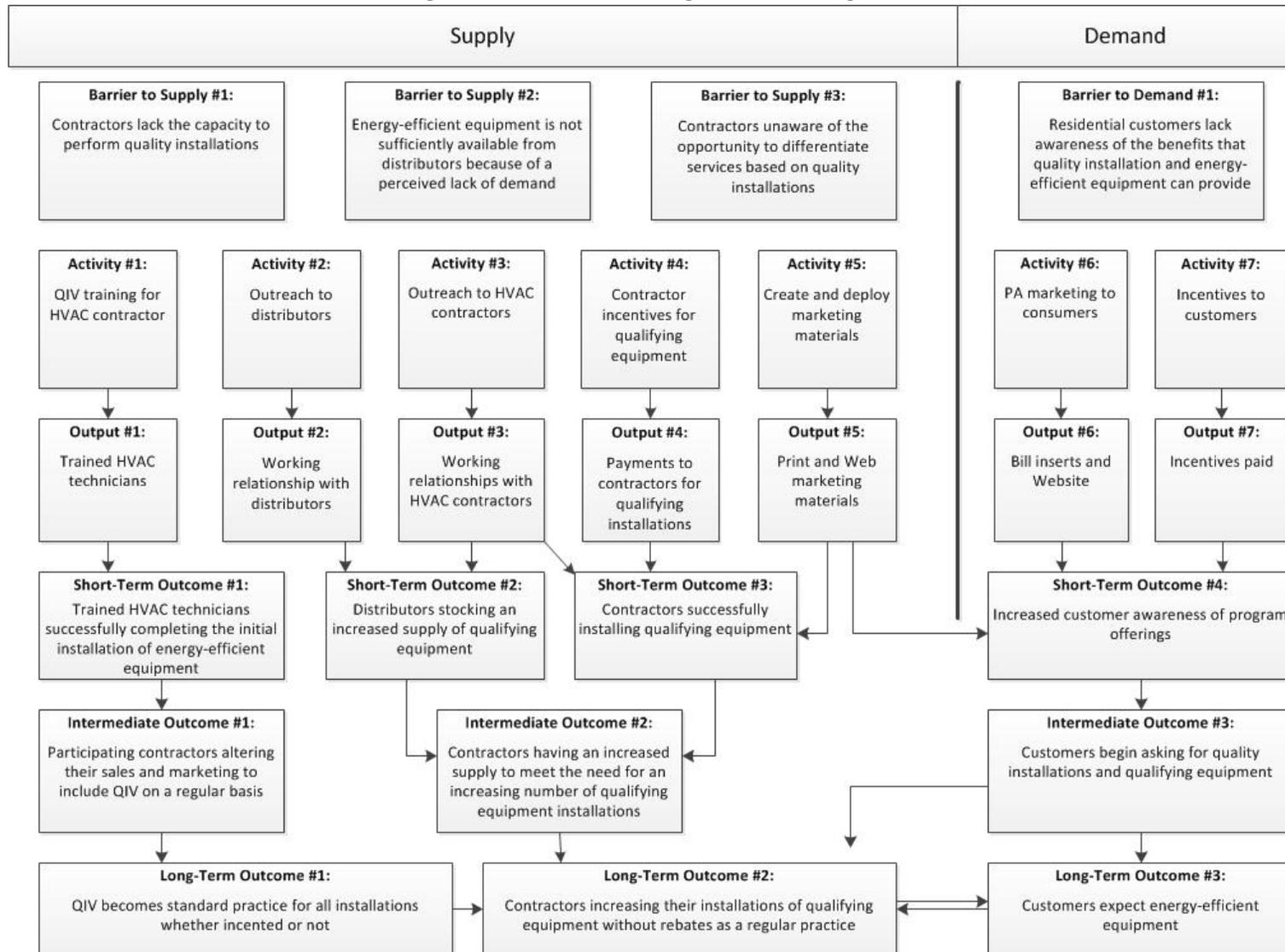


Figure 2. HEHE Program Logic Model

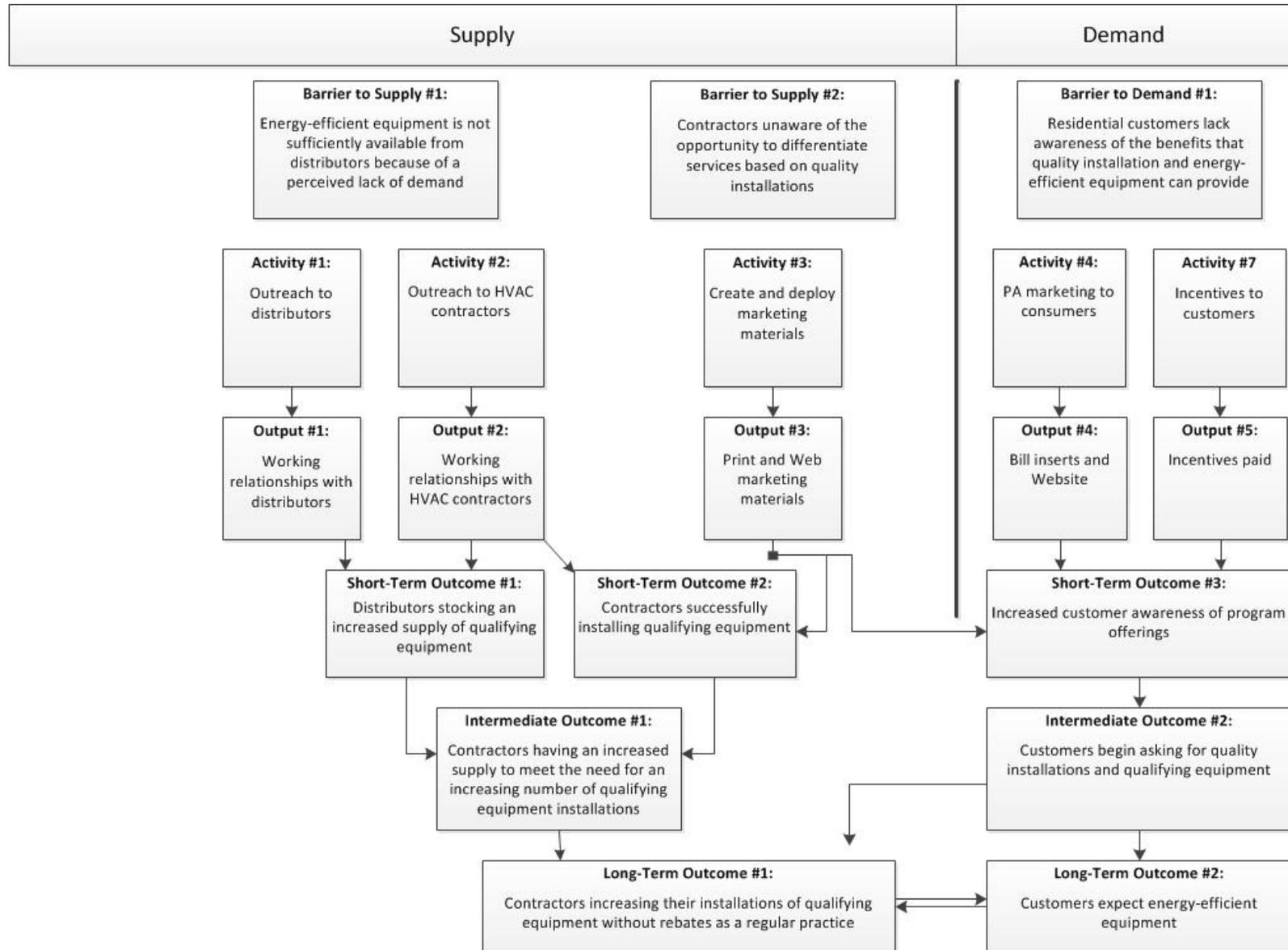


Figure 3. Combined Logic Diagram for the Cool Smart and HEHE Programs

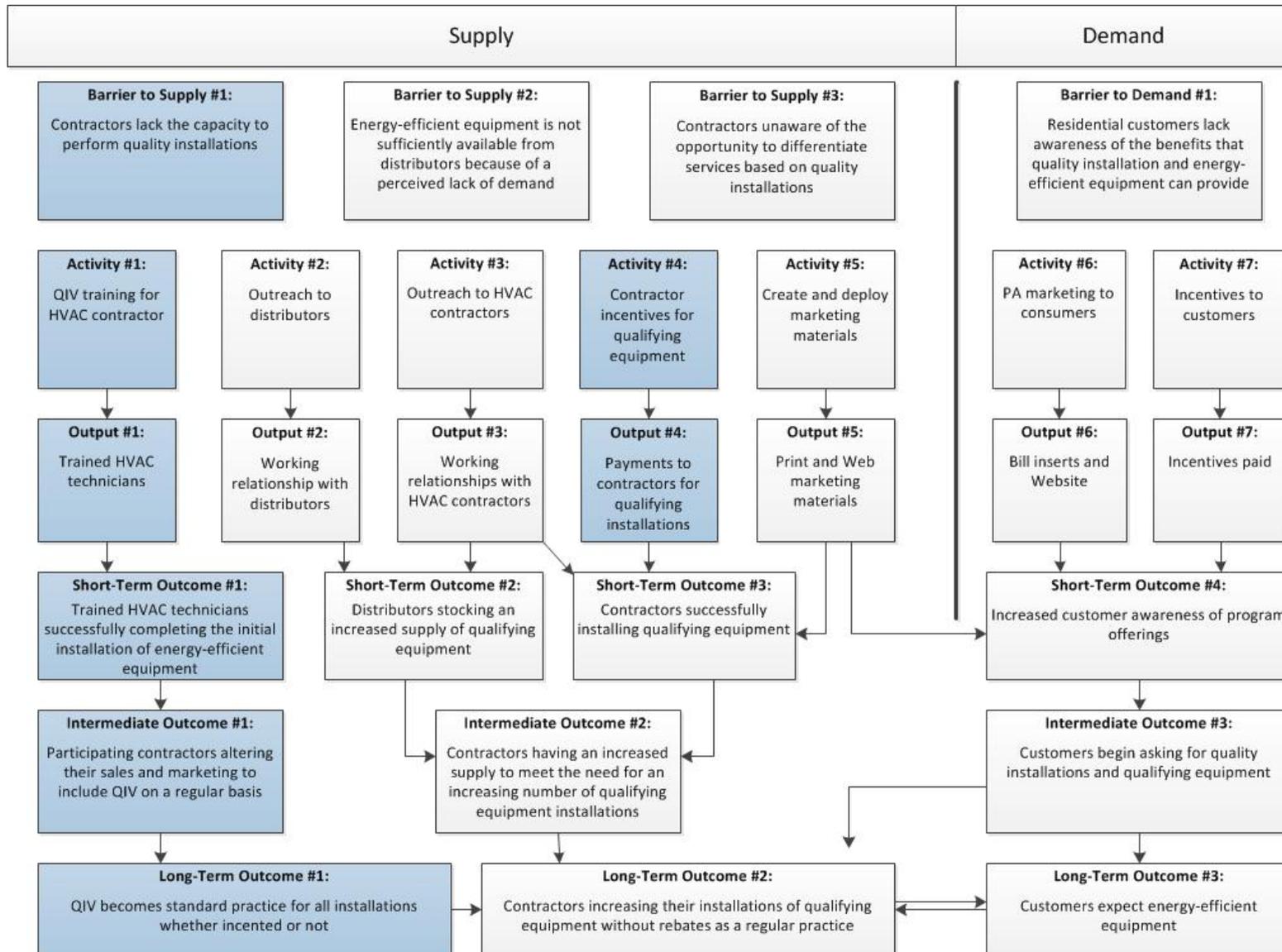


Table 6. Theory of Market Change: Outputs, Outcomes, Indicators, and Method/Sources of Validation

Outputs and Outcomes		Market Effects Indicators	Method/Source of Validation
Short-Term	Trained HVAC technician successfully complete initial installations of energy-efficient equipment	Completion of initial installations of qualifying equipment in each service territory by trained technicians	Review of tracking data
	Distributors supply qualifying products for installation	Qualifying equipment is regularly available from distributor stock	Interviews with distributors and contractors
	Increased customer awareness of QIV and rebates for qualifying equipment	Contractors increasingly report increased customer awareness of QIV techniques	Contacto interviews
Intermediate-Term	Participating contractors alter their sales and marketing to include QIV on a regular basis	Contractors introduce and maintain energy efficiency as part of their marketing messages	Contacto interviews
	Distributors change their stocking practices to supply the increased installation of qualifying equipment	Qualifying equipment becomes an increasing proportion of distributor's equipment stock	Review of AHRI data (if available);* Interviews with distributors and contractors
	Customers begin to ask for quality installations and qualifying equipment	Contractors increasingly report customer interest in QIV and qualifying equipment	Contacto interviews
Long-Term	QIV becomes standard practice in all installation, even for un-incented equipment	Increasing number of contractors employing QIV in un-incented installations	Contacto interviews
	Contractors install qualifying equipment as a regular practice without obtaining a rebate	Qualifying equipment becomes an increasing proportion of distributor's equipment stock	Distributor interviews
	Customers expect energy efficiency from cooling equipment purchases and installation	Contractors increasingly report customer requirements for energy-efficiency equipment	Distributor interviews

* AHRI data was not available for this evaluation.

3. NET MARKET EFFECTS, NET-TO-GROSS, AND EQUIPMENT REPLACEMENT TIMING METHODOLOGIES

This chapter contains information about the Evaluation Team’s approaches to developing NME and NTG estimates for the Cool Smart and HEHE programs. It begins with an overview of the 2011 Cross Cutting NTG Study³ recommendations, followed by a discussion of the methodologies the Evaluation Team used for this study. This chapter concludes with a summary of the various data collection approaches, market actor populations, and sample sizes necessary to support desired confidence and precision objectives. Appendix B of Volume II supplements this section with additional information and more detailed NME, FR SO, and ER logic models.

Background

There are no universally accepted best practices for the treatment of NTG in the demand-side management (DSM) industry. Consequently, energy-efficiency stakeholders across the country handle NTG differently: some include both FR and SO, while others only include FR and omit SO. Recent North American research conducted by Cadmus⁴ revealed that of the 32 jurisdictions, 42% did not have any NTG calculations. The components of the remaining 58% were as follows: 20% considered FR only for calculating program NTG, 38% also considered free-ridership and spillover. The components of this 38% were: 32% considered free-ridership and both participant and non-participant spillover, and 6% considered free-ridership and participant spillover only. (Appendix A of Volume II provides a table detailing the results of that study.) Finally, many jurisdictions assume that FR and SO effects offset one another when determining program cost-effectiveness.

This inconsistent regulatory treatment of NTG primarily arises from the difficulty in estimating FR and SO and the lack of industry-wide consensus on how to best estimate these values. However, in 2011, the Massachusetts Cross-Cutting Evaluation Team conducted a comprehensive review of all NTG methods, and made recommendations for each of the PAs residential programs. For Cool Smart and HEHE, the recommendations were:⁵

“The Residential Heating and Cooling and the Heating and Hot Water Equipment programs have similar features—large numbers of prescriptive measures, likelihood of substantial market effects, etc.—and can be treated similarly...A sales-based approach would be ideal for these programs, but such comprehensive data is not currently available. Therefore, self-report surveys of both customers and contractors can be used to estimate free ridership, while market effects can be estimated through interviews with contractors and suppliers in comparison

³ Nexus Market Research Group, Inc., et al., 2011.

⁴ Cadmus, et al. “Assessment of Energy and Capacity Savings Potential in Iowa.” Prepared for the Iowa Utility Association. February 28, 2012.

⁵ Nexus Market Research Group, Inc., et al. “Cross-Cutting Net to Gross Methodology Study for Residential Programs – Suggested Approaches.” Prepared for Massachusetts Program Administrators. July 20, 2011.

areas. The interviews would gather information on sales levels and market share of efficient and standard equipment.” (sic)

Methods Selected for this Study

Following the Massachusetts Cross-Cutting Evaluation Team’s NTG recommendations, as well as based on additional insights gleaned from in-depth interviews with PAs, the program theory, and logic modeling, the Evaluation Team estimated measure-specific NTG ratios using the SRA. To apply the SRA method to Cool Smart and HEHE, the Evaluation Team relied on surveys with HVAC and water heating distributors and contractors, as well as surveys with program participants. The research components were:

1. **NME:** NME are similar to the overall NTG impacts, and are used to determine an overall net impact ratio. The NME estimates in this study should be viewed as a cross-check on the final set of required NTG estimates.

The key distinction between NME and NTG is that NME does not consider or address participant motivation (i.e., FR) or account for SO. For the NME analysis, the Evaluation Team examined the market structure and market actor behavior (as described by the program logic models and market transformation indicators) of the cooling, heating, and water heating markets by asking distributors about their changes in total equipment sales and program-qualifying and non-qualifying market shares that occurred as a result of the programs (and would have occurred in the absence of the programs).

The data captured from surveys with distributors included equipment sales information, the change in sales over time, and distributor reports about how the equipment programs impacted these changes.

2. **FR:** The FR research addressed the type of equipment installed through Cool Smart and HEHE, and QIV, which only applies to Cool Smart.
 - a. **Participant Surveys:** Program participants that received incentive-eligible measures and would have installed the same measures in the programs’ absence were considered free-riders. In the self-report approach used for this study, FR is a function of the timing of purchase decisions, the quantity of measures purchased, the influence of program rebates and other features on decisions, and the likelihood of purchasing the same efficiency level in the absence of the programs.

- b. ***QIV Contractor Surveys:*** QIV contractors, who are a small subset of the HVAC contractors that participate in Cool Smart, are focused on determining whether contractors were following QIV equipment sizing and installation requirements prior to Cool Smart training and receiving incentives for QIV installations. Those who were following QIV practices prior to getting involved with QIV for the Cool Smart Program were considered free-riders.
3. ***SO:*** The Team used both QIV and regular contractor surveys to estimate the programs' SO, which are additional savings influenced by the programs but not captured in program records.
 - a. ***Contractor Surveys:*** In addition to gathering NME, the non-QIV contractor surveys captured data to distinguish between customers who installed equipment through the programs versus outside the programs. The Team derived SO estimates for qualifying equipment installations for which customers did not obtain an incentive.
 - b. ***QIV Contractor Surveys:*** In addition to asking about equipment SO, the Evaluation Team asked QIV contractors whether they apply the equipment sizing and installation practices they learned through Cool Smart to their cooling installations that did not receive QIV incentives, and for gas heating installations that were not eligible for Cool Smart QIV incentives. The Team obtained SO estimates for QIV practices that could be traced back to Cool Smart Program training and participation.

Calculating NME, NTG, and Overall Impacts

The Evaluation Team calculated the NME estimates for the Cool Smart and HEHE equipment measures and programs by comparing Massachusetts and Pennsylvania distributors' self-reported estimates of what their market sales and efficiency shares from 2010-2012 would have been in the absence of the programs. We note, however, that both small distributor survey sample sizes and the potentially "cumulative" nature of market impacts from the programs prior to 2010 render the NME estimates to a qualitative, supporting role in the determination of Cool Smart and HEHE net savings. Similarly, actual sales data provided by a subset of the Massachusetts distributors from 2007 through 2012 were used qualitatively in this study.

NTG estimates are provided at the measure level by combining the individual FR and SO components as follows:

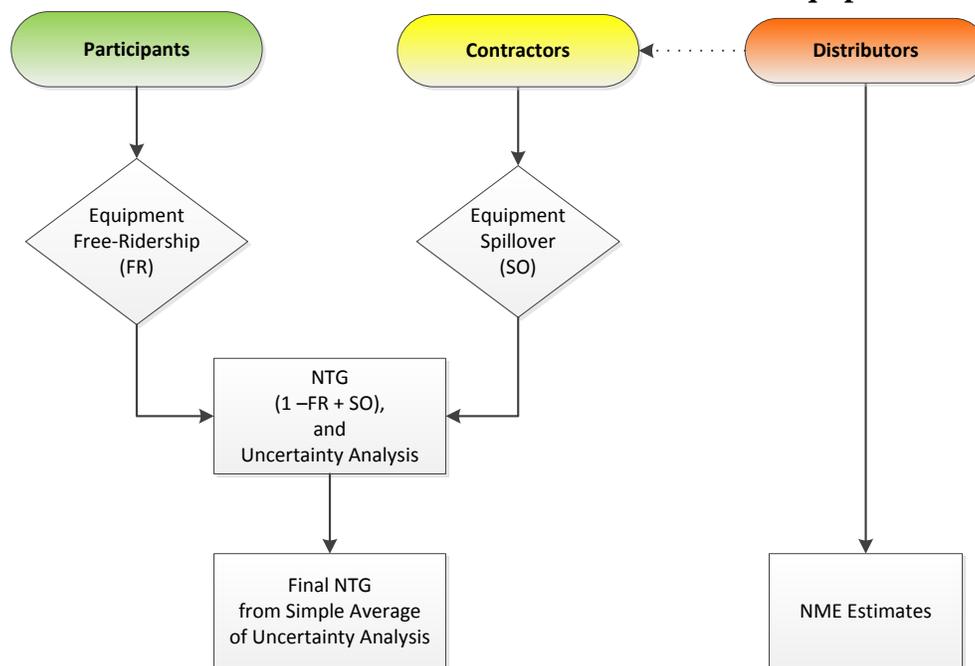
$$\text{NTG} = 1 - \text{FR} + \text{SO}$$

In that equation, FR is expressed as a percentage of program participants, and SO accruing to non-participants is also expressed as a percentage of program participants. Uncertainty is explicitly taken into account by varying key parameters within the FR and SO scoring algorithms.⁶ As shown in Figure 4, the final set of NTG estimates for each equipment measure

⁶ Please see Chapters 5 and 6, and Volume II, for details on the treatment of uncertainty within the scoring algorithms.

depends on the average of the FR and SO values, with a range of reasonable values defined by the range in FR and SO estimates.

Figure 4. Overall NTG Estimation for Cool Smart and HEHE Equipment Measures



Relationship to Cross-Cutting NTG Recommendations

To employ the approach outlined above, the Evaluation Team followed the NTG methodology suggested for Cool Smart and HEHE in the 2011 Massachusetts Cross-Cutting Net-to-Gross study. In particular, that study noted that: “*self-report surveys of both customers and contractors can be used to estimate FR, while market effects can be estimated through interviews with contractors and suppliers in comparison areas.*”⁷

As similar programs had been offered for years throughout New England and New York, the Evaluation Team and EEAC selected Pennsylvania as a comparison state, which first began running programs in 2010, and at a much lower level than those run in the Northeast states.

We targeted 25 distributor completions for each state, and although this was achieved in Massachusetts, the response rate for Pennsylvania distributors was limited, with only 8 completed surveys. Details of the disposition are located in Volume II, Appendix B. As noted above, the NME results and other findings from these distributors are qualitative in nature, and are limited to providing additional support to the NTG estimates reported in this study.

The response rate for Pennsylvania contractors was also very low. As shown in Volume II, Appendix B, the Team was able to complete surveys for 174 out of the sample frame of more

⁷ Nexus Market Research Group, Inc., et al., 2011, p. 7.

than 6,600 non-QIV Massachusetts contractors, while only 66 out of more than 4,000 Pennsylvania contractors completed the survey. This represented approximately one-third of the Massachusetts numbers, and one-third of the target completions.

Furthermore, the completion rate for the various influences of Program Administrator programs on contractor actions was very spotty in Pennsylvania. As shown in Table 7, the total number of Massachusetts Non-QIV contractors who actually provided useful answers to these questions was higher than those in Pennsylvania, where the limited number of responses combined with a significant number of “don’t know” and “refused” responses effectively rendered the majority of the 66 completions unusable for conducting spillover analysis.

Table 7. Contractor Survey Response Summary

	Measure	Survey Size	Usable Surveys	Unusable Surveys (Key Questions Not Answered)
Pennsylvania	Total	66		
	Gas Furnaces	18	5	13
	Gas Boilers	16	7	9
	Central Air Conditioning and Heat Pumps	11	3	8
	Ductless Mini-Splits	9	1	8
	Storage Water Heaters	22	6	16
	Tankless Water Heaters	13	4	9
Massachusetts	Total	174		
	Gas Furnaces	48	15	33
	Gas Boilers	61	30	31
	Central Air Conditioning and Heat Pumps	52	25	27
	Ductless Mini-Splits	49	17	32
	Storage Water Heaters	53	28	25
	Tankless Water Heaters	47	22	25

Equipment Replacement Timing

In addition to FR and SO, the net benefits from HEHE and Cool Smart are potentially impacted by the share of program participants that replaced their HVAC and water heating equipment before their old units failed. Historically, energy-efficiency industry economists have suggested that as long as equipment incentives were less than or equal to incremental equipment costs, the financial incentive was not large enough to encourage participation from those who were not already replacing failed equipment. Both Cool Smart and HEHE are in this category, as the PAs expected participation and energy savings to come from equipment being replaced on failure.

There are few, if any, programs with incentives large enough to actually claim early replacement savings, non-energy benefits, and participation.⁸

In recent years, the PAs increased the programs' incentive payments from approximately 50% of incremental costs to 75%, and they emphasized the lifetime savings of program-qualifying equipment and benefits of early equipment replacement in program marketing efforts and contractor training. This led the PAs, EEAC, and the Evaluation Team to include customer and contractor survey questions designed to discern the timing of ER.

Data Collection and Sampling

The Evaluation Team conducted the following five data collection activities:⁹

1. ***In-Depth Interviews with PAs:*** The Evaluation Team conducted telephone interviews with PAs for both the Cool Smart and HEHE programs in April 2012. The purpose of these interviews was to collect market and program context used to develop the theory of change and subsequent survey instruments.
2. ***Surveys with Massachusetts and Pennsylvania Distributors:*** The Evaluation Team conducted telephone surveys with HVAC distributors in Massachusetts and Pennsylvania during the first quarter of 2013. The purpose of the surveys was to assess current and past sales and stocking practices in both states. The sample frames we used for these surveys were commercially available lists, which we supplemented with internet searches about recommendations for other program that were provided by those other programs' survey respondents. The Evaluation Team completed 25 surveys in Massachusetts and eight in Pennsylvania.
3. ***Surveys with Massachusetts and Pennsylvania Contractors:*** The Evaluation Team conducted telephone surveys with participating and non-participating contractors that install cooling, heating, and water heating equipment. We began the surveys in June 2012, but put them on hiatus due to the intensity of the contractors' business activity at that time. We began conducting surveys again the following September, as the contractors' demand for cooling equipment declined. The purpose of the survey was to assess the following:
 - a. Firmographics
 - b. Market characterization
 - c. Proportions of installed equipment that was efficient versus standard
 - d. Application of QIV techniques

⁸ This notion should not be confused with programs that are specifically designed to address first-cost issues by paying incentives that are greater than 100% of incremental cost, or be confused with low-income programs that replace old and inefficient systems. Those types of programs are recognized as early replacement efforts, as is reflected by the program energy savings and participation estimates.

⁹ Detailed disposition reports for the survey efforts are included in Appendix B of Volume II.

The sample frame was program tracking data (for participating contractors) and commercially available lists (for non-participating contractors).. The Evaluation Team completed 174 surveys in Massachusetts and 66 in Pennsylvania.

4. ***Surveys with QIV Contractors:*** Separate from the surveys with participating contractors, the Evaluation Team surveyed contractors that had taken part in QIV training. The surveys took place in the first quarter of 2013. The purpose of the survey was to assess the following:
 - a. Firmographics
 - b. Proportions of installed equipment that was efficient versus standard
 - c. Application of QIV techniques
 - d. Proportion of equipment that was early replacement

The sample frame was program tracking data. We completed 15 surveys. (Table 8 provides the full disposition.)

5. ***Surveys with Program Participants:*** The Evaluation Team conducted telephone surveys with program participants in the final months of 2012. The purpose of the surveys was to assess:
 - a. Program awareness
 - b. Equipment Replacement timing
 - c. Uptake/awareness of QIV installation practices
 - d. Program influence
 - e. Demographics

The sample frame was program tracking data, from which we completed 759 surveys.

Table 8 displays the samples—which is the available population of that market actor group—and the resulting survey completes for each of the survey activities.

Table 8. Overall Disposition Summary

Market Actor Group	Completed Surveys	Sample
Distributor Surveys in Massachusetts	25	176
Distributor Surveys in Pennsylvania	8	164
Contractor Survey in Massachusetts	174	6,670
Contractor Surveys in Pennsylvania	66	4,042
Contractor QIV Surveys	15	62
Participant Surveys	759	8,691

4. DISTRIBUTOR SURVEYS: NET MARKET EFFECTS

This section outlines market effects and transformation indicators, and gives the qualitative findings from the Evaluation Team’s NME analysis, and sales data provided by a limited number of Massachusetts distributors.

Assessment of Market Transformation Indicators

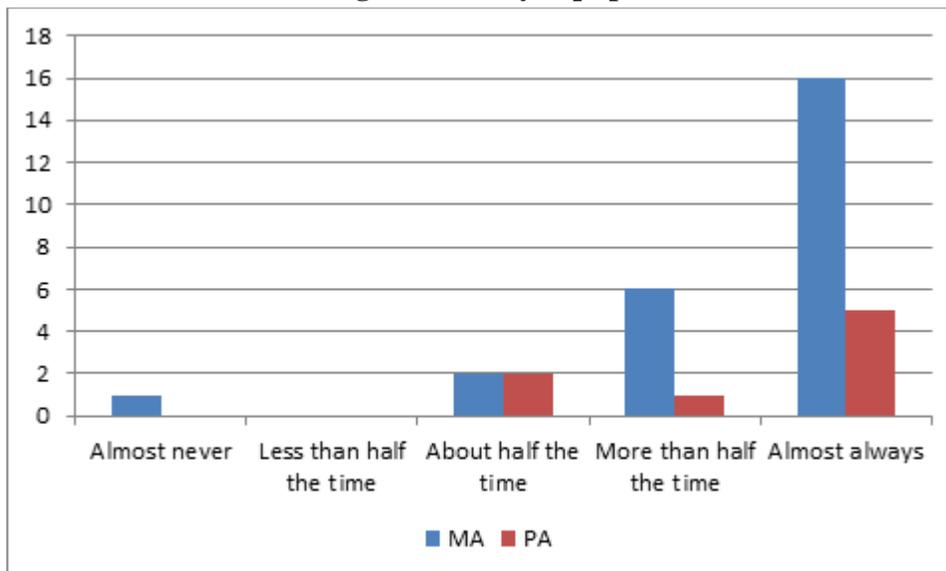
Distributors *survive* by first understanding current demand and second securing a reliable supply on behalf of their customers. Distributors *prosper* by fulfilling their customers’ current demand and anticipating their future demand. In the context of residential cooling and heating, for an HVAC distributor to compete and flourish, they must determine which equipment installation contractors are most likely to sell to residential customers weeks or months in the future. Changes in distributor stocking practices reflect this anticipation and serves as an indicator of transformation in this market.

Per the program logic models, the short-term indicator of market change for distributors is that: “*qualifying equipment is regularly available from distributor stock.*” The rationale for this indicator is that the first barrier to efficient cooling and heating equipment is availability. Clearly, based on program tracking data, Massachusetts distributors have regularly been offering qualifying cooling and heating equipment for some time.

The intermediate-term indicator of market change for distributors is that: “*qualifying equipment becomes an increasing proportion of distributor stock.*” In order to test for the presence of this market transformation indicator, the Evaluation Team conducted telephone surveys with HVAC distributors in Massachusetts (25 respondents) and Pennsylvania (eight respondents). One of the Team’s first objectives with the surveys was to determine how often distributors recommend high-efficiency equipment. Figure 5 shows the frequency that distributors’ reported recommending high-efficiency equipment to contractors.

The small sample size from Pennsylvania makes comparison difficult, but the responses indicate that distributors in both states tend to recommend higher-efficiency equipment more often than not. The Pennsylvanian distributors that indicated only offering high-efficiency equipment about half of the time stated that they: “*did not want to push folks into spending more money*” and “*the initial price point was so much higher*” as reasons for not promoting that equipment more frequently. The other Pennsylvanian distributors indicated that they almost always offer high-efficiency equipment because there are benefits to their customers and their margin.

Figure 5. Frequency of Distributors' Recommendations for High-Efficiency Equipment



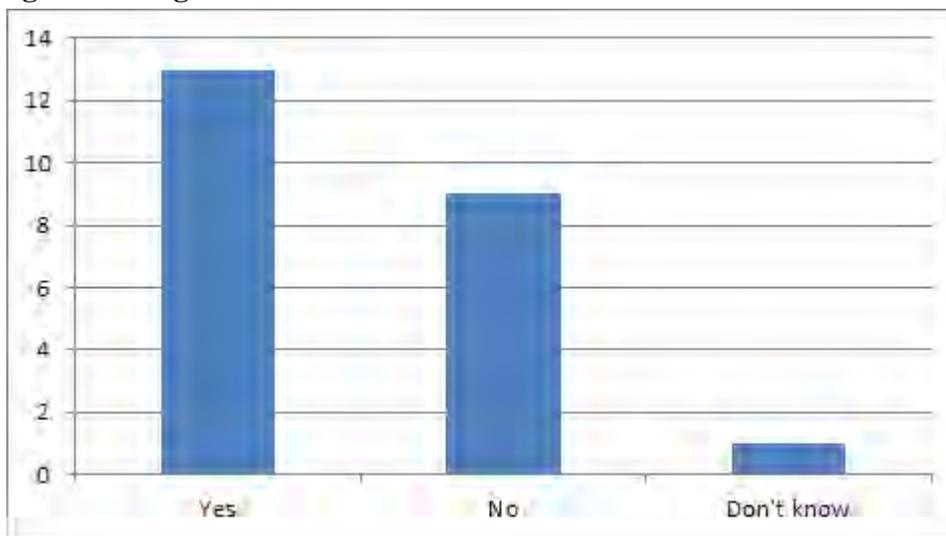
Source: Survey Question MA1: In the course of selling, bidding, or making recommendations to contractors who order residential cooling, heating, or water heating equipment, how frequently do you promote high-efficiency options, those that go beyond the minimum efficiency available? (n=25 for MA; n=5 for PA)

Twenty-one of the Massachusetts distributors who reported recommending high-efficiency equipment more than half of the time or almost always included direct references to either increased margins/profitability or the PA rebate programs. The remaining three distributors in those categories stated that they tend to recommend rebated equipment when faced with price competition.

Another objective of the surveys was to determine whether program activities had influenced the type of equipment that distributors keep in inventory. The Pennsylvania distributors stated that, to the extent they were aware of utility programs, the programs have had limited, if any, influence on their inventories. However, 13 Massachusetts respondents indicated that utility programs did influence their inventory choices, as shown in Figure 6.

Of the 13 Massachusetts distributors who stated that program support had influenced their inventory, the majority indicated that the support, particularly rebates to their contractor customers, had caused them to increase their stock of higher-efficiency equipment.

Based on these responses, the Massachusetts respondents are recommending high-efficiency equipment from an inventory that PA programs have influenced. Per the logic models for both Cool Smart and HEHE, this is consistent with a program theory that is envisioned as ultimately leading to the desired market effects.

Figure 6. Program Influence on Massachusetts Distributors' Inventories

Source: Survey Question MA3aa: Has this support influenced the types of equipment that you keep in inventory? (n=23)

Reported Market Shares and Evidence of Market Effects

The Evaluation Team also asked distributors to report their equipment efficiency shares in 2012. These data for Massachusetts are provided in Table 9. It is important to recognize that the first three columns of market share data are based on the survey responses of all 25 distributors, the subset of 19 distributors who did not provide sales data, and the subset of 6 distributors who provided sales data, respectively. These market shares represent each Massachusetts distributors' best recollection of their sales during 2012. However, the last column of Table 9 shows the 2012 market share from the subset of 6 Massachusetts distributors who took the time to complete a detailed spreadsheet showing actual sales from 2007 through 2012.

Table 9. Distributors' Self-Reported Equipment Market Shares, 2012

End-Use	Efficiency	All Distributors: Survey Market Share*	Distributors Not Providing Sales Data: Survey Market Share*	Distributors Providing Sales Data: Survey Market Share*	Distributors Providing Sales Data: Sales Data Market Share*
Central Air Conditioners and Heat Pumps	Less than 14.5 SEER	68%	67%	59%	62%
	Greater than or equal to 14.5 SEER and less than 15 SEER	5%	5%	4%	4%
	Greater than or equal to 15 SEER and less than 16 SEER	3%	3%	2%	5%
	Greater than or equal to 16 SEER	24%	24%	36%	28%
Ductless Mini-Splits	Less than 14.5 SEER	10%	10%	10%	27%
	Greater than or equal to 14.5 SEER	90%	90%	90%	73%
Natural Gas Boilers	Less than 90% AFUE	27%	28%	16%	21%
	Greater than or equal to 90% AFUE and less than 96% AFUE	34%	34%	23%	11%
	Greater than or equal to 96% AFUE	40%	38%	61%	67%
Natural Gas Furnaces	Less than 92% AFUE	20%	20%	16%	17%
	Greater than or equal to 92% AFUE and less than 95% AFUE	31%	31%	35%	21%
	Greater than or equal to 95% AFUE	49%	49%	49%	62%
Gas Water Heaters	Storage with less than 0.67 energy factor	82%	82%	26%	26%
	Storage with greater than or equal to 0.67 energy factor	13%	13%	37%	16%
	Tankless	5%	5%	37%	57%

* Totals may not sum to 100% due to rounding.

The market share data in Table 9 reveal the following:

- **CAC and Heat Pumps.** All of the estimates suggest that between 60 and 70% of CAC and heat pump units exceeded the Cool Smart Program-qualifying level of 14.5 SEER. Moreover, the market shares for the various program-qualifying efficiency levels are remarkably similar across the distributor groups. Interestingly, units greater than 16 SEER apparently have the highest share among the program-qualifying efficiency levels.
- **Ductless Mini-Splits.** All of the self-report estimates show that 90% of the ductless mini-splits exceeded the program-qualifying level of 14.5 SEER. The actual sales data provided by the six distributors shows a smaller amount (73%). Regardless, the data suggest that we might expect relatively high FR rates for ductless mini-splits.
- **Natural Gas Boilers.** Approximately 75% of natural gas boilers were condensing and met the minimum HEHE Program requirement of 90% AFUE. As with CAC/HP, the data reveal that the highest share among program-qualifying equipment apparently occurred at the most efficient tier (AFUE \geq 96).
- **Natural Gas Furnaces.** As with boilers and central cooling equipment, the data suggest higher market shares at the highest efficiency tiers. According to the distributor self-reports, approximately 50% of natural gas furnaces met the 2012 HEHE Program minimum efficiency requirement of 95% AFUE. The figure was higher among the subset of six distributors who provided sales data (60%).
- **Gas Water Heaters.** This category shows the largest difference between the distributor groups. The total number of sales and the market shares reported by the six providing sales data reveal that they are not at all representative of the gas water heater market. As a group they specialize in tankless water heaters, with lower total sales relative to those distributors who did not provide sales. The overall sample of distributors indicates that the sale of less efficient storage water heaters exceeded 80% of the market, with tankless water heaters accounting for about 5% of sales.

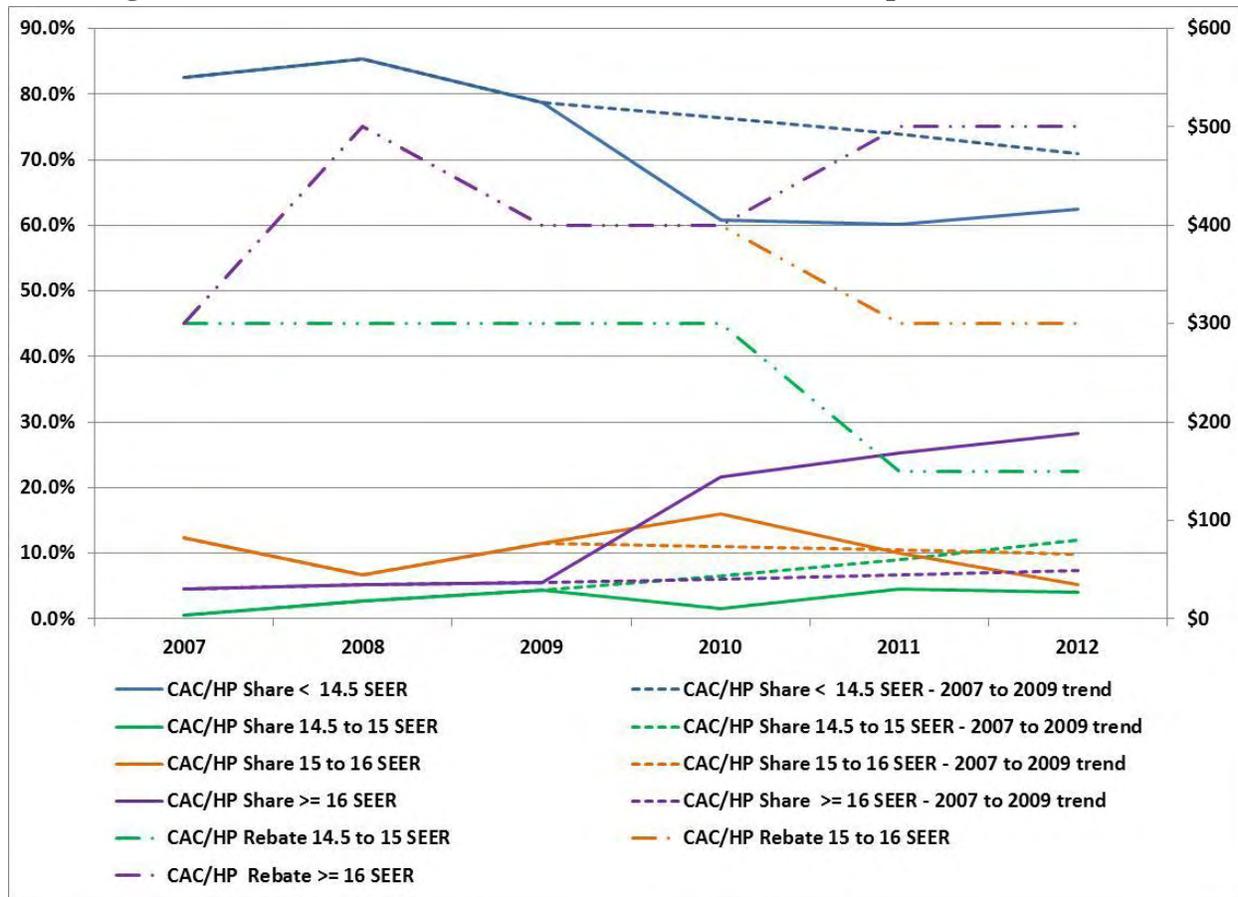
The apparent representativeness of the actual sales data for CAC/HP, boilers and furnaces provided by size distributors can be used to draw qualitative inferences about how market shares have changed between 2007 and 2012. The next set of analyses further explore market share changes among efficiency levels, with program rebate changes over time providing evidence of market effects.

The first of these analyses is shown for CAC/HP in Figure 7. The solid lines show actual market shares by efficiency level, and the dashed lines show the underlying trend by efficiency level if the 2007 to 2009 sales data were used to forecast shares from 2010 to 2012. The third set of varying-length dashed lines show the average rebates by efficiency level over time. The data are illustrative and there is no proof of causality.

Yet there is evidence that the adding of an additional tier and a higher rebate for CAC units at 16 SEER or above in 2010 was accompanied by a fourfold increase in the market share of these units, from about 5% to more than 20% in one year. Similarly, the reduction in the rebate for the two lowest qualifying tiers (14.5 to 15 and 15 to 16 SEER) was accompanied by reductions in the market share of these units relative to their respective 2010-2012 trend lines. Finally, the share of non-qualifying units has fallen relative to its trend line, suggesting that these changes in

rebates and other aspects of the program are moving customers into the program-qualifying efficiency tiers.

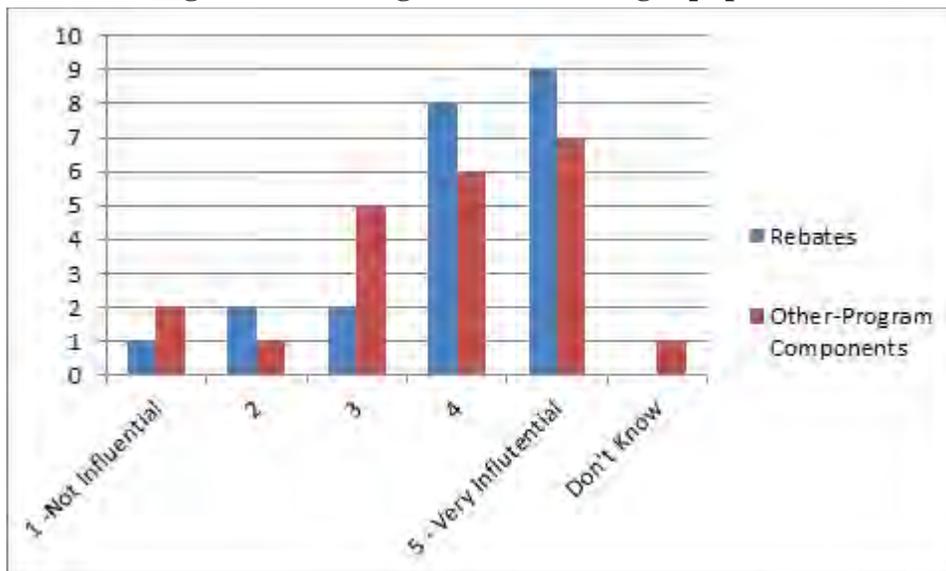
Figure 7. Sales of Central Air Conditioners and Heat Pumps in Massachusetts



Source: Actual 2007-2012 sales data from six Massachusetts distributors.

We also asked Massachusetts distributors to rate the influence of incentives versus training and marketing materials. Most of them credited rebates as having a greater influence on their sales of high-efficiency cooling equipment, as shown in Figure 8.

Figure 8. Distributors' Perceptions of the Relative Influence of Program Rebates vs. Training and Marketing on Their Cooling Equipment Sales



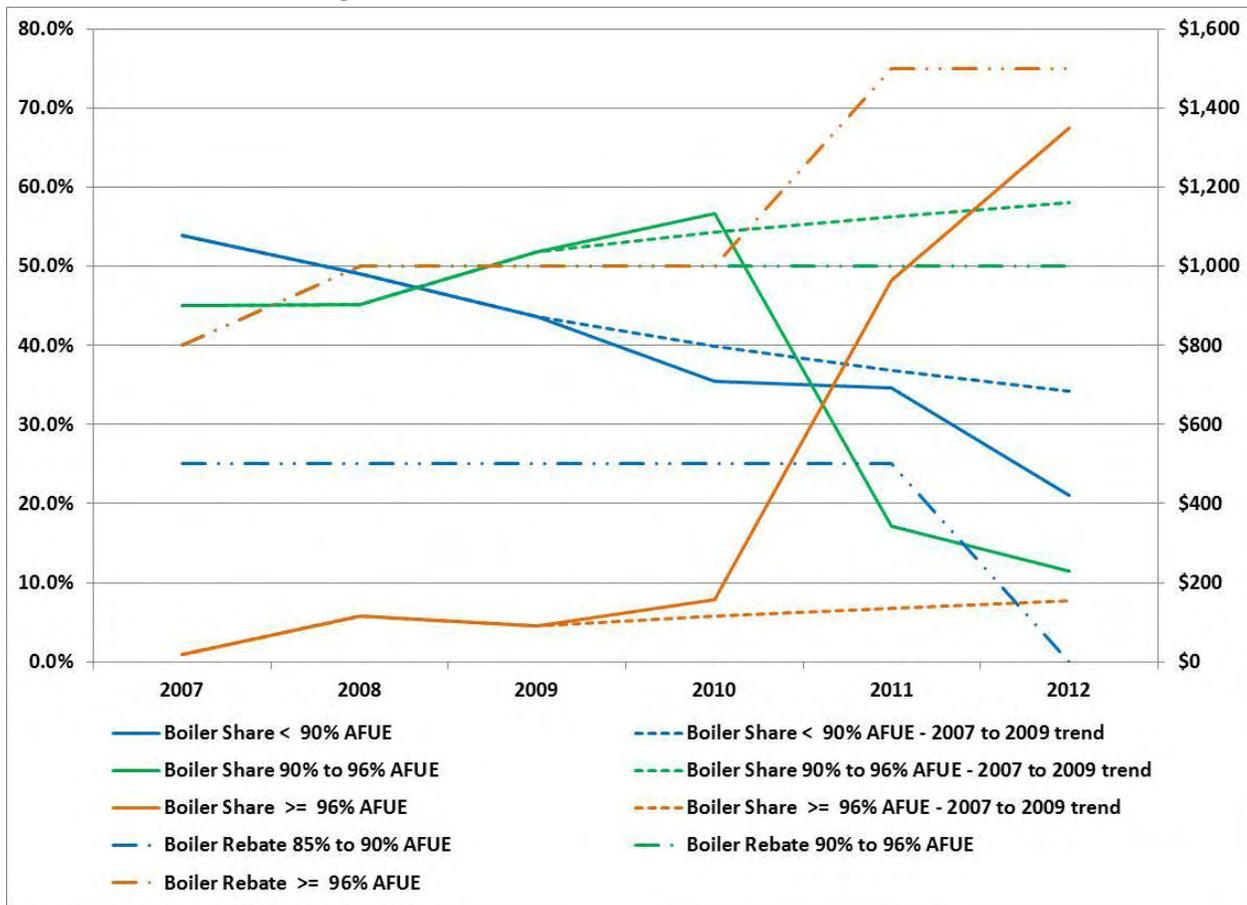
Source: Survey Questions MA9d: On a scale of 1 to 5, with 1 being not influential and 5 being very influential, considering the many possible reasons why equipment has become more energy efficient, how influential have utility [rebates/training and marketing] been in promoting high-efficiency cooling equipment sales? (n=22)

Since the distributors do not collect rebates, the Evaluation Team interprets their higher ranking of incentives as a proxy that drives the demand from their customers, the installation contractors.

Gas boiler 2007-2012 sales data from the six Massachusetts distributors are shown in Figure 9. The first change in rebates over this time period occurred in 2008, with boilers exceeding 90% AFUE showing an increase from \$800 to \$1,000. This was accompanied by a modest increase in the share of units over 90% AFUE through 2010. In 2011 the HEHE program added the above 96% AFUE tier and increased the rebate to \$1,500, and the market share as reported by these distributors rose from about 10% to 50%.

The data suggest most of this increase was a shift from 90% to 96% program-qualifying units to this highest tier. However, an additional change in 2011—the elimination of the lowest qualifying level (85% to 90% AFUE units)—was accompanied by a further shift to the highest tier and a marked reduction of units less than 90% AFUE from the trend line. All of these changes suggest that the program has been moving the market as intended into higher efficiency tiers.

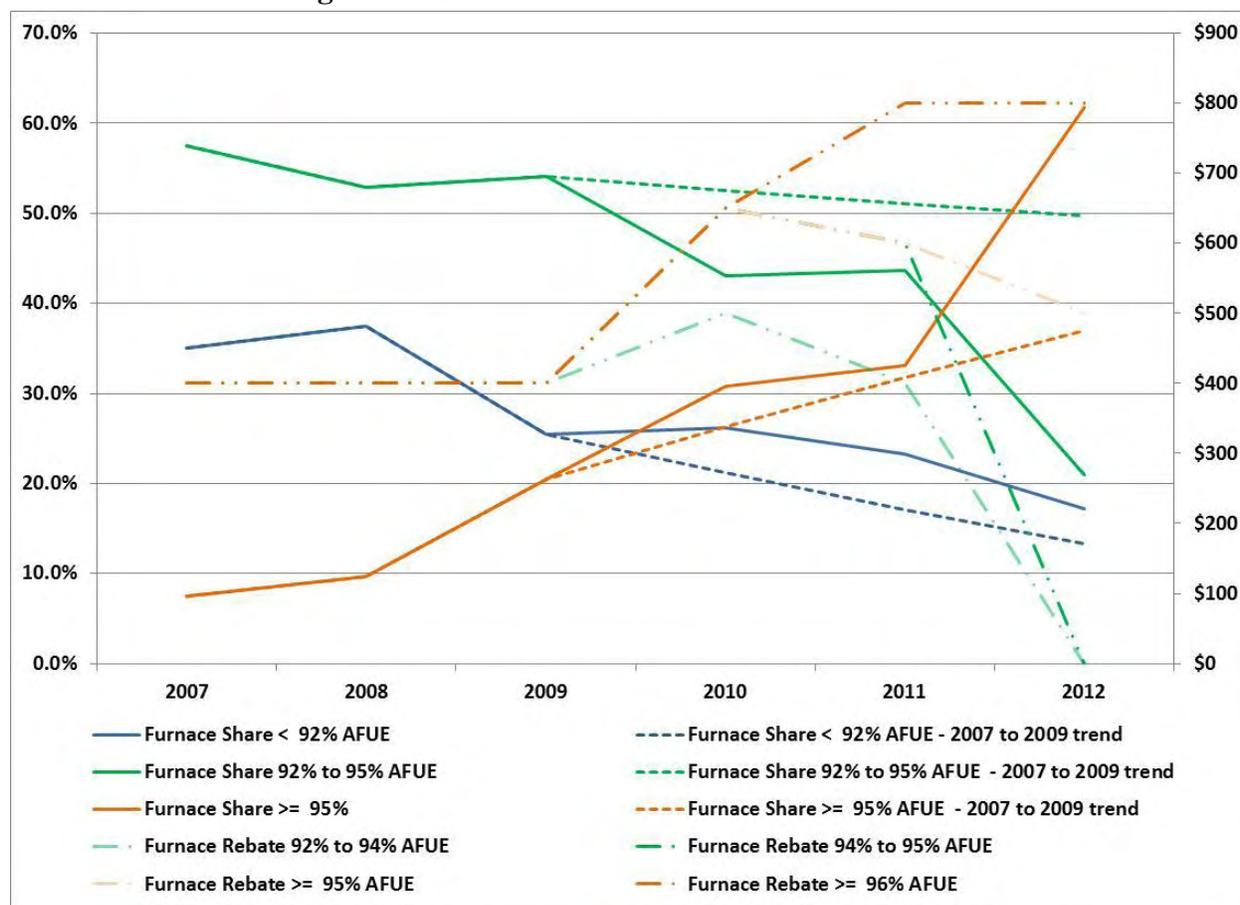
Figure 9. Sales of Gas Boilers in Massachusetts



Source: Actual 2007-2012 sales data from six Massachusetts distributors.

The gas furnace 2007-2012 sales data from these distributors shown in Figure 10 tell a similar story. We note that the gas furnace rebate structure has been more complex than can be shown on this chart, with various combinations of AFUE qualifying levels, with and without ECM features, and accompanying rebate levels. However, the data again support the notion that changes in the rebate level across tiers are generally accompanied by market share shifts. The largest shifts to 95% AFUE and above units apparently occurred in 2010, when units above this level were first rebated as a separate tier, and in 2012 when rebates for units below 95% AFUE were eliminated from the HEHE program.

Figure 10. Sales of Gas Furnaces in Massachusetts



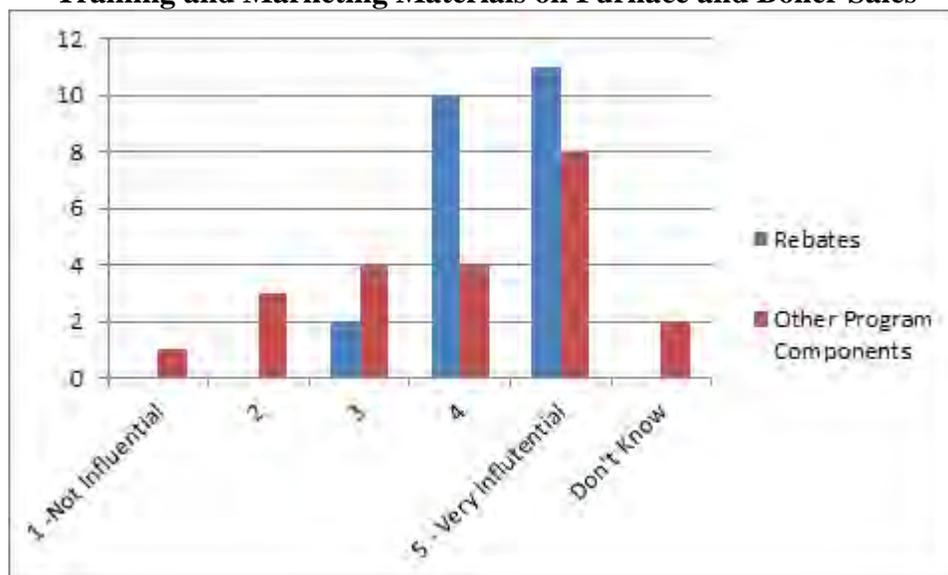
Source: Actual 2007-2012 sales data from six Massachusetts distributors

The gas boiler and furnace data suggest that the boiler and furnace equipment with the greatest efficiency now dominates the market share. The least efficient equipment is becoming less and less available over time.

As with central cooling equipment, when asked to rate the influence of incentives versus training and marketing materials, the respondents attributed rebates as having a greater influence on their sales of high-efficiency furnaces and boilers than training or marketing materials, as shown in Figure 11.

The distributors’ also recognized rebates as having the greatest influence on furnace and boiler sales. Again, these rebates were provided to contractors, so the Evaluation Team interprets these ratings as indicating that the distributors’ view the HEHE rebates as the primary programmatic influence in driving sales.

Figure 11. Distributor Perceptions of Relative Influence of Program Rebates vs. Training and Marketing Materials on Furnace and Boiler Sales



Source: Survey Question MA8d: On a scale of 1 to 5, with 1 being not influential and 5 being very influential, considering the many possible reasons why equipment has become more energy efficient, how influential have utility rebates/training and marketing materials been in promoting high-efficiency furnace and boiler sales? Rebate n = 23; Other n = 22

Summary of Market Transformation Indicators

The proportion of efficient central HVAC equipment has increased in recent years, and has accelerated as incentives increased for both Cool Smart and HEHE measures. Further, the equipment with the greatest efficiency has had the most gain in market share.

The distributors' estimated sales figures, along with the actual sales figures from a subset of six distributors, reflect their decisions to purchase and make more efficient equipment available to Massachusetts HVAC contractors. The distributors' choice to stock and sell more efficient equipment is based on their expectations of continued demand for efficient equipment. If distributors did not have confidence in the long-term need for contractors to install such equipment, it is unlikely they would have changed their stocking proportions over the course of the programs.

Because the longitudinal sales figures came from only six of the Massachusetts distributors, the Evaluation Team cannot assert that the time trends represent overall programs' impacts. However, these self-reports and sales data do confirm the presence of the expected market transformation indicator: the distributors, as supply-side market actors, have changed their behavior (i.e., stocking practices) in a manner that qualitatively correlates to market effects as a result of the programs.

Distributor Net Market Effects

The Evaluation Team utilized self-report data from the sample of 25 Massachusetts distributors to estimate NME relative to Cool Smart and HEHE central HVAC equipment.¹⁰ NME estimates were also derived for these measures using Pennsylvania as a control area. Again, these results should be viewed as qualitative rather than definitive, and are provided as supporting evidence of the NTG estimates in this study.

The Evaluation Team derived NME values from a series of questions we designed to capture the distributors' change in total sales due to these programs. For each end-use measure, we asked:

- What were your company's total sales over the last year?
- What were your company's sales (or the share of total sales) of high-efficiency equipment (as defined by program-qualifying thresholds)?
- How have these sales patterns changed relative to a hypothetical environment in which the programs did not exist?

Figure 12 illustrates this NME methodology as it applies to each high-efficiency measure using Massachusetts data only. The Evaluation Team weighted the results by each distributor's reported total sales. Then the Team multiplied the percent change in the market share of high-efficiency equipment, adjusted for the total change in the equipment sales' overall efficiency levels as a result of the programs, by the annual appliance turnover¹¹ for each measure. The result was the net increase in high-efficiency sales as a result of the programs.

To obtain the NME, the Team then divided the resulting net increase in high-efficiency equipment sales by the annual programs' participation of each measure in Massachusetts. Two alternative NME methods using Pennsylvania data were also applied. The first essentially uses a "difference in differences" method to normalize the change in MA shares. Although this is interesting to consider, conceptually it considers the counterfactual twice: once for MA sales, and again by looking at the difference in shares in MA relative to the difference in shares in Pennsylvania. The second control area approach recognizes this by just normalizing the change in MA share by Pennsylvania shares in the hypothetical absence of the limited programs there. It

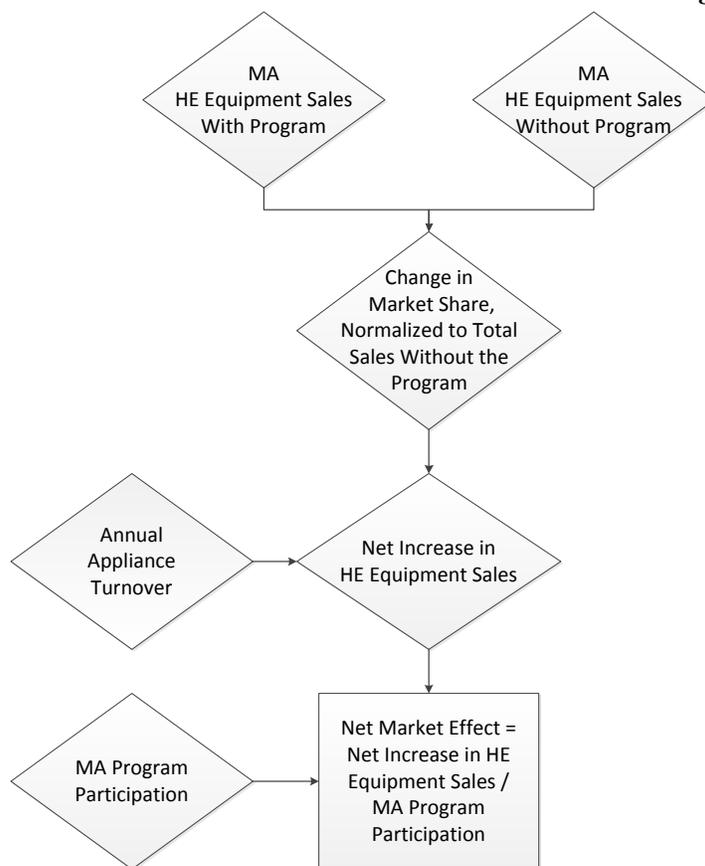
¹⁰ As noted in the previous section, data for ductless mini-splits and gas water heaters were too sparse to facilitate this qualitative analysis.

¹¹ The Team derived the installed base of each end-use from the total installed equipment base using equipment saturation estimates from Opinion Dynamics Corporation. "Massachusetts Residential Appliance Saturation Survey (RASS): Volume 1: Summary Results and Analysis." April 2009. Available online: <http://www.env.state.ma.us/dpu/docs/electric/09-64/12409nstrd2af.pdf>. The Evaluation Team calculated the annual turnover rate as a function of appliance lifetimes, and the fact that early replacement is occurring in the HVAC market due in part to Cool Smart and HEHE. We note that end-use lives (EULs) reflect a "half-life" of equipment, with approximately 50% of installed units failing before and the other half failing after. This means that all equipment fails for a given cohort after 2 * EUL. For example, if furnaces last an average of 20 years, we would expect all units to fail after 40 years, and the annual rate of failure would be 1/40. However, early replacement would spend up the annual turnover for the older cohorts. As there is not enough information available to fully isolate this effect, the Evaluation Team approximated this effect by adjusting the annual turnover rate to 1.5 * EUL.

is effectively showing the percentage increase in shares as opposed to the absolute increase in shares in the MA-only NME estimates.

See Appendix B in Volume II for more details on these distributor NME calculations.

Figure 12. Massachusetts Distributor Net Market Effects Logic Model*



* HE indicates high efficiency.

As shown in Table 10, the Massachusetts-only NME analysis suggests profound differences within these end uses by efficiency category. The hypothetical changes in market share and NME increase with each efficiency tier within these end-uses. This is consistent with the sales time series data provided by the subset of six distributors discussed previously, and 2012 program participation.

Table 10. Distributor Net Market Effects, Massachusetts Only Algorithm

End-Use	Efficiency Level	2012 Program Participation	Share Without Program - MA	Share With Program - MA	Change in Market Share	Annualized Sales Due to Program	MA Only NME
Central Air Conditioners and Heat Pumps	< 14.5 SEER		86%	67%	-19%	-4,323	
	≥ 14.5 to < 15 SEER	189	5%	5%	0%	78	0.41
	≥ 15.5 to < 16 SEER	879	2%	3%	2%	342	0.39
	≥ 16 SEER	2,085	8%	25%	17%	3,903	1.87
	All Program Qualifying Equipment	3,153	14%	33%	19%	4,323	1.37
Boilers	< 90% AFUE		54%	19%	-36%	-5,742	
	≥ 90% to < 96% AFUE	1,541	30%	37%	8%	1,216	0.79
	≥ 96% AFUE	4,869	16%	44%	28%	4,526	0.93
	All Program Qualifying Equipment	6,410	46%	81%	36%	5,742	0.90
Furnaces	< 92% AFUE		40%	10%	-30%	-4,509	
	≥ 92% to < 95% AFUE	1,440	33%	35%	3%	387	0.27
	≥ 95% AFUE	4,909	27%	54%	28%	4,123	0.84
	All Program Qualifying Equipment	6,349	60%	90%	30%	4,509	0.71

Table 11. Distributor Net Market Effects, Massachusetts with Pennsylvania Algorithms

End-Use	Efficiency Level	Penn. Share without Programs	Penn. Share with Programs	Change in Market Share	NME Method 1 - Pennsylvania			NME Method 2 - Pennsylvania		
					Net Change in Market Share (MA Change - Penn Change)	Annual Sales Due to Program	NME	Net Change in Market Share (MA Change / Penn without)	Annual Sales Due to Program	NME
Central Air Conditioners and Heat Pumps	< 14.5 SEER	80%	60%	-20%						
	≥ 14.5 to < 15 SEER	19%	33%	14%	-14%	-3,108	-16.44	2%	410	2.17
	≥ 15.5 to < 16 SEER	1%	2%	1%	1%	131	0.15	189%	42,561	48.42
	≥ 16 SEER	0%	5%	5%	13%	2,859	1.37	6310%	1,418,693	680.43
	All Program Qualifying Equipment	20%	40%	20%	-1%	-118	-0.04	96%	21,583	6.85
Boilers	< 90% AFUE	59%	55%	-3%				-60%		
	≥ 90% to < 96% AFUE	31%	31%	0%	8%	1,216	0.79	24%	3,896	2.53
	≥ 96% AFUE	10%	14%	3%	25%	3,968	0.81	279%	45,013	9.24
	All Program Qualifying Equipment	41%	45%	3%	32%	5,184	0.81	86%	13,916	2.17
Furnaces	< 92% AFUE	28%	22%	-6%				-108%		
	≥ 92% to < 95% AFUE	48%	67%	19%	-16%	-2,398	-1.67	5%	804	0.56
	≥ 95% AFUE	24%	11%	-13%	40%	6,043	1.23	116%	17,298	3.52
	All Program Qualifying Equipment	72%	78%	6%	24%	3,645	0.57	42%	6,266	0.99

The addition of Pennsylvania data to the analysis (Table 11) offers further qualitative support for market effects. Although Pennsylvania is now offering tiered incentives for central air conditioners and heat pumps, rebates range from \$150 for SEER 14.5 to \$300 for SEER 16 and higher. The upper end in Massachusetts is \$500. This is probably why the gains in Pennsylvania are concentrated at the minimum qualifying level, and the net change in Massachusetts market share relative to Pennsylvania (NME Method 1) for models between 14.5 and 15 SEER is actually negative. As with the Massachusetts-only analysis, the data suggest net market effects are occurring in the central cooling market, but the effects are concentrated in the higher efficiency levels. Similar qualitative market effects evidence for boilers and furnaces is shown in Table 11.

Turning to NME Method 2, where the net change in the Massachusetts market shares is divided by the hypothetical Pennsylvania shares without programs, the Evaluation Team notes that the theoretical accuracy of this approach is negated somewhat by dividing by close to zero. The approach is basically impractical arithmetically when the control area market share is close to zero. Yet, once again the numbers directionally support the notion that market effects are occurring at the highest end-use efficiency tiers in Massachusetts.

Northeast Residential HVAC Incentive Comparison

The Evaluation Team researched residential HVAC programs across the Northeast and Pennsylvania to compare the rebate levels offered by HEHE and Cool Smart to those offered by other programs in the region. The data included rebate levels from programs offered by 19 program administrator across five states. Energy-efficiency measures included central air conditioners, air source heat pumps, gas furnaces, and gas boilers. Each measure was compared at a various program-qualifying efficiency levels.¹²

These comparisons are presented in Table 12. Although data was gathered from 19 program administrators, there are many variations in program requirements and rebate tiers. Yet a distinct pattern in the differences in program rebates emerges in the rebates offered at different efficiency levels. In particular, Massachusetts PAs do not offer rebates for many of the measures at the lower tier efficiency levels. For example, several programs offer rebates for CAC units with a SEER of 14–14.49, but Massachusetts PAs do not. This pattern is also found in air source heat pumps, gas furnaces, and gas boilers. For all of these measures, the Massachusetts PAs do not offer a rebate for the lowest tier energy efficiency level.

Moreover, the Massachusetts PAs offer larger rebates at the higher efficiency levels, and no other state in the northeast region offers larger incentives at the highest efficiency tier. The Massachusetts rebates for CAC units with a SEER of 14.5 or greater average \$100 more than other programs in the region, and \$400 more for CAC units with a SEER of 16 or higher. Again, this pattern is also found in air source heat pumps, gas furnaces, and gas boilers. Rebates for furnaces at or above 96% AFUE average \$450 more and the rebates for boilers at or above 96% AFUE average \$950 more.

¹² For this analysis, the Evaluation Team used a combination of online sources, starting with www.dsireusa.org, which listed the available utility rebate program within the geographic area studied. From there, the evaluation team used the individual utility program rebate websites to gather the incentive information.

Table 12. Northeast and Pennsylvania HVAC Rebates Compared to MA Programs

Measure	Efficiency Level	Programs with Higher Rebates	Programs with Same Rebates	Programs with Lower Rebates	Average Difference Compared to MA
Central Air Conditioner	< 14.5 SEER	2	NA	NA	+ \$250
	≥ 14.5 to < 15 SEER	0	2	4	- \$100
	≥ 15.5 to < 16 SEER	0	0	0	- \$200
	≥ 16 SEER	0	0	0	- \$400
Air Source Heat Pump	< 14.5 SEER	3	NA	NA	+ \$250
	≥ 14.5 to < 15 SEER	2	1	4	+ \$100 / -\$150
	≥ 15.5 to < 16 SEER	0	0	0	- \$200
	≥ 16 SEER	0	0	0	- \$400
Gas Furnace	< 95% AFUE	2	NA	NA	+ \$222
	≥ 95% to < 96% AFUE	1	1	3	+ \$100 / -\$167
	≥ 96% AFUE	0	0	0	- \$450
Gas Boiler	< 90% AFUE	2	NA	NA	+ \$350
	≥ 90% to < 96% AFUE	0	1	4	- \$380
	≥ 96% AFUE	0	0	0	- \$950

5. CONTRACTOR SURVEYS: EQUIPMENT REPLACEMENT, TIMING, FREE-RIDERSHIP, AND SPILLOVER

This section outlines the ER, FR, and SO results reported by HVAC installers. Appendix B of Volume II contains more detailed methodology logic models.

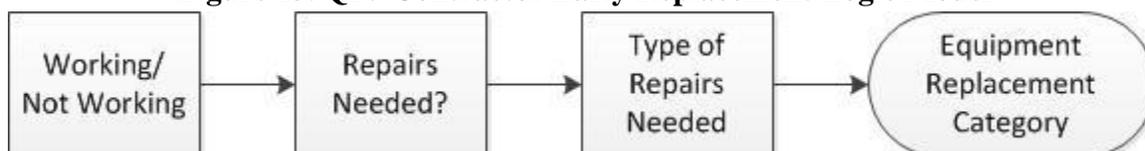
Contractor Replacement Timing Analysis

For QIV contractors, we conducted ER analysis and calculated the share of early replacement installations using the following formula (which is displayed in Figure 13):

$$\begin{aligned} \text{Early Replacement} = & \% \text{ of Units that are Working and Need No Repairs} \\ & + \% \text{ of Units that are Working but Need Minor Repairs} \\ & + \% \text{ of Units that are Not Working but Only Need Minor} \\ & \text{Repairs to be Restored to Working Condition.} \end{aligned}$$

Note that this formulation is different from the replacement timing analysis conducted in Chapter 6 using the participant survey. The greatest distinction between the two approaches is that the QIV contractor survey only uses self-reports about repair histories, whereas the participant replacement timing analysis also considers the participant's belief about when equipment would fail and how that factored into their decision to replace equipment. The QIV contractor analysis will therefore overstate early replacement, and should be viewed as qualitative support for the participant-based replacement timing estimates shown in Chapter 6.

Figure 13. QIV Contractor Early Replacement Logic Model



The ER results of the QIV contractor surveys are presented in Table 13. The measures with the highest ER rate were boilers, followed by furnaces.

Table 13. QIV Contractor Early Replacement

Measure	% Early Replacement	N
Boilers	47%	9
Furnaces	38%	15
Central Air Conditioners/Heat Pumps	25%	12
Ductless Mini-Split	14%	8

Contractor Free-Ridership and Spillover Analysis

This section begins with an analysis of equipment SO, as revealed from non-QIV contractors. Then, FR and SO from QIV contractors is examined.

Contractor Equipment Spillover Analysis

While the Evaluation Team used distributor survey results to establish overall equipment market effects, we used a battery of survey questions about each measure category to refine the estimate of SO. Collectively, the questions allowed the Evaluation Team to estimate the influence of the Cool Smart and HEHE programs on HVAC and water-heating equipment availability, the influence of the programs' marketing and outreach, contractors' recommendations to customers, and contractors' sales of high-efficiency equipment outside of the programs. Specifically, the Team included the following questions in the survey to determine non-participant SO:

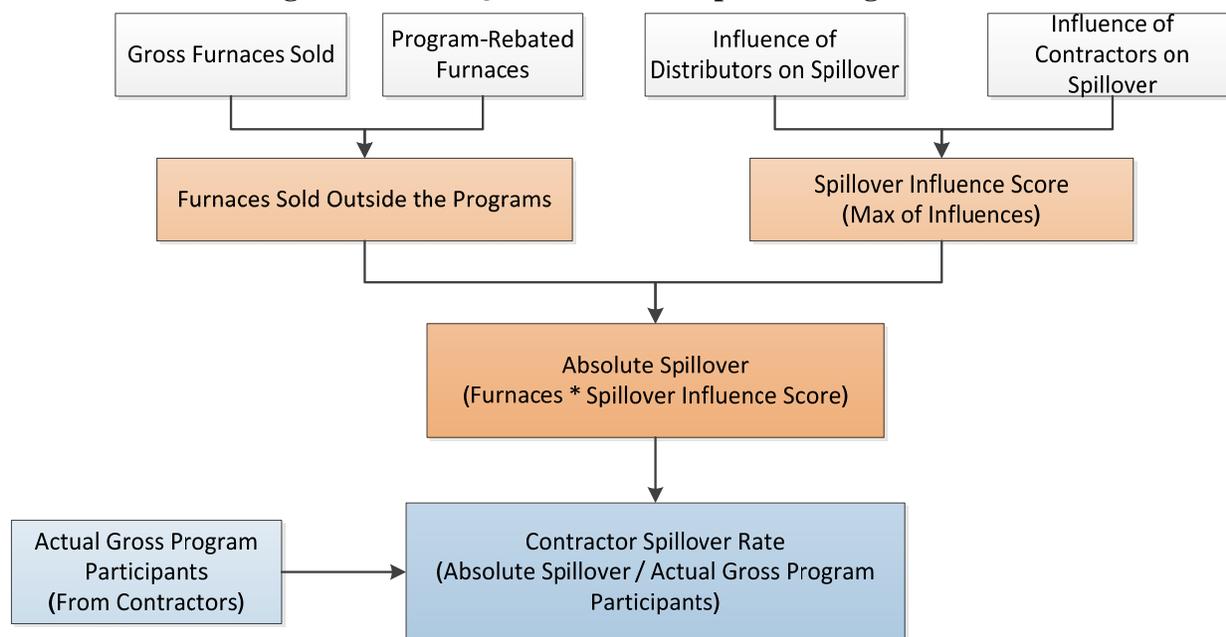
- How much influence did the programs have on how frequently you recommended high-efficiency equipment?
- What was the influence of the programs (including customer incentives, marketing, advertising, education, and other support) on the recommendations you made?
- What was the influence of equipment availability (distributor stocking practices) on your equipment installations?

Figure 14 illustrates how the Evaluation Team converted the contractors' responses to these questions into an equipment SO score.¹³ Using this framework, the Team calculated the SO rate using four methods for scoring the influence questions.

- The first method used the maximum of the contractor and distributor influence scores along with only scoring responses as SO for which the program was very influential and somewhat influential on for their consumers' choices for that equipment.
- For the second method, we followed the same calculations as with the first method, but then included the next level of influential responses (e.g., a 3) as a minimal amount of SO.
- The third and fourth SO rate methods were similar to the first and second methods, with the exception that we incorporated the average of the contractor and distributor influence scores, instead of using the maximum.

Additional details relating to these calculations are provided in Appendix B of Volume II.

¹³ As shown in Figure 14, the Team derived this estimate from the results of the distributor surveys.

Figure 14. Non-QIV Contractor Spillover Logic Model

The results from this analysis are shown in Table 14. The SO rate for gas boilers was the lowest of the participating measures. This is a result of contractors' reporting that approximately 90% of their high-efficiency gas boiler installations received rebates. On the other end of the spectrum, CACs and heat pumps had the highest SO rate of the participating measures, which contractors' reported received a rebate approximately 50% of the time. As discussed in Chapter 7, the overall NTG assessment uses the average SO estimates. The impact of SO uncertainty is also presented in showing the range of NTG estimates.

Table 14. Non-QIV Contractor Spillover Calculations from Four Influence Scoring Methods

Measure	Spillover Rate				
	Method 1	Method 2	Method 3	Method 4	Average
Gas Furnaces	0.19	0.37	0.09	0.23	0.22
Gas Boilers	0.10	0.11	0.05	0.06	0.08
Central Air Conditioners and Heat Pumps	0.32	0.42	0.16	0.22	0.28
Ductless Mini-Splits	0.04	0.12	0.02	0.10	0.07
Storage Water Heaters	0.14	0.19	0.07	0.11	0.13
Tankless Water Heaters	0.29	0.30	0.15	0.29	0.26

Method 1: maximum influence, answers of 4-5 included in scoring

Method 2: maximum influence, answers of 3-5 included in scoring

Method 3: average influence, answers of 4-5 included in scoring

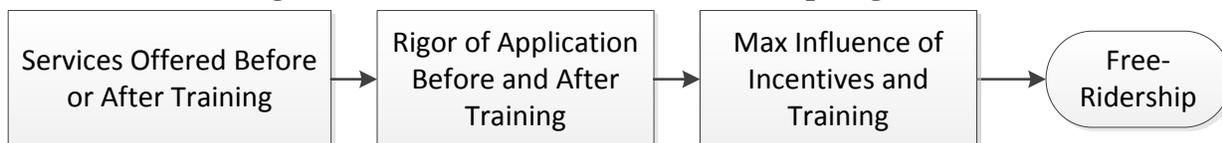
Method 4: average influence, answers of 3-5 included in scoring

The relatively low level of program participation among consumers who had a program-qualifying high-efficiency CAC or heat pump installed indicates a high level of SO, given the increased market share of high-efficiency equipment shown in Table 10 as reported by distributors.

QIV Contractor Free-Ridership and Spillover Analysis

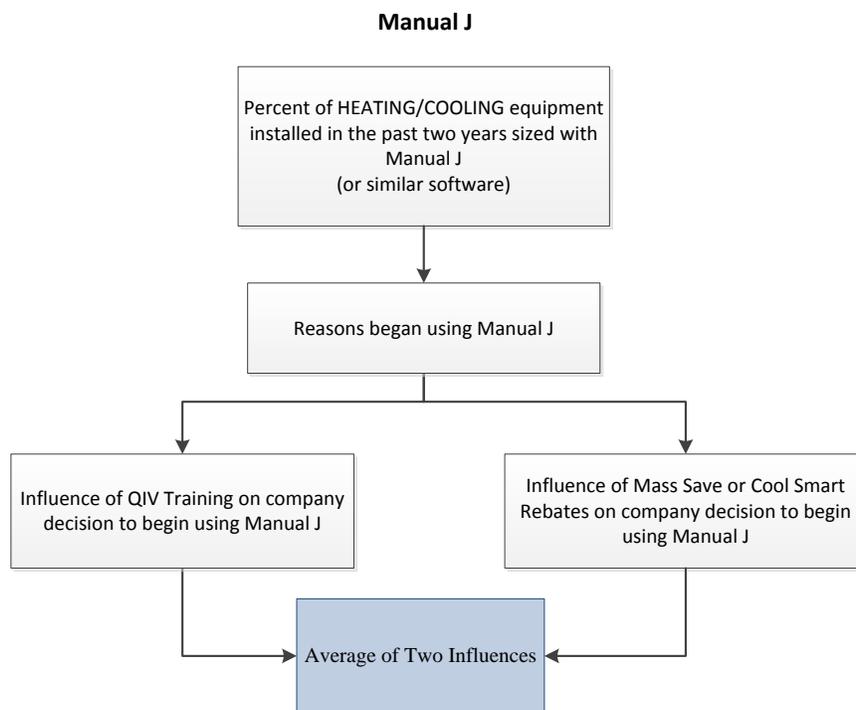
The Evaluation Team calculated QIV contractor FR for their application of Manual J calculations for cooling measures, as well as for air flow testing, duct sealing, and refrigerant testing. We based the FR rate on the timing of their application of the QIV techniques, as well as the degree of the programs’ influence on their use of those techniques, and the rigor to which they applied the techniques. The logic of the QIV contractor FR calculations is shown in Figure 15, and additional details are provided in Appendix B of Volume II.

Figure 15. QIV Contractor Free-Ridership Logic Model



The Evaluation Team based QIV contractor SO on their application of QIV techniques for cooling equipment, including for testing of airflow balance, applying proper refrigerant charges outside of the programs, and applying QIV techniques on heating equipment. Since the Cool Smart Program does not include heating measures, the Team considered any use of Manual J or other QIV techniques on heating equipment as SO. The Evaluation Team’s SO calculations account for the timing of the application of QIV techniques, and the influence that the programs had on their adoption. Figure 16 shows a logic model of QIV contractor SO as it applies to Manual J calculations.

Figure 16. QIV Contractor Spillover for Manual J Calculations



The Evaluation Team calculated the QIV contractor FR and SO rates using four different methods. We asked participating contractors about two ways the programs’ influences their

behavior: 1) through the availability of the programs' incentives and 2) through the availability of the programs' training. The team asked contractors to rates the degree of each of these programs' influences on a scale from 1 to 5, where one indicates being not at all influential and 5 indicates being highly influential.

For the first two methods, we averaged the two different programs' influences, and that average represented the total influence of the programs on that participating contractor. For the second two methods, we used the maximum value of either of the programs' influences.

A second aspect that the Evaluation Team examined with the four FR and SO methods was the scale of the scoring values assigned. Methods 1 and 3 use a scales-based value in one-third increments, with one as the highest value, zero as the lowest value, and middles values of 0.33 and 0.67. Methods 2 and 4 use a scales-based value in one-quarter increments, where the middle values are 0.25, 0.5, and 0.75. Because the scale for Methods 2 and 4 has more variation than the scale for Methods 1 and 3, the Team included those participants in Method 1 and 3 in the lowest groups who would have fallen in the bottom two Method 2 and 4 groups (i.e., those with a value of 0 and 0.25). Additional details about the Team's QIV FR and SO calculations are provided in Appendix B of Volume II.

The results of the QIV FR, SO, and NTG calculations are shown in Table 15, Table 16, and Table 17. As shown, the highest level of FR occurs for contractors' using Manual J when installing cooling measures, and the lowest FR occurs for contractors' conducting airflow testing and duct sealing.

The highest level of SO occurs for contractors' using Manual J techniques for refrigerant testing, which had slightly more SO than FR. The Evaluation Team considered any application of Manual J techniques to the installation of heating measures as SO when the contractor learned about the technique through the Cool Smart Program. The lowest level of SO occurred for contractors' applying QIV techniques to airflow testing and duct sealing.

There is some variation in FR estimates across the methods, but there is almost no variation in the SO estimates given scoring uncertainty. This is due to the fact that positive spillover answers (questions scores) were concentrated among a few QIV contractors, and those contractors had very similar or identical incentive and training influence scores. Also, most of those contractors with SO reported very high levels of influence, and were therefore not as affected by the change in scale as they would have been had they reported very low levels of influence.

Table 15. QIV Technique, Free-Ridership

Measure	Free-Ridership				Average	N
	Method 1	Method 2	Method 3	Method 4		
Manual J CAC/HP	0.42	0.36	0.40	0.34	0.38	16
Air Flow Testing/Duct Sealing	0.23	0.17	0.10	0.08	0.15	13
Refrigerant Testing	0.27	0.22	0.21	0.17	0.22	16

Table 16. QIV Technique, Spillover

Measure	Spillover				Average	N
	Method 1	Method 2	Method 3	Method 4		
Manual J Central Air Conditioners and Heat Pumps	0.16	0.16	0.16	0.16	0.16	16
Manual J Heating	0.14	0.15	0.14	0.15	0.15	16
Airflow Testing/Duct Sealing	0.06	0.07	0.06	0.07	0.07	13
Refrigerant Testing	0.23	0.24	0.23	0.24	0.24	16

The overall QIV FR, SO, and NTG estimates presented in Table 17 are based on a simple average of the Manual J central air conditioners and heat pump sizing, and airflow and refrigerant testing results. This is because the TRM does not break out QIV savings by measure. Additionally, the benefits associated with Manual J heating spillover primarily include equipment cost savings, which is a non-energy benefit.

Table 17. Average QIV for Free-Ridership, Spillover, and Net-to-Gross

Measure	Average FR	Average SO	NTG
Manual J Central Air Conditioners and Heat Pumps	0.38	0.16	0.78
Manual J Heating	NA	0.15	NA
Airflow Testing/Duct Sealing	0.15	0.07	0.92
Refrigerant Testing	0.22	0.24	1.02
Overall QIV	0.25	0.16	0.91

6. CUSTOMER SURVEYS: EQUIPMENT REPLACEMENT, TIMING, AND FREE-RIDERSHIP

The Evaluation Team determined customer self-reported FR and SO through surveys with 2011 and 2012 Cool Smart and HEHE programs' participants. The program measures we selected for discussion with participants are shown in Table 18 and Table 19. The Team conducted a total of 759 participant surveys. (See Appendix B of Volume II for detailed disposition of the customer surveys.)

Table 18. Cool Smart Program Measures for Participant Survey

Measure
Central air conditioners/heat pumps with SEER 15 to less than SEER 16
Central air conditioners/heat pumps with SEER 16+
Ductless mini-splits of SEER 14.5+
QIV

Table 19. HEHE Program Measures for Participant Survey

Measure
Gas furnaces with AFUE 95%+
Gas boilers with AFUE 90% to less than AFUE 96%
Gas boilers with AFUE of 96%+
Storage water heaters with an energy factor of 0.67+
Tankless water heaters with an energy factor of 0.94 or less
Tankless water heaters with an energy factor of 0.95+
Integrated heating and water heating systems with a condensing boiler

This section first outlines the participant survey ER results, then outlines the FR results.

Participant Equipment Replacement Timing Analysis

The Evaluation Team's participant replacement timing methodology was similar to the process described in Chapter 5 for QIV contractor ER analysis, but augments that approach to consider how customer expectations around near-term equipment failure impacted the replacement decision.

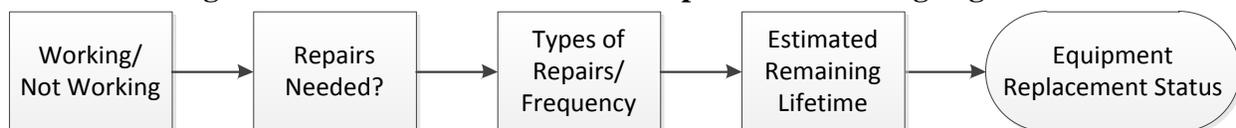
Participants were initially placed into four categories based strictly on repair history: early, replace-on-failure (ROF), new units, and in-between, which includes units that are neither clearly early nor ROF. We then made two additional adjustments:

- Adjustment 1: Participants who said their unit would likely have lasted less than a year were classified as ROF. This moved individuals from early and in-between to ROF. Also, anyone who was ER and said their unit would likely have lasted two to three years moved to in-between.

- Adjustment 2: This is on top of Adjustment 1, and includes participants who said the “fact that the unit might be reaching the end of its expected life” was very important—a 5 in their decision—was reclassified as ROF. Again, this moves individuals from early and in-between to ROF. Additionally, anyone who answered a “4” to this question and was previously classified as early was moved to in-between.

The participant equipment replacement timing algorithm is summarized in Figure 17, and additional details are provided in Volume II, Appendix B..

Figure 17. HEHE and Cool Smart Replacement Timing Algorithm



The results of the participant replacement timing calculations are presented in Table 20. As expected, the estimates are somewhat lower than the qualitative QIV contractor ER results for heating and cooling equipment (where we can make directional comparisons). The share of gas heating participants who can be classified as ER is 23-30%, less than the range of 40-50% derived from the QIV contractor ER analysis. The difference in the two methods can be primarily attributed to the existence of the in-between category in the participant analysis, and the fact that participants’ perceptions of when equipment will fail were addressed in their estimates. The other gas measures—integrated boilers and hot water heat, and storage and tankless water heaters—had replacement timing estimates that were similar to furnaces and boilers.

The share of participants who reported replacing their CAC or heat pump early was less than 10%, whereas the QIV contractor analysis estimated the ER of CAC and heat pump systems at 25%. Again, much of the difference is due to the existence of the in-between category, and customer expectations of equipment failure and that influence on the decision to replace units. As expected, the majority of ductless min-split systems were first-time installations.

Table 20. Equipment Replacement Timing in HEHE and Cool Smart Programs

Measure	Equipment Replacement Timing Shares				
	Early	New	ROF	In-Between	N
Boiler	30.6%	0.0%	44.9%	24.5%	147
Furnace	23.1%	0.0%	61.5%	15.4%	78
Central Air Conditioner / Heat Pump	8.0%	50.4%	29.2%	12.4%	137
Ductless Mini-Split	2.5%	95.1%	0.0%	2.5%	81
Integrated Boiler / Water Heater	20.0%	0.0%	55.7%	24.3%	115
Storage Water Heater	33.3%	0.0%	50.0%	16.7%	108
Tankless Water Heater	28.0%	0.0%	54.8%	17.2%	93

The participant surveys further explored the old equipment holdings for a subset of measures. Customers who installed furnaces or boilers were asked whether they previously had gas heat, and if not, what heating fuel they previously used. The overwhelming majority of those who switched fuels previously had oil heat.

Cross-tabulations of oil-to-gas conversion status and the replacement status are provided in Table 21. The objective here is to discern whether there are any systematic differences in the equipment replacement timing shares in Table 20 by conversion status or efficiency level. The shares in Table 21 are grouped in blocks of six cells. For example, the first boiler efficiency category is split by conversion status (no, yes), and by the three timing options relevant to boilers and furnaces (Early, ROF, and In-Between).¹⁴ These six shares add up to 100%, as noted by the “All” column.

It is apparent that the share of gas heating customers replacing equipment early is dominated by oil-to-gas conversions, whereas there is more of an even split among the ROF and in-between categories. More than three-quarters of early boiler installations, and nearly two-thirds of early furnace installations, are oil-to-gas conversions. Additionally, approximately 50% of in-between and ROF boilers are fuel conversions, but ROF furnaces – which make up more than 60% of furnace installations – are dominated by gas-to-gas replacement.

Table 21. Boiler and Furnace Participant Replacement Timing by Efficiency Category and Oil-to-Gas Conversion Status

Measure	Oil to Gas Conversion?	Equipment Replacement Timing Shares			
		Early	ROF	In-Between	All
Boilers between 90 and 96% AFUE	No	6.8%	23.0%	13.5%	100%
	Yes	27.0%	18.9%	10.8%	
Boilers greater than or equal to 96% AFUE	No	6.9%	20.8%	12.5%	100%
	Yes	20.8%	26.4%	12.5%	
Furnaces greater than or equal to 95% AFUE	No	9.1%	45.5%	5.2%	100%
	Yes	14.3%	15.6%	10.4%	

Participant Free-Ridership Analysis

The Evaluation Team used a battery of survey questions for each measure category to calculate FR, or the percentage of savings that would have occurred in the programs’ absence.

Collectively, the questions allowed us to estimate the influence of the Cool Smart and HEHE programs on participants’ decision-making processes, which the Team then used to determine

¹⁴ The attribution of relative fuel prices, the HEHE program, and other factors influencing the decision to switch from oil to gas heating prior to equipment failure was not considered in this study. Although approximately 30% of early replacement and in-between fuel switching participants made the decision to replace existing equipment after learning about the program, the questions weren’t formulated to address attribution.

the likelihood that the measure would have been installed in the programs' absence. Specifically, the Team included the following questions in the participant surveys to determine FR:

- Did you have plans to install the high-efficiency measure prior to learning about the programs?
- Would you have installed the same quantity of measures without the programs?
- How influential was the program rebate and marketing materials on your decision to install high-efficiency measure?
- In the programs' absence, when would you have had the measures installed?

Our approach provided additional important information, including:

- Derivation of a partial FR score based on the likelihood of a respondent taking similar actions in the programs' incentive absence.
- Use of a rules-based approach for consistency among multiple respondents.
- The ability to change weightings in alternative methods to test the scoring sets.

Participant Equipment Free-Ridership Analysis

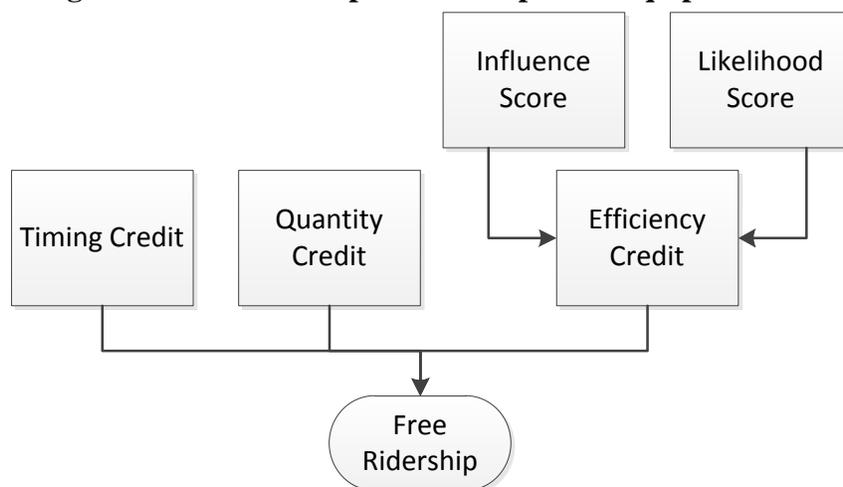
The Evaluation Team calculated participant FR rates using the following steps. First, we established when the participant became aware of the HEHE and Cool Smart programs. We considered participants who became aware of the programs after they had installed the high-efficiency measure as full FR, and assigned them a FR score of 1. We then asked participants a series of questions to determine the effect of the programs on the timing of their decision to purchase the program-qualified measures. We gave a timing credit to those participants who reported that the programs accelerated their purchase.

Second, we established the level of the programs' influence on each participant's decision to purchase the program-qualified equipment. We assigned an influence credit to the participants that was based on their reported influence of the program rebate, the influence of the contractor's recommendations, and the likelihood that they would have purchased a measure with the same level of efficiency had the programs not been in place. The Team combined these components to form an overall efficiency credit.

Then, we calculated a quantity credit base on whether each participant would have purchased the same quantity of program-qualified equipment in the absence of the programs. We determined that participants who, at any point in the FR survey, reported that they would not have installed the high-efficiency measure without the program as non-FR, and assigned them an FR score of 0.

We determined the participant FR using the following equation (which is displayed in Figure 18):

$$FR = (1 - Efficiency Credit) * (1 - Timing Credit) * (1 - Quantity Credit)$$

Figure 18. Logic Model for Participant Self-Reported Equipment Free-Ridership

As part of the sensitivity analysis for the HEHE and Cool Smart participant FR rates, the Evaluation Team used several different methods to determine the participant FR rates. First, we determined the average of the participants' scores for the influence of the contractor and the program rebate. Then we used the average of that influence score and the likelihood that the participant would have installed a measure with the same level of efficiency without the programs to determine the efficiency credit. Alternatively, we determined the efficiency credit using the maximum value of the contractor and rebate influences, and the maximum value of the influence and likelihood scores.

The Evaluation Team also applied a higher timing credit for our method sensitivity analysis. We originally assigned a partial timing credit of 50% for units that would have been replaced within six months to a year of the rebated unit. However, for the higher timing credit methods used in our sensitivity analysis, we increased the partial timing credit to 66% for units that would have been installed within six months to a year.

Table 22 presents the results of the HEHE and Cool Smart FR calculations for each of the following scenarios:

- Method 1: Original Timing Credit, Average of Likelihood and Influence Components
- Method 2: Original Timing Credit, Maximum of Likelihood and Influence Components
- Method 3: Higher Timing Credit, Average of Likelihood and Influence Components
- Method 4: Higher Timing Credit, Maximum of Likelihood and Influence Components

The results indicate that varying the timing credit has little, if any, impact on the FR results. However, the difference between using the average and the maximum values of the program influence and likelihood components in calculating the efficiency credit had very significant implications for FR, with the maximum values effectively halving the FR estimates.

Table 22. Participant Free-Ridership Results for HEHE and Cool Smart Measures

Measure	N	Method 1	Method 2	Method 3	Method 4	Average
Boilers, AFUE 90-95.9%	75	0.42	0.21	0.42	0.21	0.32
Boilers, AFUE ≥96%	72	0.40	0.21	0.41	0.22	0.31
Furnaces, AFUE ≥95%	78	0.52	0.30	0.53	0.30	0.41
Central Air Conditioners/Heat Pumps, SEER 14.5-14.9	69	0.48	0.21	0.49	0.22	0.35
Central Air Conditioners, SEER ≥16	68	0.54	0.31	0.54	0.31	0.42
Ductless Mini-Splits	81	0.55	0.34	0.56	0.34	0.45
Storage Water Heaters, Energy Factor ≥0.67	108	0.20	0.05	0.20	0.05	0.13
Tankless Water Heaters, Energy Factor ≤0.94	47	0.48	0.25	0.48	0.25	0.37
Tankless WH, Energy Factor ≥0.95	46	0.35	0.20	0.35	0.20	0.28
Integrated Space Heaters/Water Heaters with a Condensing Boiler	115	0.46	0.23	0.46	0.23	0.34

7. SUMMARY: OVERALL COOL SMART AND HEHE PROGRAM EVALUATION RESULTS

This section summarizes the ER timing, and FR and SO results for the Cool Smart and HEHE programs' measures. It also provides overall NTG estimates based on these findings.

Equipment Replacement Timing Findings

The measures responsible for the majority of savings due to equipment installations in the HEHE and Cool Smart programs are central HVAC systems: gas boilers, gas furnaces, CAC, and heat pumps. The estimates from both QIV contractors and participants suggest that significant shares of participants are replacing equipment early. Those replacing equipment early (four or more years of remaining life) represent more than 30% of boiler and 23% of furnace installations, but just 8% of central air conditioner and heat pump installations. Early replacement shares among integrated boiler/hot water units, storage water heaters, and tankless water heaters range from 20 to 33%. There is virtually no early replacement among ductless mini-split installations. More than 95% of these are either first-time cooling installations or are replacing window air conditioners. There are also a significant number of HEHE participants who are neither early or ROF. These in-between installation estimates range from 15 to 25% across all of the program's major equipment measures.

A large proportion of customers replacing boilers and furnaces early are also switching from oil to gas. More than three-fourths of early boilers, and nearly two-thirds of early gas furnaces, are oil-to-gas fuel conversions. This phenomenon is also present in the in-between category, with about half the installations representing oil-to-gas conversions.

These findings have profound policy implications in Massachusetts. First, the larger early or in-between energy savings in the initial set of post-installation years are not currently accounted for in programs' gross savings calculations. Second, there is no mechanism to consider or count the oil savings from early and in-between oil-to-gas fuel conversions in meeting the PAs' savings goals. Third, there the non-energy emissions benefits associated with oil-to-gas conversions are not presently counted. All of these policy issues are beyond the scope of this evaluation, but the findings do suggest that the PAs, EEAC, and other stakeholders may want to consider them in the near future.

Net-to-Gross Findings

Equipment Measures

The participant and contractor FR and SO findings included a range of estimates, with an actual value that depends on which variation of scoring is used within the overall methodology. These scoring variations reflect two things:

1. Uncertainty in how self-reported question were scaled should be reflected (e.g., a scale of 1 to 5, a 4 may be assigned as 0.5 or 0.75). There are no empirical data within the energy-efficiency evaluation industry to support one scoring scale over another.

2. There are legitimate differences in subject matter experts' opinions about whether the maximum or average of various influence components should be applied.

There are also legitimate differences across subject matter experts as to whether the various FR (or SO) components should be averaged or multiplied together. Arithmetically, multiplying always leads to lower estimates relative to averaging,¹⁵ but logical arguments can be made for both cases. The final estimates shown below employ the multiplication approach used in other residential and non-residential Massachusetts NTG studies conducted in the 2010-2012 period. However, the Evaluation Team wants to acknowledge the lack of consensus on NTG algorithms, and recommends that the PAs and EEAC develop clear protocols that directly address these and other issues across all residential and non-residential program categories.

The Cool Smart and HEHE equipment measure FR and SO ranges are summarized in Table 23 and Table 24. The low estimates are the lowest score from the four scenarios, the high estimates are the converse, and the average is the simple average of the four scenarios. We combined these estimates as follows to develop the NTG ranges shown in Table 25:

- Low NTG: This combines the low SO and high FR estimates, both of which assume the average of the programs' influences on behavior.
- High NTG: This combines the high SO and low FR estimates, both of which assume the maximum of the programs' influences on behavior.
- Average NTG: This simply combines the average values of SO and FR.

Table 23. Equipment Spillover Range

Measure	Low	High	Average
Gas Furnaces	0.09	0.37	0.22
Gas Boilers	0.05	0.11	0.08
Central Air Conditioners and Heat Pumps	0.16	0.42	0.28
Ductless Mini-Splits	0.02	0.12	0.07
Storage Water Heaters	0.07	0.19	0.13
Tankless Water Heaters	0.15	0.30	0.26

¹⁵ See Keating, K., "Freeridership Borscht: Don't Salt the Soup," 2009 Energy Program Evaluation Conference, Portland, OR.

Table 24. Equipment Free-Ridership Range

Measure	Low	High	Average
Boilers, AFUE 90-95.9%	0.21	0.42	0.32
Boilers, AFUE ≥96%	0.21	0.41	0.31
Boilers, Overall	0.21	0.41	0.31
Furnaces, AFUE ≥95%	0.30	0.53	0.41
Central Air Conditioners/Heat Pumps, SEER 14.5-14.9	0.21	0.49	0.35
Central Air Conditioners, SEER ≥16	0.31	0.54	0.42
Central Air Conditioners, Overall	0.28	0.52	0.40
Ductless Mini-Splits	0.34	0.56	0.45
Storage Water Heaters, Energy Factor ≥0.67	0.05	0.20	0.13
Tankless Water Heaters, Energy Factor ≤0.94	0.25	0.48	0.37
Tankless Water Heaters, Energy Factor ≥0.95	0.20	0.35	0.28
Tankless Water Heaters, Overall	0.22	0.41	0.32
Integrated Space Heaters/Water Heaters with a Condensing Boiler	0.23	0.46	0.34

Table 25. Equipment Net-to-Gross Range

Measure	Low NTG	High NTG	Average NTG
Boilers, AFUE 90-95.9%	0.63	0.90	0.76
Boilers, AFUE ≥96%	0.64	0.90	0.77
Boilers, Overall	0.64	0.90	0.77
Furnaces, AFUE ≥95%	0.56	1.07	0.81
Central Air Conditioners/Heat Pumps, SEER 14.5-14.9	0.67	1.21	0.93
Central Air Conditioners, SEER ≥16	0.62	1.11	0.86
Central Air Conditioners, Overall	0.63	1.14	0.88
Ductless Mini-Splits	0.46	0.78	0.62
Storage Water Heaters, Energy Factor ≥0.67	0.87	1.14	1.00
Tankless Water Heaters, Energy Factor ≤0.94	0.67	1.05	0.89
Tankless Water Heaters, Energy Factor ≥0.95	0.80	1.10	0.98
Tankless Water Heaters, Overall	0.73	1.08	0.93
Integrated Space Heaters/Water Heaters with a Condensing Boiler	0.59	0.88	0.74

All of the average NTG estimates are approximately 0.75 or greater with the exception of ductless mini-splits (0.62). This is not surprising given the lack of incentive tiers for this measure. The Evaluation Team recommends the PAs consider changing the rebate structure to more closely resemble the tiered rebate structure for central air conditioners, which should lower FR and increase NTG.

The average NTG values in the last column should be used for reporting purposes and cost-effectiveness analysis. However, the range of outcomes—particularly the low NTG estimates—can be used to provide guidance related to the risk of lower net savings on PA goal achievement and program cost-effectiveness.

Overall, these NTG estimates are supported by distributor NME analysis. Although qualitative in nature due to small sample sizes and the unavailability of total Massachusetts equipment sales data, the NME estimates are generally higher than the associated NTG estimates contained in Table 10 and Table 11.

Furthermore, a subset of distributors provided actual sales data showing that the tiered rebates in the Cool Smart and HEHE programs are apparently working as intended. Although these data are limited, there were unmistakable increases in the share of the highest efficiency shares for central air conditioners and heat pumps, and gas boilers and furnaces, as rebate levels changed during the 2010-2012 program cycle.

Quality Installation Verification

In general, QIV contractors appear to be divided into two types that are contributing to free-ridership and spillover, respectively. The first type learned and practiced individual quality installation techniques prior to joining the Cool Smart program, and already viewed the techniques as best practices, and are likely to be free-riders for those techniques. However, the Evaluation Team did not detect any evidence that this type of respondent had practiced Quality Installation Verification as a formal business practice of integrated techniques.

The second type of respondent learned about quality installation techniques through the program, and view quality installations as a valuable activity that they often perform in non-QIV program HVAC installations (i.e., SO). The Evaluation Team interprets this application of QIV techniques on non-incented measures as evidence of the emergence of a specific business practice that favors energy efficiency. This division was especially pronounced for Manual J Sizing as shown by its high levels of both free-ridership and spillover. For the other techniques, the net results were near 1.0. Table 26 provides a summary of QIV NTG values.

Table 26. Quality Installation and Verification NTG

Measure	Average FR	Average SO	NTG
Manual J Central Air Conditioners and Heat Pumps	0.38	0.16	0.78
Manual J Heating	NA	0.15	NA
Airflow Testing/Duct Sealing	0.15	0.07	0.92
Refrigerant Testing	0.22	0.24	1.02
Overall QIV	0.25	0.16	0.91

The overall QIV FR, SO, and NTG estimates are based on a simple average of the Manual J central air conditioners and heat pump sizing, and airflow and refrigerant testing results. This is because the Massachusetts TRM does not break out QIV savings by measure. Additionally, the benefits associated with Manual J heating spillover primarily include equipment cost savings, which is a non-energy benefit.

FINAL REPORT

THE
CADMUS
GROUP, INC.

2012 Residential Heating, Water Heating, and Cooling Equipment Evaluation: Net-to-Gross, Market Effects, and Equipment Replacement Timing

Volume II: Appendices

Part of the Massachusetts Residential Retrofit and Low-Income Program Area Evaluation

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ACRONYM GLOSSARY

Acronym	Full Name
BCR	Benefit/Cost Ratio
CAC	Central Air Conditioner
DSM	Demand-Side Management
ECM	Electronically Commutated Motor
EEAC	Massachusetts Energy Efficiency Advisory Council
EERS	Energy Efficiency Resource Standard
ER	Equipment Replacement
HEHE	High-Efficiency Heating and Water Heating Equipment
NME	Net Market Effects
PA	Massachusetts Program Administrator
NTG	Net-to-Gross
QIV	Quality Installation Verification
ROF	Replace-on-Failure
SRA	Self-Report Approach
SO	Spillover

APPENDIX A: NET-TO-GROSS COMPONENTS BY STATE

Table A-1 shows results from 32 jurisdictions surveyed in how they compute NTG: 42% did not have any NTG calculations. The components of the remaining 58% were as follows: 20% considered FR only for calculating program NTG, 38% also considered free-ridership and spillover. The components of this 38% were: 32% considered free-ridership and both participant and non-participant spillover, and 6% considered free-ridership and participant spillover only.

Table A-2. State-by-State Net-to-Gross Components*

Jurisdiction	EERS	Spillover		Freeridership
		Participant	Non-Participant	
Arizona	Yes	No	No	No
Arkansas	Yes	Yes	Yes	Yes
California	Yes	Yes	No	Yes
Colorado	Yes	No	No	Yes
Connecticut	Yes	Yes	Yes	Yes
Delaware	No	No	No	No
District of Columbia	No	No	No	No
Florida	Yes	Yes	Yes	Yes
Hawaii	Yes	No	No	Yes
Idaho	No	No	No	No
Illinois	Yes	Yes	Yes	Yes
Indiana	Yes	No	No	Yes
Iowa	Yes	No	No	No
Maine	Yes	No	No	Yes
Maryland	Yes	No	No	No
Massachusetts	Yes	Yes	Yes	Yes
Michigan	Yes	No	No	No
Minnesota	Yes	No	No	Yes
Nevada	Yes	No	No	Yes
New Hampshire	No	Yes	Yes	No
New Jersey	No	No	No	No
New York	Yes	Yes	Yes	Yes
North Carolina	Yes	No	No	No
Ohio	Yes	No	No	No
Oregon	Yes	Yes	Yes	Yes
Pennsylvania	Yes	No	No	No
Texas	Yes	No	No	No
Utah	No	Yes	Yes	Yes
Vermont	Yes	Yes	Yes	Yes
Washington	Yes	No	No	No
Wisconsin	Yes	No	No	Yes

Source: Haeri, Hossein and M.S. Khawaja "The Trouble with Freeriders." Public Utilities Fortnightly (March 2012): p. 40.

*EERS = Energy Efficiency Resource Standard

APPENDIX B: ADDITIONAL RESEARCH DETAILS

This appendix contains details of the Evaluation Team’s analysis methods. First, we provided disposition reports in tables for each of the surveys. Then, we provided details for each of the following assessments:

- Distributor net market effects (NME)
- Contractor NME
- Quality Installation Verification (QIV) Contractor early replacement (ER)
- QIV contractor free-ridership (FR)
- QIV contractor spillover (SO)
- Non-QIV contractor SO
- Participant ER
- Participant FR

Disposition Reports for All Survey Efforts

This section displays the disposition report for each of the surveys administered for this research:

- Table B-1. Massachusetts Distributor Survey
- Table B-2. Pennsylvania Distributor Survey
- Table B-3. Massachusetts Contractor Survey
- Table B-4. Pennsylvania Contractor Survey
- Table B-5. QIV Contractor Survey
- Table B-6. Participant Survey

Table B-1. Massachusetts Distributor Survey Disposition

Disposition	n
Completed Interviews	25
Eligible Non-Interviews (Refusals)	19
Not Eligible	46
<i>Did Not Qualify</i>	23
<i>Disconnected Numbers or Wrong Numbers</i>	23
Unknown Eligibility Non-Interview (No Answers/Busy Tone)	33
<i>No Answer/Busy Tone</i>	3
<i>Contacted at Least Three Times Without Response</i>	30
Total Distributors in Sample	123

Table B-2. Pennsylvania Distributor Survey Disposition

Disposition	n
Completed Interviews	8
Eligible Non-Interviews (Refusals)	28
Not Eligible	82
<i>Disconnected Numbers or Wrong Numbers</i>	19
<i>Redirects (to corporate or other staff)</i>	22
<i>Contacted at Least Three Times Without Response</i>	41
Unknown Eligibility Non-Interview (No Answer/Busy Tone)	46
Total Distributors in Sample	164
<i>Original Sample (Usable Sample from D&B List)</i>	86
<i>Additional Sample (From Vetted Internet Search and Referrals)</i>	78

Table B-3. Massachusetts Contractor Survey Disposition

Disposition	n
Completed Interviews	174
Eligible Non-Interviews	2,050
<i>Refusals</i>	1,857
<i>Broke Off Call</i>	29
<i>Respondent Never Available</i>	159
<i>Language Problem</i>	5
Not Eligible	1,544
<i>Fax/Data Line</i>	125
<i>Non-Working</i>	822
<i>Wrong Number</i>	153
<i>Residential</i>	160
<i>No Eligible Respondent</i>	264
<i>Cell Phone</i>	5
<i>Duplicate Number</i>	15
Unknown Eligibility Non-Interview	2,902
<i>Not Dialed/Not Working</i>	0
<i>No Answer</i>	890
<i>Answering Machine</i>	1,972
<i>Busy</i>	20
<i>Call Blocking</i>	20
<i>Other</i>	0
Total Contractors in Sample	6,670

Table B-4. Pennsylvania Contractor Survey Disposition

Disposition	n
Completed Interviews	66
Eligible Non-Interviews	1,279
<i>Refusals</i>	1,040
<i>Broke Off</i>	13
<i>Telephone Answering Device (confirming business)</i>	0
<i>Respondent Never Available</i>	224
<i>Language Problem</i>	2
Not Eligible	975
<i>Fax/Data Line</i>	80
<i>Non-Working</i>	457
<i>Wrong Number</i>	148
<i>Cell Phone</i>	2
<i>Residential</i>	63
<i>No Eligible Respondent</i>	212
<i>Duplicate Number</i>	13
<i>Quota Filled</i>	0
Unknown Eligibility Non-Interview	1,722
<i>Not Dialed/Not Working</i>	0
<i>No Answer</i>	96
<i>Answering Machine</i>	1,599
<i>Busy</i>	13
<i>Call Blocking</i>	14
<i>Other</i>	0
Total Contractors in Sample	4,042

Table B-5. QIV Contractor Survey Disposition

Disposition	n
Completed Interviews	15
Eligible Non-Interviews	64
<i>Refused</i>	3
<i>Telephone Answering Machine or Reception Message</i>	55
<i>E-mail Survey Outstanding</i>	6
Not Eligible	13
<i>Redirected (to non-specific staff/number/Corporate)</i>	2
<i>Disconnected Number/Wrong Number</i>	3
<i>Out of Business</i>	1
<i>Contacted at Least Three Times Without Response</i>	7
Unknown Eligibility Non-Interview	2
<i>No Answers/Busy Tone</i>	2
Total Participants in Sample	94

Table B-6. Participant Survey Disposition

Disposition	n
Completed Interviews	759
Partial Interviews	0
Eligible Non-Interviews	2,769
<i>Refusals</i>	982
<i>Broke Off</i>	95
<i>Telephone Answering Device (confirming household)</i>	1,071
<i>Respondent Never Available</i>	605
<i>Language Problem</i>	16
Not Eligible	965
<i>Fax/Data Line</i>	30
<i>Non-Working</i>	344
<i>Wrong Number</i>	193
<i>Business/Government</i>	296
<i>No Eligible Respondent</i>	18
<i>Duplicate Number</i>	18
<i>Quota Filled</i>	66
Unknown Eligibility Non-Interview	4,198
<i>Not Dialed/Not Working</i>	2,263
<i>No Answer</i>	1,918
<i>Busy</i>	9
<i>Call Blocked</i>	8
Total Participants in Sample	8,691

Additional Methodological Details

Distributor Net Market Effects

The Evaluation Team calculated the distributor NMEs using the results of the Massachusetts and Pennsylvania distributor surveys, installed equipment stock data from the 2009 Opinion Dynamics Corporation (ODC) residential appliance saturation survey, and the programs' participation data from each of the Massachusetts Program Administrators' (PAs) benefit/cost ratio (BCR) data sets. (See Appendix C for the programs' participation data and annual energy savings per unit for each measure.)

As noted in Volume I, small sample sizes and missing information necessarily led to the treatment of the NME estimates in a qualitative manner. They were used in this study to offer additional supporting evidence for the final set of NTG estimates, but should not be used to conduct BCR analyses. Three alternative NME estimates were derived for this purpose:

1. An initial set of estimates was developed using Massachusetts distributor responses only. Their answers to total sales and efficiency shares for the hypothetical case where the programs did not exist were used to establish the counterfactual and isolate NME. This approach does not adjust for the Pennsylvania “control area”, which was called for by the Massachusetts Cross-Cutting Evaluation Team.¹ The PAs, EEAC, and the Evaluation Team all recognized that Pennsylvania recently introduced its first set of rebate programs, but it was agreed that it was the best we could do given that all of the Northeast states have had active DSM programs for many years.
2. A difference-in-differences approach, where the net market share change in Pennsylvania is subtracted from the net market change in Massachusetts from (1) in deriving the net change in market shares. Although this set of NME estimates is interesting to consider—and only considered because the NME estimates are qualitative in nature in this study—it should be recognized that they would not be viable from a quantitative analysis standpoint because they consider the counterfactual twice: once for MA sales, and again by looking at the difference in shares in MA relative to the difference in shares in Pennsylvania.
3. A second Pennsylvania control area NME approach that corrects for the theoretical issues noted in (2). In this approach the change in Massachusetts shares is normalized by dividing by the Pennsylvania shares in the hypothetical absence of DSM programs. It shows the percentage increase in shares, as opposed to the absolute increase in shares in the Massachusetts only NME estimates. Although this NME approach has theoretical appeal, it suffers arithmetically from the fact that some of the hypothetical high-efficiency shares without Pennsylvania programs approach zero, and can therefore yield artificially high NME estimates.

¹ Nexus Market Research Group, Inc., et al. “Cross-Cutting Net to Gross Methodology Study for Residential Programs – Suggested Approaches.” Prepared for Massachusetts Program Administrators. July 20, 2011.

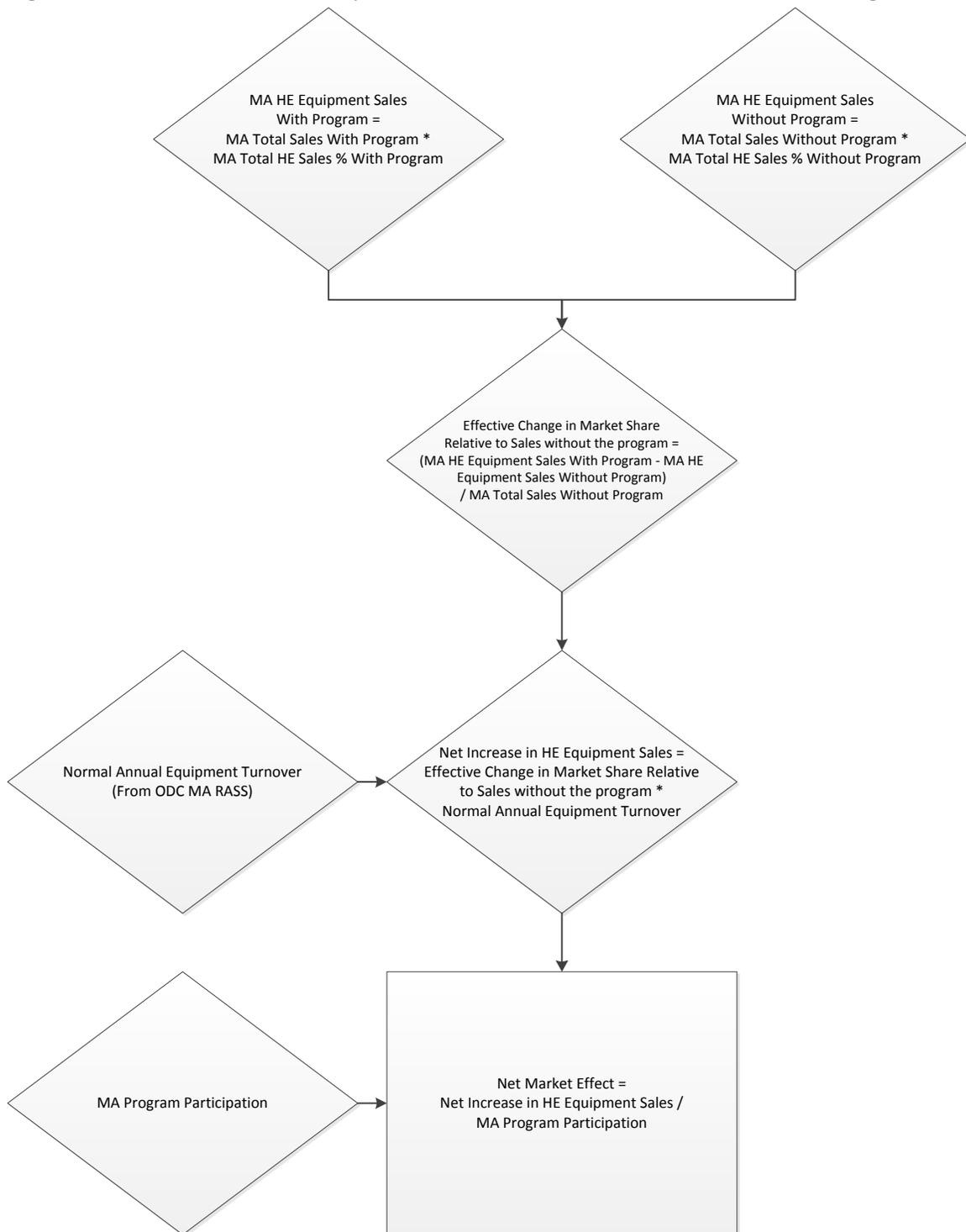
The first approach is depicted in Figure B-1. The Evaluation Team calculated the distributor NMEs by first determining the total high-efficiency sales by measure for all Massachusetts distributors with the programs and without the programs. We accomplished this by using survey data to determine the number of units sold in each efficiency range of every program measure for each distributor, both with the programs and without the programs. We based the number of units sold without the programs on a series of hypothetical questions we asked distributors about what changes they anticipate would have happened to their total number of units sold and market share of each efficiency level had the programs not been available.

The next step in the Massachusetts only distributor NME calculation was for the Evaluation Team to calculate the effective change in the market share of high-efficiency sales relative to total sales without the programs. We calculated this by subtracting the hypothetical number of high-efficiency sales without the programs from the number of high-efficiency sales with the programs, then dividing that number by the hypothetical total number of sales across all efficiency levels without the programs. This calculation yielded the percentage increase in the market share of high-efficiency sales.

Then, the Evaluation Team calculated the net increase in high-efficiency equipment sales by multiplying the percent increase in the market share of high-efficiency sales by the annual turnover of each type of program measure in Massachusetts.² The result yields the net increase in high-efficiency sales as a result of the programs. After the Evaluation Team calculated the net increase in high-efficiency equipment sales, we calculated the distributor NME by dividing the net increase in high-efficiency equipment sales by the annual programs' participation.

² The Evaluation Team derived the total installed equipment base from: Opinion Dynamics Corporation. "Massachusetts Residential Appliance Saturation Survey (RASS): Volume 1: Summary Results and Analysis." April 2009. Available online: <http://www.env.state.ma.us/dpu/docs/electric/09-64/12409nstrd2af.pdf>. The annual turnover rate is determined as a function of appliance lifetimes, and the fact that early replacement is occurring in the HVAC market is due in part to Cool Smart and HEHE. We note that end-use lives (EULs) reflect a "half-life" of equipment, with approximately 50% of installed units failing before and the other half failing after. This means that all equipment fails for a given cohort after 2 * EUL years. For example, if furnaces last an average of 20 years we would expect all units to fail after 40 years, and the annual rate of failure would be 1/40. However, early replacement would speed up the annual turnover for the older cohorts. As there is not enough information available to fully isolate this effect, the Evaluation Team approximated this effect by adjusting the annual turnover rate to 1.5 * EUL.

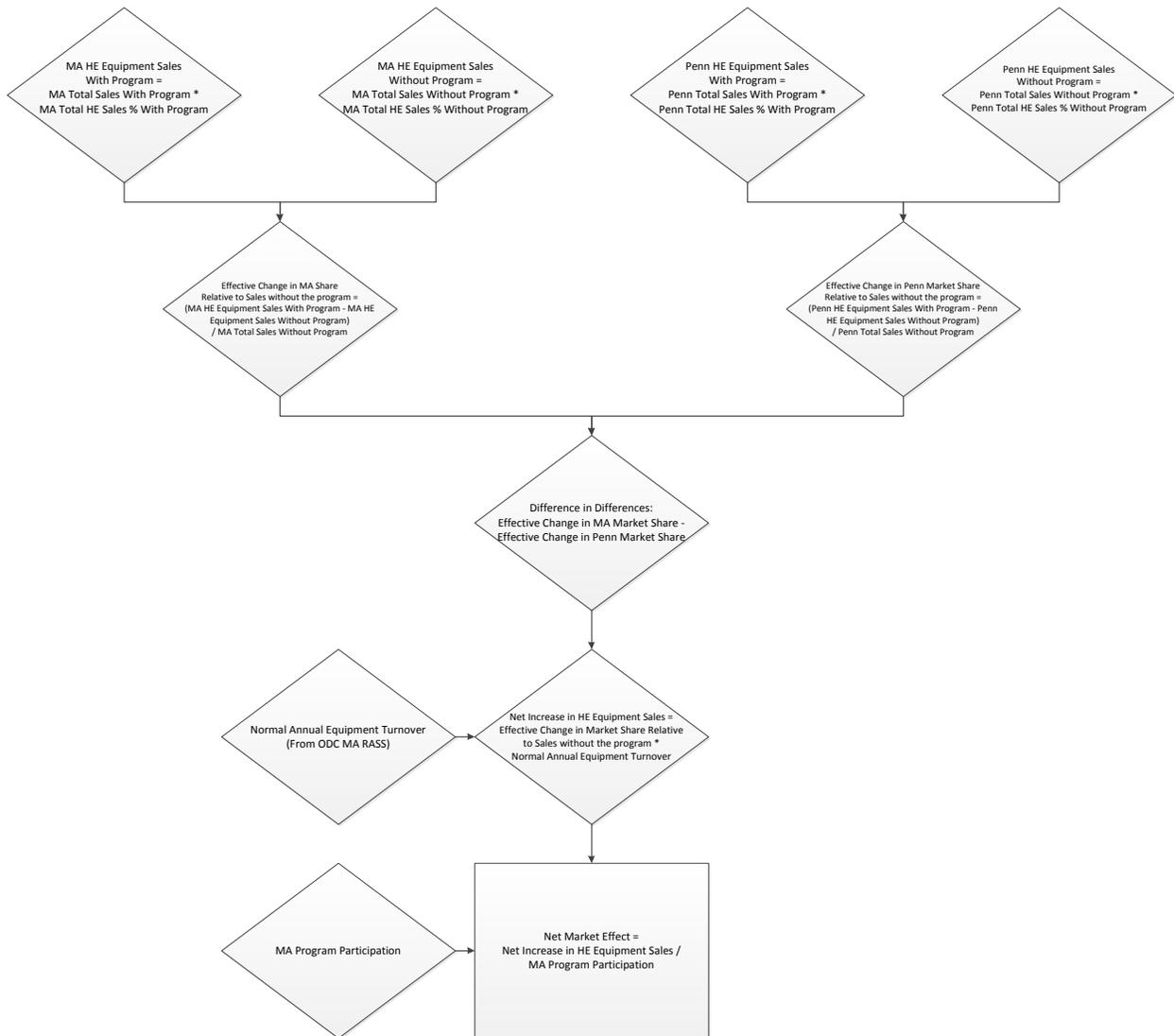
Figure B-1. Massachusetts Only Distributor Net Market Effects Detailed Logic Model



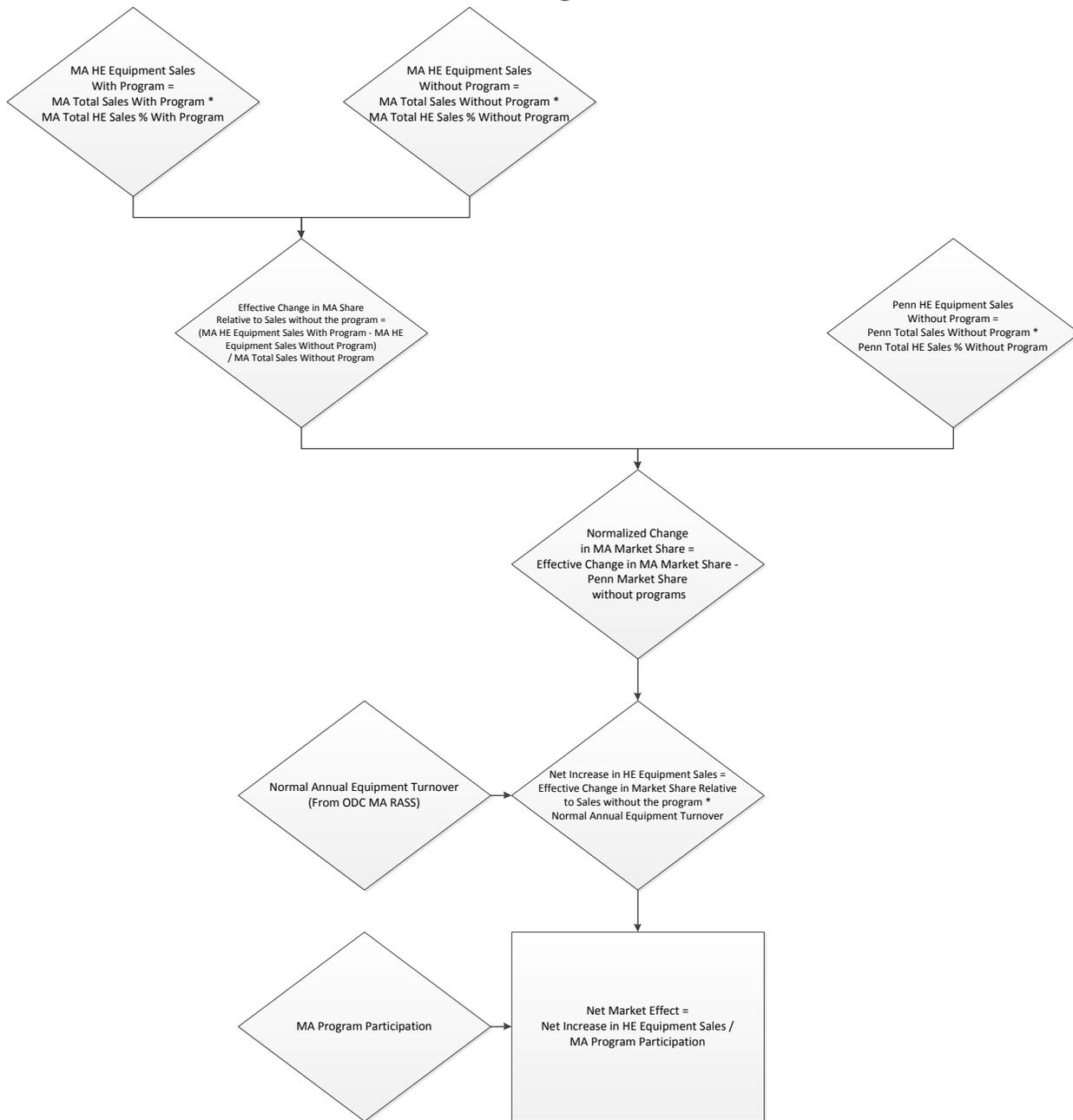
The first Pennsylvania-based NME approach, the difference-in-differences approach, is shown in Figure B-2. The determination of the change in efficiency shares for Pennsylvania (top right) is the same as Massachusetts (top left). The net increase in Massachusetts shares is derived by subtracting the Pennsylvania shares from the Massachusetts shares. The remainder of the NME calculations are identical to the approach described above for Figure B-1.

The second Pennsylvania-based NME approach, normalization of the Massachusetts change in shares by dividing by the associated Pennsylvania high-efficiency shares without DSM programs, is depicted in Figure B-3. It follows a similar format as Figures B-1 and B-2, with the remainder of the NME calculations following the Pennsylvania adjustment identical to the other two approaches.

Figure B-2. Massachusetts-Pennsylvania Distributor Difference-in-Differences Net Market Effects Detailed Logic Model



**Figure B-3. Massachusetts Distributors Net Market Effects, Normalized by Pennsylvania Efficiency Shares in the Absence of Programs
Detailed Logic Model**



QIV Contractor Equipment Replacement Timing

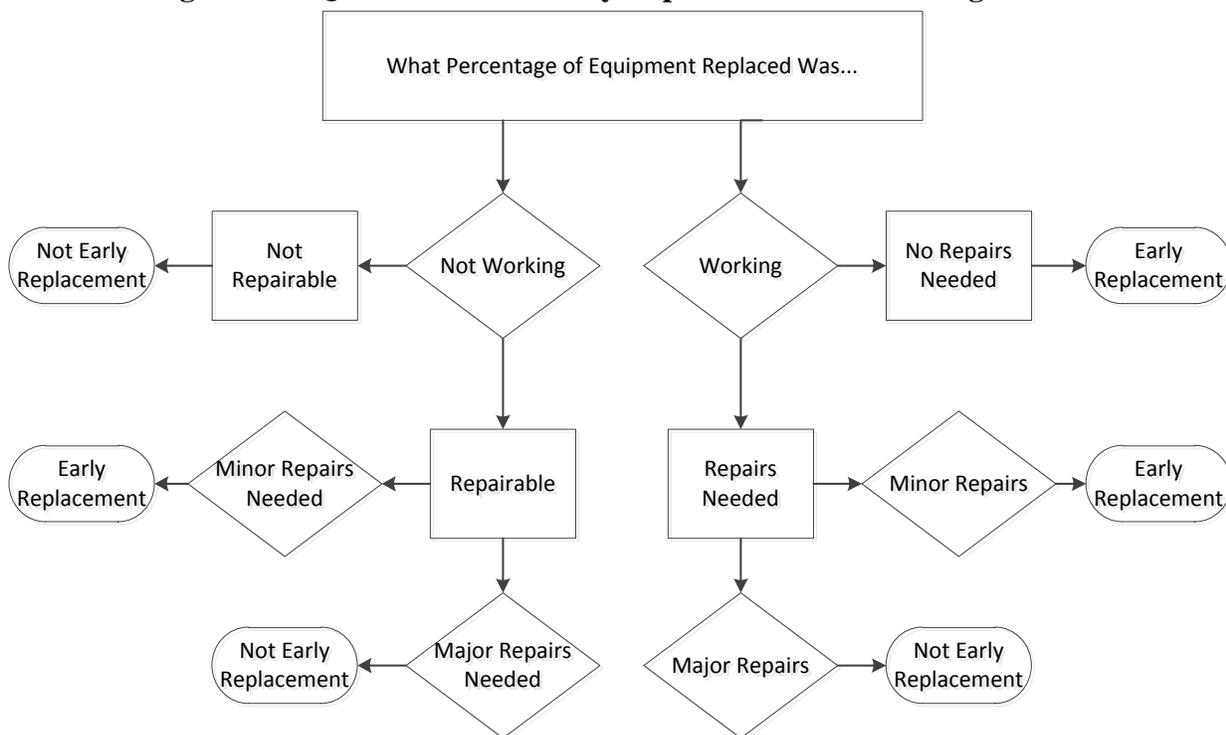
The Evaluation Team calculated the QIV contractor ER percentages using the results of the QIV contractor surveys. We asked the QIV contractors about the equipment that they replaced to determine the percentages that were early vs. ROF. Because different contractors may have different definitions of what early means, we did not ask them directly what the percentage of the units they replaced were early. Instead, we asked them a series of questions that we later used to determine what percentage of their units were early vs. ROF.

Throughout the surveys, we asked consistency checking questions to ensure that no types of measures were under- or overcounted as early replacement. These questions were:

1. First, we asked each contractor to estimate what percentages of the equipment they replaced was working and not working.
2. The, we asked each contractor about the units that were no longer working and about the units that were working.
 - For those units no longer working, we asked each contractor to estimate the percentages of those non-working units that could have been repaired to working condition, and of those, what percentage would have only needed minor repairs, and which would have needed major repairs.
 - For those units that were working, we asked each contractor to estimate the percentage were in working condition and needed no repairs. Then we asked them to estimate the percentage of units that were working, but needed either minor or major repairs.

As shown in Figure B-4, the equipment that would have been considered early replacement units were those that were working and needed no repairs; those that were not working but would have only needed minor repairs to be restored to working condition; and those that were working and would have only needed minor repairs. The Evaluation Team calculated the early replacement rate using the following formula:

$$\begin{aligned} \text{Early Replacement} &= \% \text{ of Units that were Working and Needed No Repairs} \\ &+ \% \text{ of Units that were Working but Needed Minor Repairs} \\ &+ \% \text{ of Units that were Not Working and Only Needed Minor Repairs} \\ &\quad \text{to be Restored to Working Condition} \end{aligned}$$

Figure B-4. QIV Contractor Early Replacement Detailed Logic Model

QIV Contractor Free-Ridership

To determine the QIV contractor free-ridership (FR) rate, the Evaluation Team used the self-report results from the QIV contractor surveys. We based this rate on the timing of the application of the QIV techniques, as well as on the degree of the programs' influence on the contractors' use of the techniques, and the rigor to which they applied the techniques.

The Evaluation Team asked each contractor FR questions for each of the following QIV techniques: their application of Manual J techniques when installing cooling measures (such as heat pumps, central air conditioners (CAC), and ductless mini-splits), air flow testing and duct sealing, and refrigerant testing. The Evaluation Team's Manual J questions were as follows (and we used a similar logic flow to determine FR for each individual measure):

- First, we asked each contractor to rate the influence that the programs had on their decision to begin using Manual J or another equipment sizing software.
- Next, we asked them to rate two ways that the programs could have influenced them: 1) through the QIV training, and 2) through the Cool Smart rebates. The Team then asked each contractor to rate the level of influence that the programs had on a scale of 1 to 5, where 1 indicated that they were not at all influential and 5 indicated that they were highly influential.
- The Evaluation Team then assigned the contractors to three groups based on the level of influence they indicated the programs had on their decision to begin using Manual J or another equipment sizing software. We placed contractors with an influence score of 4 or

5 into a high influence group, we placed those with a score of 2 or 3 into a medium influence group, and placed those with an influence score of 1 into a low influence group.

- Then, the Evaluation Team asked contractors whether they had been using Manual J calculations before they received the QIV training, or if they started using Manual J after their program training. If the contractor responded that they had applied Manual J calculations, we asked follow-up questions to determine if they applied with the same, lower or greater rigor. Based on the combination of these responses, we assigned those contractors who reported that they had been using Manual J before they received the training a FR score based on their influence group.
- Finally, we asked those contractors who reported that they had started using Manual J after they received the training whether they were using Manual J calculations with the same rigor, less rigor, or more rigor since employees at their company began to take the Manual J training. We then assigned QIV contractors a FR value based on any changes to their reported level of rigor.

The Evaluation Team calculated the QIV contractor FR rate using four different methods for each. Participating contractors were asked about two ways the programs influences their behavior: 1) through the availability of the programs' incentives, and 2) through the availability of the programs' training. The Evaluation Team asked each contractor to rate the degree to which both of those programs' aspects influenced them, on a scale from 1 to 5, where 1 is not at all influential and 5 is highly influential.

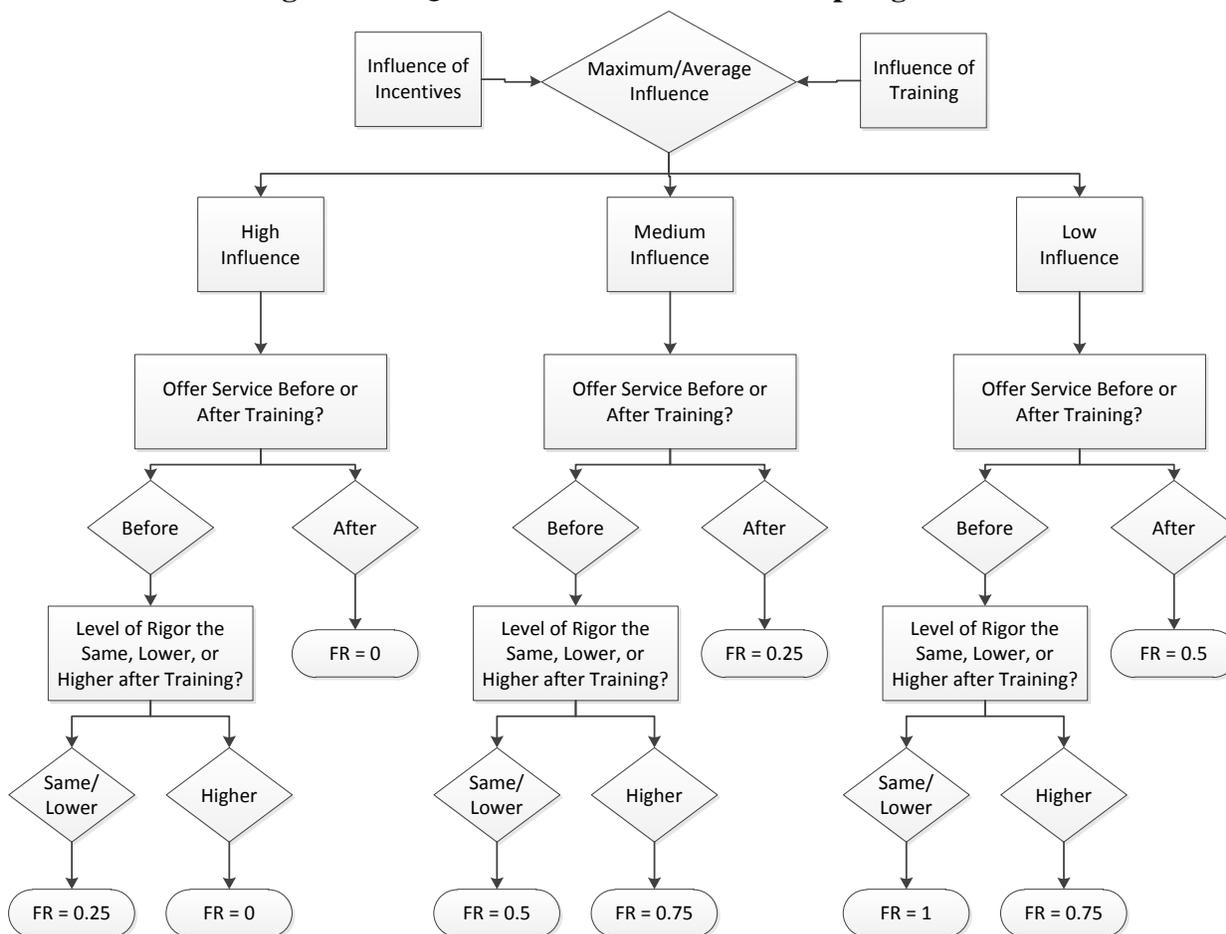
- In Methods 1 and 2, we averaged the two programs' influence scores and used that average to represent the influence of the programs on the participating contractor in total.
- In Methods 3 and 4, we used the maximum value of either the programs' incentive score or the programs' training score to represent the influence of the programs.

Another aspect the Evaluation Team examined using the four methods was the scale of the scoring values assigned.

- For Methods 1 and 3, we used a scale based on one-third increments: the highest value was 1, the lowest value was 0, and the values in between were 0.33 and 0.67.
- For Methods 2 and 4, we used a scale base on one-quarter increments: the highest value given was 1, the lowest value given was 0, and the incremental values were 0.25, 0.5, and 0.75. Because this scale has more variation than the scale for Methods 1 and 3, the Team included those contractors who fell into the lowest two groups (those with values of 0 and 0.25) in the lowest group when using the Methods 1 and 3 scale (and thus assigned them a value of 0).

The methods that the Evaluation Team used to calculate the QIV contractor FR, along with the assigned FR scores, are depicted in Figure B-5. This shows the scoring for Methods 2 and 4.

The highest level of FR occurred for the use of Manual J when installing cooling measures, and the lowest level of FR occurred for airflow testing and duct sealing.

Figure B-5. QIV Contractor Free-Ridership Algorithm

QIV Contractor Spillover

As with determining the QIV contractor FR rate, the Evaluation Team relied on self-reported results from the QIV contractor surveys to quantify SO. We based the SO rate on the proportion of non-program installations where the contractor applied QIV techniques, as well as the degree of influence they reported the programs' training and incentives had their application of the techniques on measures that did not receive a program incentive.

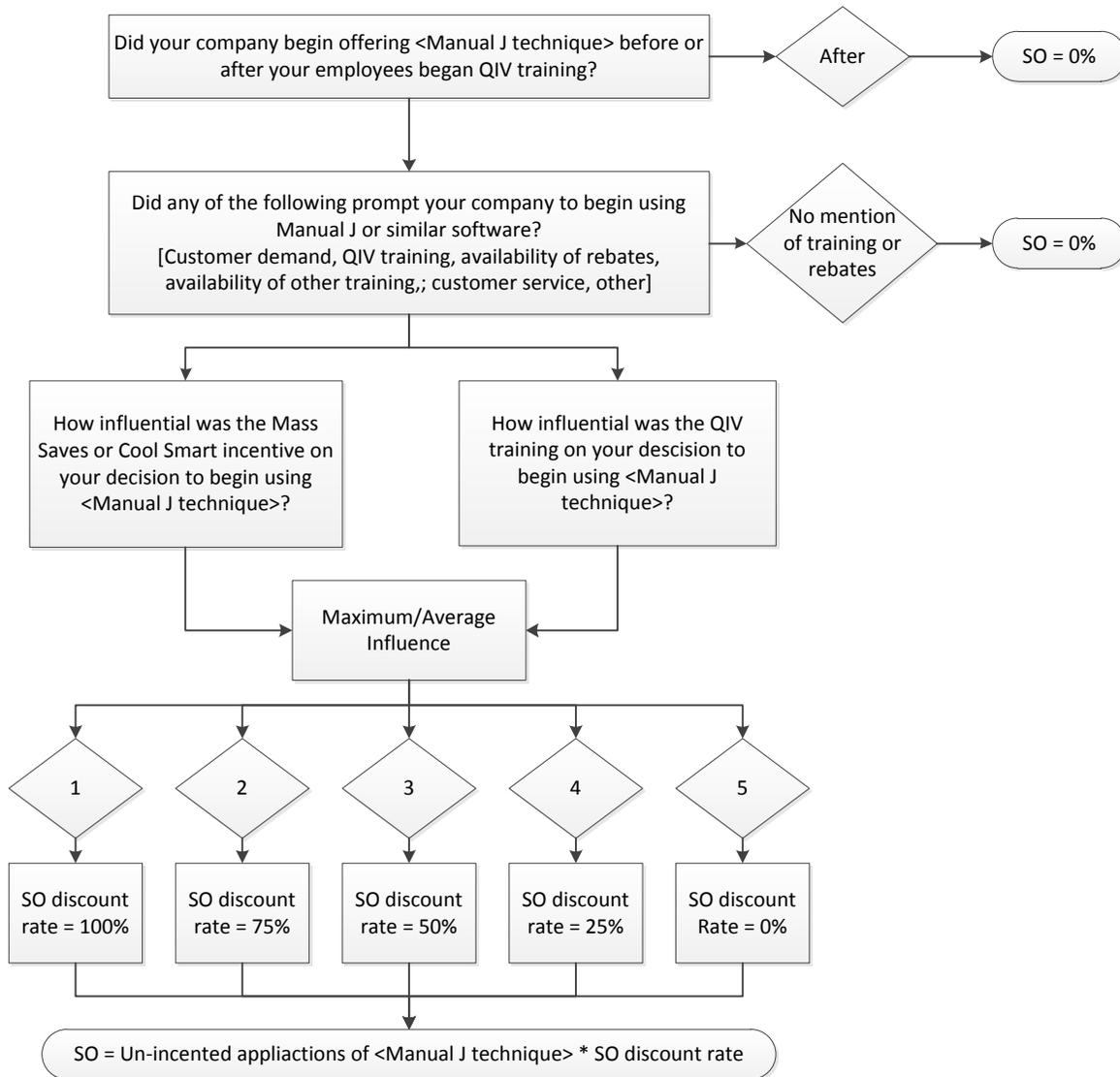
The Evaluation Team asked contractors SO questions about each of the following QIV techniques: their application of Manual J techniques to installations of cooling measures (such as heat pumps, CACs, and ductless mini-splits), airflow testing and duct sealing, and refrigerant testing (for cooling installations only). The Team asked contractors the following SO Manual J questions (and we used a similar logic flow for individual measures' SO):

- We asked each contractor a set of questions to determine the proportion of non-programs' installations that they used Manual J or another equipment sizing software for to determine proper sizing to within half a ton of the software recommendation.

- Next, we read each contractor a list of potential factors that could have influenced their decision to apply Manual J or another equipment sizing software to non-program’s installations. If the contractor did not mention training, we assumed that SO did not exist.
- We then asked each contractor to rate the influence of programs’ training and the influence of programs’ incentives on their decision to apply the QIV techniques to non-program’s installations.

The approach the Evaluation Team used to explore uncertainty and sensitivity regarding QIV SO was identical to that we used to explore the same for FR. The general method we used to calculate the QIV contractor SO is shown in Figure B-6.

Figure B-6. QIV Contractor Spillover Algorithm



Non-QIV Contractor Spillover

During the Evaluation Team's process of calculating the equipment SO rate for each measure, we observed that the SO rate is significantly dependent on how we scored the contractor and distributor influence factors. To ascertain the sensitivity to influence score, the Evaluation Team calculated the SO rate from contractor and distributor surveys using four alternative scoring methods:

- The first method used the maximum of the contractor and distributor influence scores along with only scoring responses as SO for which the program was very influential and somewhat influential on for their consumers' choices for that equipment.
- For the second method, we followed the same calculations as with the first method, but then included the not very influential response as a minimal amount of SO.
- The third and fourth SO rate methods were similar to the first and second methods, with the exception that we incorporated the average of the contractor and distributor influence scores, instead of using the maximum.

Figure B-7 shows results of Methods 1 and 3 for determining the SO rate when only including very influential and somewhat influential responses. The Evaluation Team scored those levels of influence as 1 and 0.5, respectively. We used this method of influence scoring consistently across all influence questions for contractors and distributors. The only difference between Method 1 and Method 3 is the way in which we calculated the SO influence score. For Method 1, we used the *maximum* of the contractor and distributor SO influence scores. Conversely, for Method 3 we used the *average* of the contractor and distributor SO influence scores. In all cases the first scenario is greater than the third scenario due to this difference in spillover influence calculation methodology.

Figure B-8 shows results of Methods 2 and 4 for determining the SO influence score when including not very influential, very influential, and somewhat influential responses. We scored those levels of influence as 1, 0.67, and 0.33, respectively. We used this method of influence scoring consistently across all influence questions for contractors and distributors. The only difference between Method 2 and Method 4 is the way in which we calculated the SO influence score. For Method 2, we used the *maximum* of the contractor and distributor SO influence scores. Conversely, for Method 4 we used the *average* of the contractor and distributor SO influence scores.

In all cases, the results of Method 2 are greater than all of the other methods due to the inclusion of an additional level of influence and the use of the maximum contractor or distributor influence score.

Figure B-7. Contractor Spillover Calculations – Methods 1 and 3

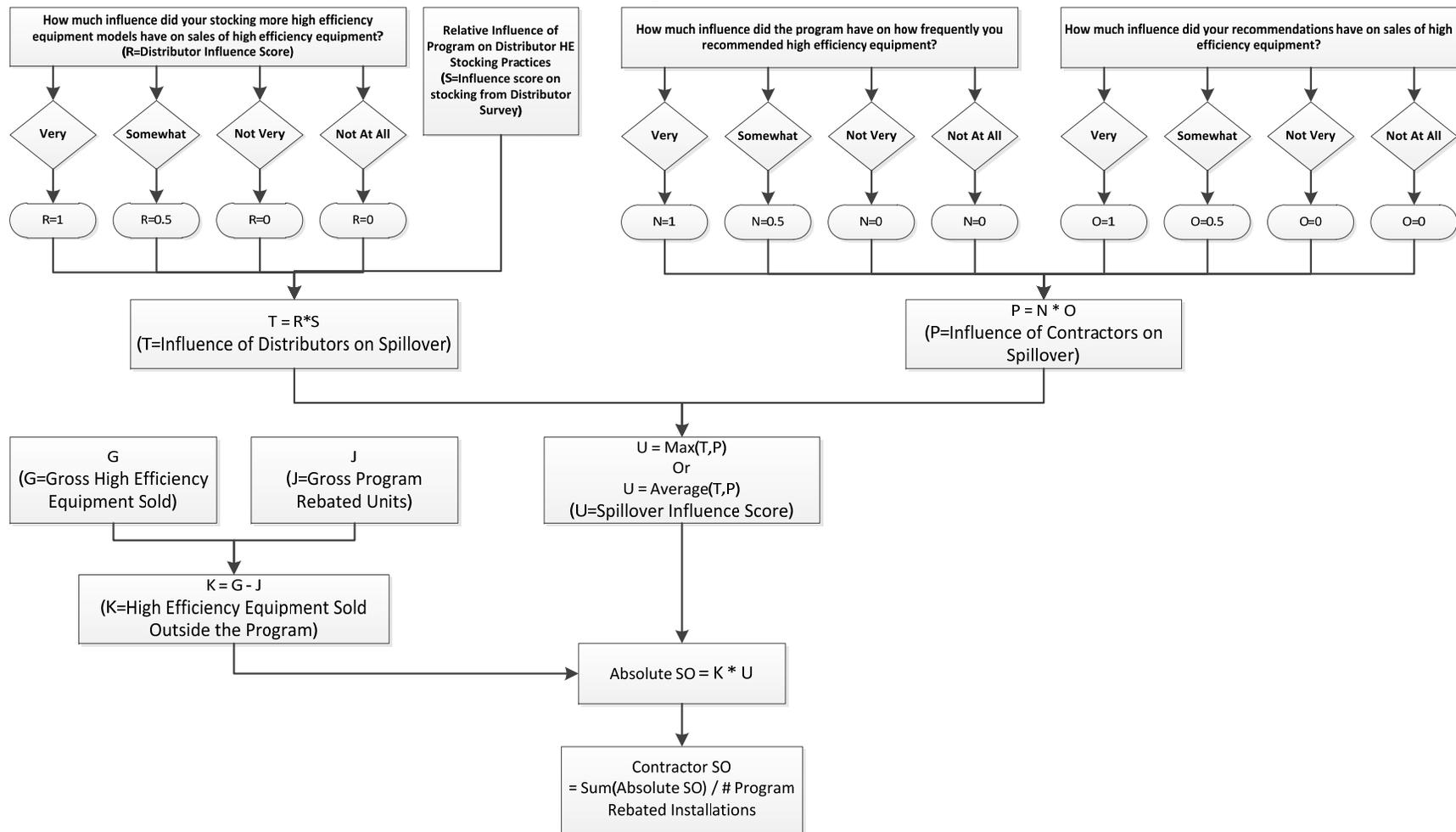
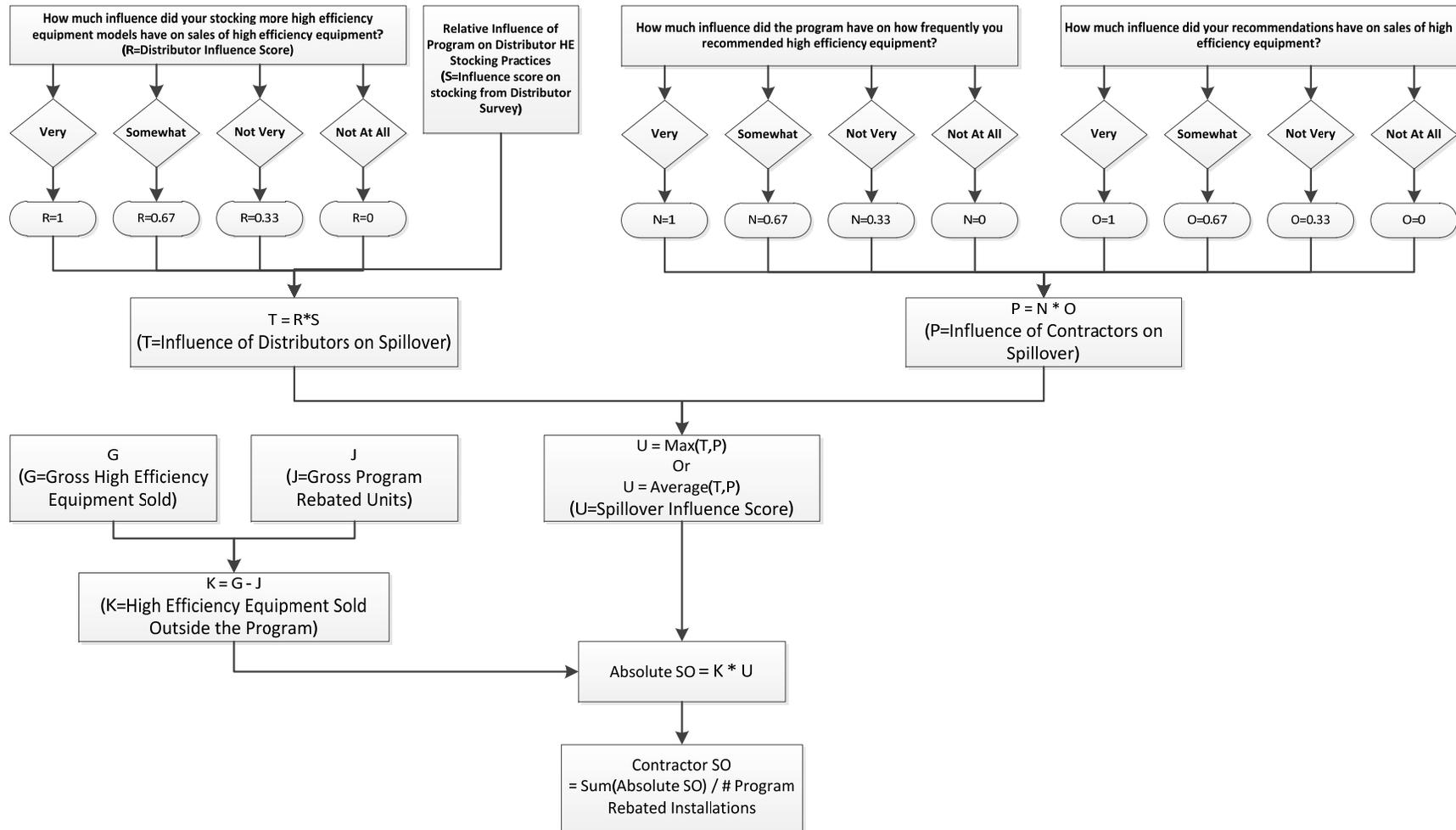


Figure B-8. Contractor Spillover Calculations – Methods 2 and 4



Participant Equipment Replacement Timing

The Evaluation Team determined the participant ER timing using the results from the Cool Smart and HEHE participant surveys. We asked participants a series of questions to determine whether the units they replaced were new, replace-on-failure (ROF), early, or in-between ROF and early replacement.

The participant ER methodology is as follows:

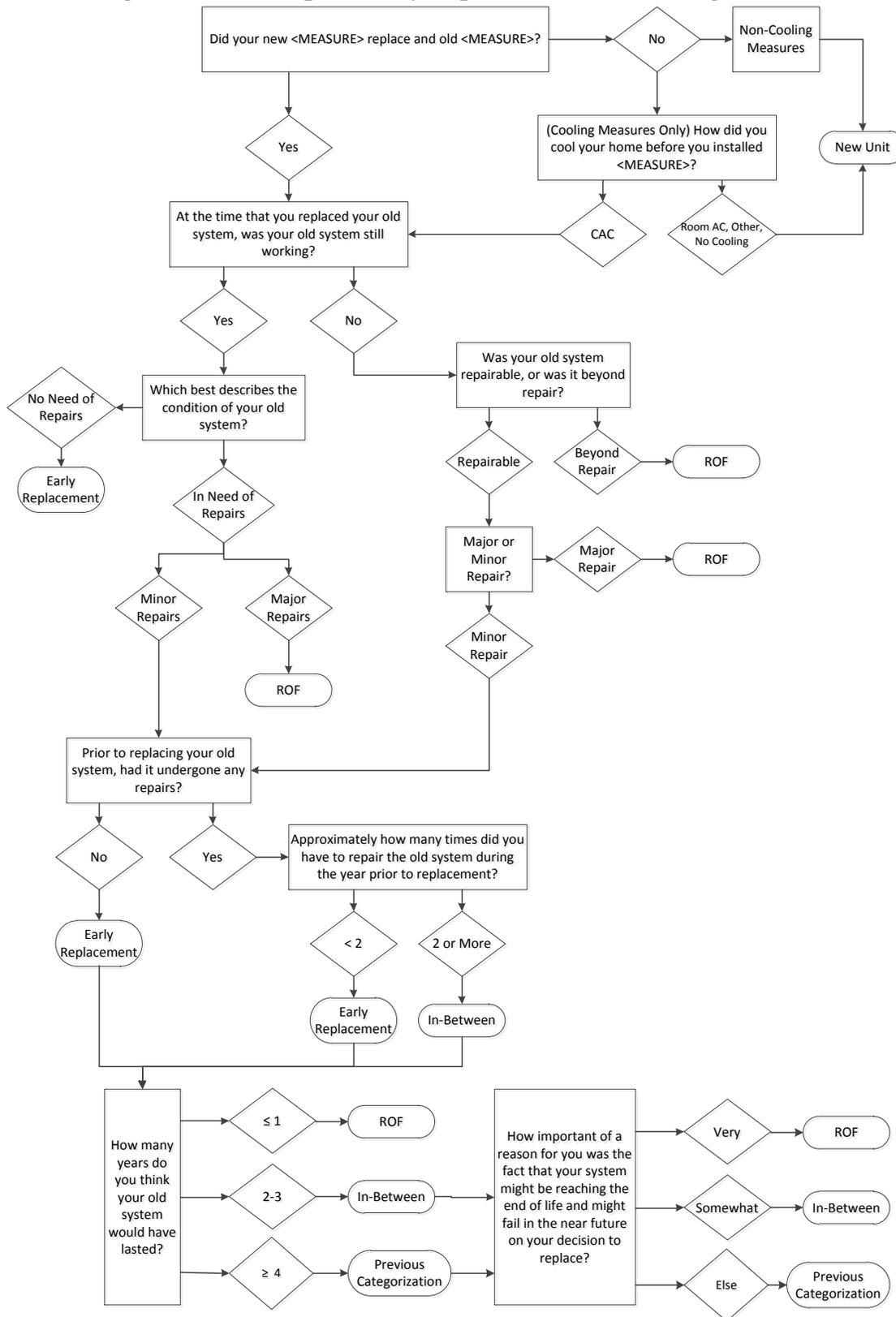
1. **Equipment replacement or a first-time installation of the end use?** The Evaluation Team first asked cooling participants whether the unit they had installed was new, or if it was replacing an existing unit. We then asked participants' who said it was a new unit how they had previously cooled their house.
 - If they had previously used a CAC, we no longer considered them as having a new unit, and asked them the remaining ER questions (this was true even if they replaced their CAC with something other than CAC, such as a ductless mini-split or air source heat pump).
 - If they had not previously had a cooling system or had used a room air conditioner or another form of cooling, we assigned them to the new unit group.
2. **Physical repair history.** We asked the participants who replaced equipment a series of questions about the condition of the unit they replaced. First, we asked whether their unit had been working when it was replaced.
 - We asked *participants whose units had not been working* whether their unit had been repairable. We assigned those whose unit was beyond repair to the ROF group and did not ask them further questions.
 - We asked *participants whose units were repairable* whether their unit would have required major or minor repairs. We assigned those participants whose units would have required major repairs to the ROF group and did not ask them further questions.
 - We asked *participants whose units were not working, but would have required only minor repairs* whether their old system had been previously repaired. We considered those whose units had not been previously repaired as ER and did not ask them further questions.
 - We then asked *participants whose units had required repairs to quantify the number of repairs* their unit had required in the year before being replaced. We considered units that had required two or more repairs as ROF and units that had required fewer than two repairs as in-between.
 - We asked *participants whose unit had still been working* at the time of replacement about the condition of their old unit. We considered participants who had working units that needed no repairs as early replacement.
 - We asked *participants whose units needed repairs* about the type(s) of repairs needed. As with the non-working units, we considered the working units that needed major repairs as ROF. We asked participants who had working units that

only needed minor repairs whether their unit had undergone any repairs before being replaced, and considered those units that had not undergone any repairs as early replacement. Those participants whose unit had previously required repairs were asked how many times the unit had been repaired in the year prior to being replaced. We considered units that had two or more repairs as ROF, and considered those that required fewer than two repairs as in-between.

3. **Expected remaining life.** The next set of questions addressed the expected future life of the equipment that was replaced, and the influence of expected future life on the decision to replace. These questions are used to adjust the initial ER categorization developed in (1) and (2):
 - Adjustment 1: *Participants who said their unit would likely have lasted less than a year* were classified as ROF. This moved individuals from early and in-between to ROF. Also, anyone who was early and said their unit would likely have lasted 2-3 years was reclassified as in-between.
 - Adjustment 2: This is on top of Adjustment 1, and includes *participants who said the “fact that the unit might be reaching the end of its expected life” was very important—a 5 in their decision—*were reclassified as ROF. Again, this moves individuals from early and in-between to ROF. Additionally, anyone who answered a “4” to this question and was previously classified as early was moved to in-between.

The analysis and scoring flow are shown in Figure B-9.

Figure B-9. Participant Early Replacement Detailed Logic Model



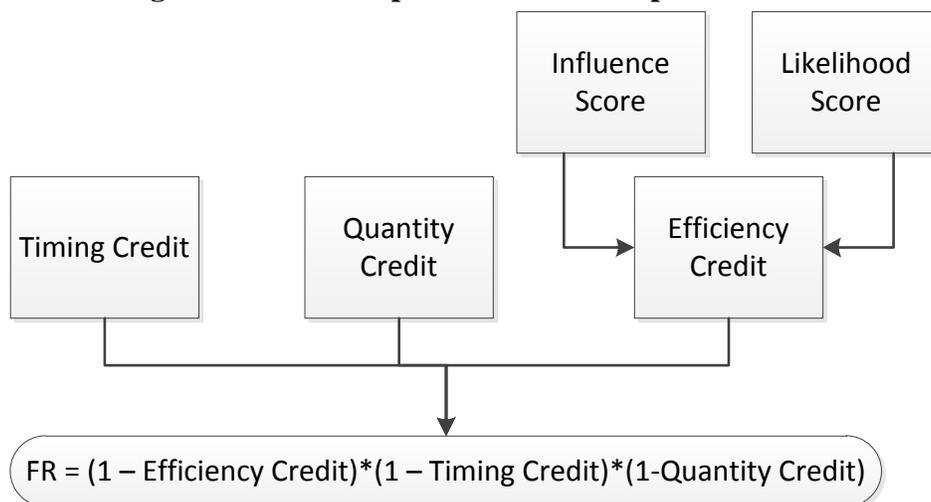
Participant Free-Ridership

The Evaluation Team calculated participant FR in three steps, each of which contributed a variable to the final calculation. We assigned a credit to each participant based on three ways the programs' affected their installation of the high-efficiency measure:

1. The accelerated timing of the installation,
2. The increase in the quantity of measures installed, and
3. The increase in the efficiency of the measure.

These three credits were factored into the final FR calculation, as shown in Figure B-10.

Figure B-10. Participant Free-Ridership Calculation



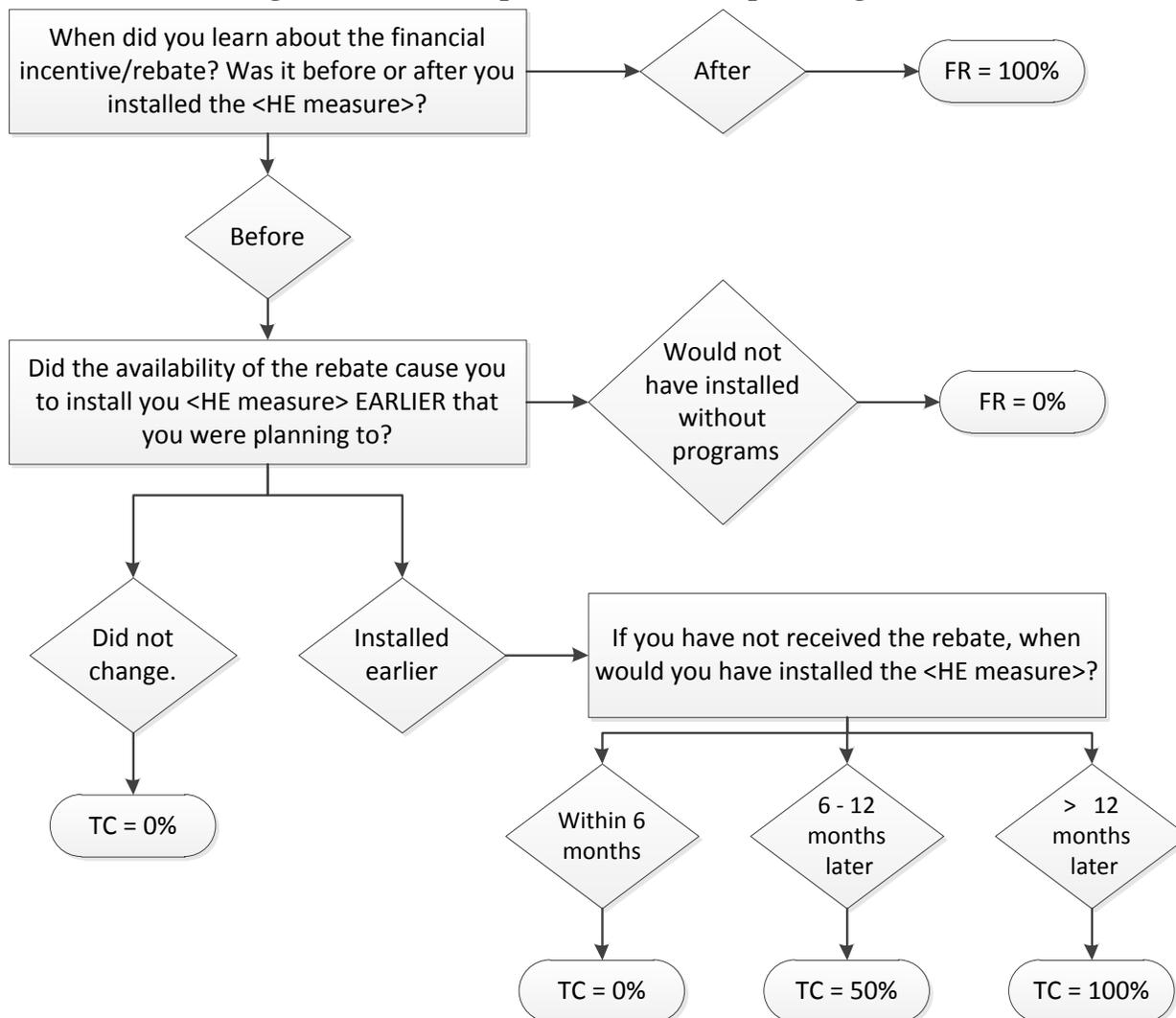
Timing Credit

The first aspect of the participant FR the Evaluation Team calculated was the timing credit. We assigned each participant a credit, which contributed to decreasing their overall FR rate, based on several questions about the timing of their installation. The Evaluation Team first asked the participants when they learned about the availability of the rebate. We assigned a FR score of 100% to those who learned about the incentive after they had their high-efficiency measure installed, and excluded them from the rest of the credit questions leading to the overall FR calculation. We asked those participants who learned about the program rebate before having their high-efficiency measure installed whether the availability of the rebate caused them to have the measure installed sooner than they would have otherwise. We assigned a timing credit of 0% to those participants who indicated that the rebate had no effect on installation timing. Additionally, some participants volunteered that they would not have had the measure installed without the programs, and we assigned these participants a FR score of 0%.

Then the Evaluation Team asked participants who accelerate the timing of having their unit installed as a result of the program rebate to predict when they would have installed the measure without the programs. We assigned them a timing credit based on their response, applying the

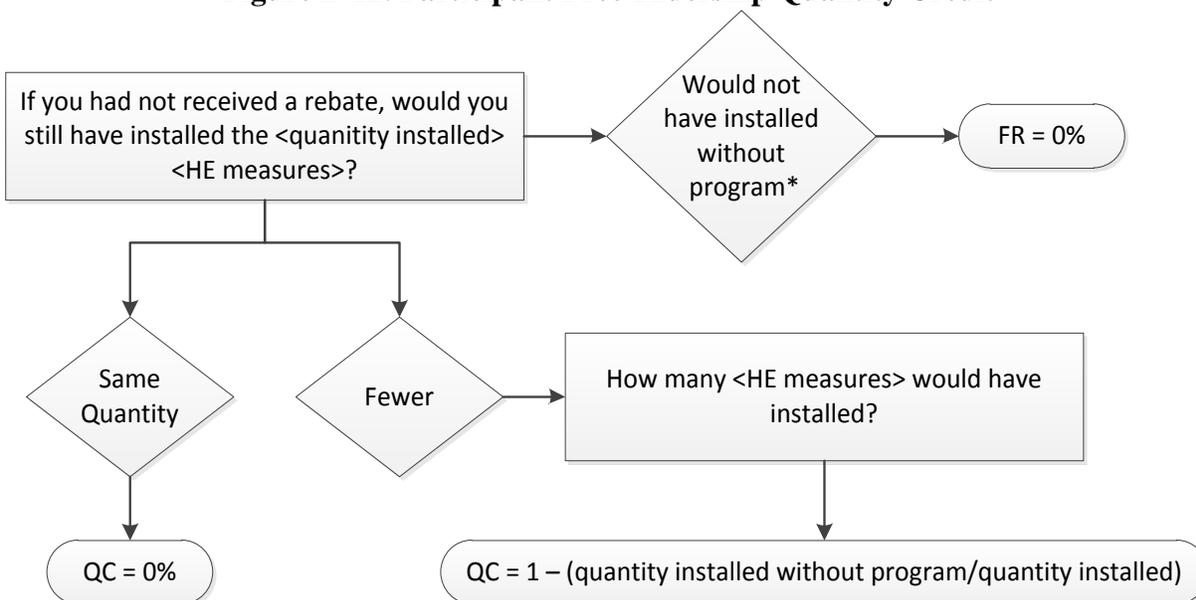
largest credits to those participants who would have waited over a year before having the new measure installed. The calculation of the timing credit is shown in Figure B-11.

Figure B-11. Participant Free-Ridership Timing Credit



Quantity Credit

The Evaluation Team then asked program participants questions to determine their quantity credit. First, we asked whether they would have had the same quantity of measures installed without receiving a program rebate. At this point, some participants volunteered that they would not have installed the measure at all without the programs, and we assigned them a FR score of 0%. We also assigned a zero quantity credit to those participants who would have installed the same quantity of high-efficiency measures without the programs. We asked participants who would have installed fewer measures without a program rebate to estimate the quantity they would have had installed. The Team then calculated those participants' quantity credit based on the difference between their stated non-programs' quantity and the actual quantity they had installed. The quantity credit calculation is shown in Figure B-12.

Figure B-12. Participant Free-Ridership Quantity Credit

Efficiency Credit

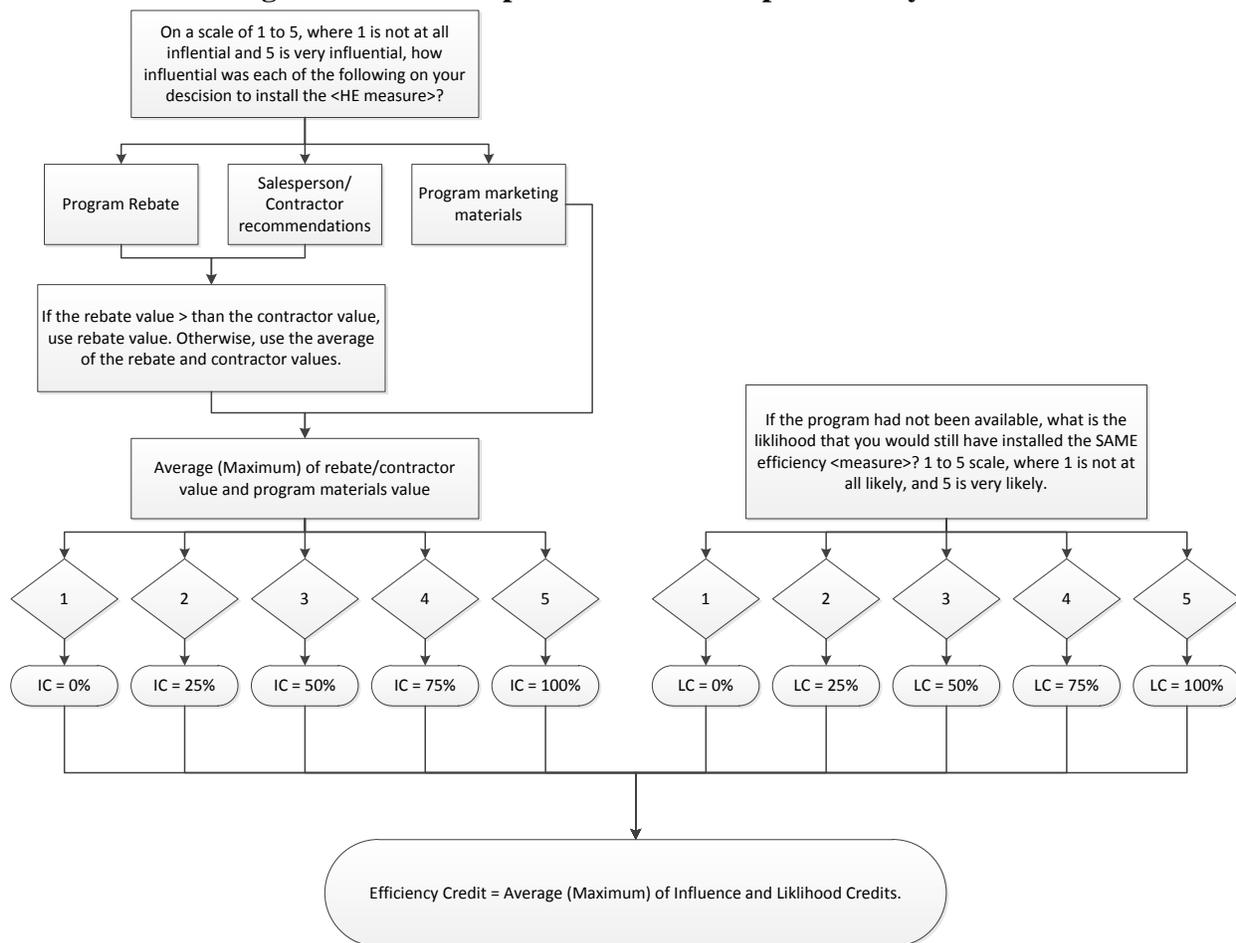
The last variable in the Evaluations Team's calculation of FR was the efficiency credit, which we based on two ways the programs could have change participant behavior:

1. The programs' may have influenced the participant to install a higher-efficiency measure (influence credit), and
2. The programs' may have increased the likelihood of the participant installing a measure with the same level of efficiency as they did under the program (likelihood credit).

To determine the programs' influence on a participant's decision to purchase the high-efficiency measure, the Evaluation Team asked participants to rate the amount of influence certain program aspects had on their decision, on a 1 to 5 scale where 1 indicates being not at all influential and 5 indicates being very influential. The specific aspects we asked about were: the rebate, the contractor, and the marketing materials. We assigned a score to each of these aspects, then used those scores to calculate the influence credit for that participant.

To calculate the likelihood credit, we asked participants to rate the likelihood they would have had a measure with the same high level of efficiency installed in absence of the programs. They rated this on scale of 1 to 5, where 1 indicated being not at all likely and 5 indicated being very likely.

Then the Evaluation Team calculated the efficiency credit based on the combined influence and likelihood credits. This methodology is depicted in Figure B-13.

Figure B-13. Participant Free-Ridership Efficiency Credit

As part of the sensitivity analysis of the HEHE and Cool Smart programs, the Evaluation Team used four Methods to determine participant FR. First, we averaged the participants' rating of the influence of the contractor and of the program rebate to calculate their influence score. Next, the Evaluation Team averaged that influence and likelihood scores, and used that value to determine the efficiency credit. We determined the efficiency credit by averaging the maximum value of either the contractor or rebate influence with the maximum value of either the influence or likelihood score.

The Evaluation Team also applied a different timing credit as part of the sensitivity analysis. For the original timing credit, we assigned a partial credit of 50% for units that would have been replaced within six months to a year of the rebated unit. For the sensitivity analysis timing credit, we increased that partial timing credit to 66%.

In summary, the four methods were:

- Method 1: Original timing credit, average of likelihood and influence credits
- Method 2: Original timing credit, maximum of likelihood and influence credits
- Method 3: Sensitivity analysis timing credit, average of likelihood and influence credits

Method 4: Sensitivity analysis timing credit, maximum of likelihood and influence credits

Varying the timing credit had a limited impact on final FR results. However, using the average versus maximum of the programs' influence and likelihood credits had very significant implications for calculating the FR efficiency credit, with the maximum values effectively halving the FR estimates when using the average values.

APPENDIX C: PROGRAM PARTICIPATION DATA

Each PA provided the Evaluation Team with 2012 participation data for the HEHE and Cool Smart programs. The following tables break down the participation data by PA and provide annual totals by measure.

Table C-1. Cool Smart Participation, 2012

Measure	Program Administrator					Total Participation
	NSTAR	National Grid	Western MA Electric Company	Unitil	Cape Light Compact	
Central Air Conditioners, SEER 14.5-15	59	57	5	-	17	138
Central Air Conditioners , SEER 15-16	265	157	32	3	48	505
Central Air Conditioners, SEER >16	1,052	685	140	2	206	2,085
Heat Pumps, SEER 14.5-15	17	28	-	-	6	51
Heat Pumps, SEER 15-16	168	152	21	-	33	374
Ductless Mini-Splits, SEER >14.5	52	1,009	25	48	1,008	2,142
Quality Installation Verification for Central Air Conditioners	405	219	24	-	118	766
Quality Installation Verification for Heat Pumps	118	57	3	-	2	180
Brushless/ Electronically commutated fan motors	-	64	5	20	23	112
Correct Sizing	2,022	12	103	-	-	2,137
Duct Sealing	134	291	1	-	8	434
Refrigerant Charge and Airflow for Central Air Conditioners	-	276	81	9	-	366
Refrigerant Charge and Airflow for Heat Pumps	-	8	-	-	-	8

Table C-2. HEHE Participation, 2012

Measure	Program Administrator						Total Participation
	NSTAR	Berkshire Gas	National Grid	Unitil	New England Gas	Columbia Gas	
Boilers, 90-95% AFUE	302	134	669	32	72	332	1,541
Boilers, ≥96% AFUE	664	216	3,327	26	97	539	4,869
Furnaces, 92-95% AFUE	341	47	430	19	50	553	1,440
Furnaces, >95% AFUE	673	144	2,966	5	59	1,062	4,909
Storage Water Heaters, Energy Factor ≥0.67	57	11	119	3	2	50	242
Tankless Water Heaters, Energy Factor ≥0.95	150	64	1,159	9	53	271	1,706
Tankless Water Heaters, Energy Factor ≤0.94	282	74	1,001	5	29	337	1,728
Condensing Water Heaters	2	-	34	-	-	5	41
Integrated Space Heating and Water Heating Systems with a Condensing Boiler	454	83	-	15	141	362	1,055
Heat Recovery Ventilators	8	2	49	-	1	13	73
Outdoor Boiler Reset Controls	46	9	186	2	8	32	283

Table C-3. Customer Participation by Measure Category, 2012

Measure	Programs' Participation Totals (based on PA Benefit/Cost Ratio Data)
Gas Boilers	6,410
Gas Furnaces	6,349
Central Air Conditioners and Heat Pumps	3,153
Ductless Mini-Splits	2,142
Storage Water Heaters	242
Tankless Water Heaters	3,434
Quality Installation Verification	946

APPENDIX D: SURVEY INSTRUMENTS

This appendix provides the following survey instruments:

- Distributor survey
- Non-QIV contractor survey
- Contractor QIV survey
- Participant survey

Massachusetts Distributor Survey

Hi my name is _____ from Navigant Consulting, and I am calling on behalf of the Massachusetts utilities and Energy Efficiency Program Administrators. This is not a sales call. May I please speak with the person most knowledgeable about your company's heating, cooling, or water heating sales and stocking practices?

I'm working on a project on behalf the Massachusetts electric and gas utilities. Specifically, we are conducting a study with distributors involved with heating, cooling, and water heating systems to learn about their equipment stocking and sales practices. This will help the utility Energy Efficiency Program Administrators of Massachusetts better understand the impacts of two of their energy programs: the Cool Smart program and the GasNetworks High-Efficiency Heating & Water Heating program. The survey will take about 15-20 minutes of your time and, for completing this survey, you will receive a \$100 Visa card as a token of our appreciation of your time. Also, you may choose to donate \$100 to the Red Cross which has been instrumental in Hurricane Sandy response actions. Anything that you tell me will be held in the strictest confidence.

May I please speak to the manager or person at your firm most familiar with your residential cooling, heating, and water heating businesses?

Name	Record NAME	Title
Title	Record TITLE	Phone
Company Address	Record ADDRESS	Address
State	Record STATE	State
Zip Code	Record ZIP CODE	Zip Code
Phone	Record PHONE	Fax
Fax	Record FAX	Email
Email	Record EMAIL	S1

SCREENING/FIRMOGRAPHICS

S1. What products and services does your company provide to the residential cooling, heating and water heating market? Does your company ...[READ, Select all that Apply]

1	Distribute cooling, heating or water heating equipment? (NOTE: END if not selected)	S2
2	Install HVAC units	Contractor Survey
3	Design HVAC systems	End if S1≠1
4	Manufacture HVAC units	End if S1≠1
77	Other (RECORD VERBATIM)	End if S1≠1
88	(Don't Know)	End if S1≠1
99	(Refused)	End if S1≠1

S2. What percentage of your business at this location does residential cooling, heating and water heating distribution represent?

%	Percent (NOTE: END if less than 30 percent)	S3
88	(Don't Know)	End
99	(Refused)	End

S3. Approximately what percent of your residential cooling, heating and water heating business at this location is in Massachusetts?

%	Percent (NOTE: END if less than 50 percent)	S4
88	(Don't Know)	S4
99	(Refused)	S4

End if S2 is less than 30 percent or if S3 less than 50 percent

S4. Are you a wholesale distributor that sells primarily to contractors and installers, a contractor that sells primarily to end users, or both?

1	Wholesale distributor that sells primarily to contractors and installers	S4a
2	A contractor that sells primarily to end users	End
3	Both	S4a
88	(Don't Know)	End
99	(Refused)	End

S5. Which of the following best describes your HVAC distribution business?

1	Manufacturer representative [RECORD NAME OF MFG]	NC1
2	General industrial supplier (multiple mfrs.) [RECORD NAMES OF MFG]	NC1
3	Catalog/mail order firm	NC1
77	[DON'T READ] Other [RECORD VERBATIM]	NC1
88	(Don't Know)	NC1
99	(Refused)	NC1

NEW CONSTRUCTION BUSINESS

NC1. What percent of your Residential HVAC distribution business at this location is in new construction, and what percent is retrofit / remodel? (MUST add to 100%)

%	% New construction	ES1
%	% Retrofit/remodel	ES1
88	(Don't Know)	ES1
99	(Refused)	ES1

UTILITY PROGRAMS

U1a Prior to this call, were you aware of Massachusetts residential cooling program known as Cool Smart?		
1	Yes	U2
2	No	U1b
88	(Don't Know)	U1b
99	(Refused)	U1b

U1b And before this call, were you aware of another Massachusetts residential program known as the GasNetworks High-Efficiency Heating & Water Heating program?		
1	Yes	U2
2	No	U1c
88	(Don't Know)	U1c
99	(Refused)	U1c

U1c. [READ] Cool Smart and GasNetworks High-Efficiency Heating & Water Heating are programs that promote the purchase of higher-efficiency cooling, heating and water heating equipment to residential customers in the State of Massachusetts. Local utilities give incentives to either the contractors who install the equipment or the residential customers that buy the equipment. Specific to Cool Smart, the program provides quality installation and verification training to contractors as well. [CONTINUE TO U2].

U2. Do you believe these types of programs are effective in increasing the residential sales of more efficient HVAC systems?

1	Yes	U3
2	No	U4
88	(Don't Know)	U4

99	(Refused)	U4
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[ASK IF U2 = Yes, ELSE SKIP TO U4]

U3. What program activities or components have contributed to the increase in the sales of more efficient residential HVAC equipment?

77	RECORD VERBATIM	U4
88	(Don't Know)	U4
99	(Refused)	U4

EQUIPMENT SPECIFIC SALES AND EFFICIENCY

SALES DETAIL

ES1. Which of the following types of equipment has your company sold over the past year?

1	Furnaces	ES5
2	Boilers	ES5
3	Integrated Heating and Water Heating Systems	ES19
4	Storage Water Heaters	ES11
5	Tankless Water Heaters	ES11
6	Condensing Water Heaters	ES11
7	Central Air Conditioners and Heat Pumps	ES2
9	Ductless Mini-Split Systems	ES4

88	(Don't Know)	ES1a
99	(Refused)	ES1a

If ES1 = 88 or 99

ES1a. Could you share with me possible reasons that you do not know or refused the types of equipment your company sells? As a reminder, all information collected will be considered proprietary, and no information will be tied to specific companies. We are trying to understand the broader market. [RE-ASK ES1 IF RESPONDENT ALLOWS, ELSE RECORD ANSWER AND PROCEED TO MA1]

77	RECORD VERBATIM	
88	(Don't Know)	
99	(Refused)	

[READ ONLY THOSE THAT APPLY]

For purposes of the rest of this survey, when we speak of high efficiency equipment it is

- [IF ES1=2] Boilers with efficiencies of 90% or greater,
- [IF ES1=1] Furnaces with efficiencies of 95% or greater, ,
- [IF ES1=7 or 9] Central Air Conditioners, Heat Pumps, and Ductless Mini-Split Systems of SEER 14.5 or higher,
- [IF ES1=4] Storage Water Heaters with energy factor of 0.67 or higher,
- [IF ES1=5] Tankless Water Heaters with energy factors of 0.82 and higher and

CENTRAL AIR CONDITIONERS AND HEAT PUMPS

ASK IF ES1 = 7

ES2a. How many residential central air conditioning and heat pump systems did your company sell in Massachusetts in the PAST YEAR? [NOTE: Let respondent know they must answer question to receive incentive.]

a ___ Amount of central air conditioning and heat pumps

88 (Don't Know) [DO NOT READ] TERMINATE

99 (Refused) [DO NOT READ] TERMINATE

ES2b. Now, if you were to divide all your company's sales of the CENTRAL AIR CONDITIONERS AND HEAT PUMPS in the past year across the following efficiency levels, what percent of your company's sales – in the State of Massachusetts - were..? The percentages should add up to 100%. We can go back and adjust your answers as necessary. [IF NEEDED: YOUR BEST ESTIMATE IS FINE]

a	Less than 14.5% SEER
b	Greater than or equal to 14.5 SEER but less than 15 SEER
c	Greater than or equal to 15 SEER but less than 16 SEER
d	Greater than or equal to 16 SEER
88	(Don't Know) [DO NOT READ]
99	(Refused) [DO NOT READ]

ES2c0. You mentioned that your company installed [READ IN ES2a] CENTRAL AIR CONDITIONERS AND HEAT PUMPS in the past year. In the absence of the program, do you think total sales this year would have been higher, lower, or the same?

1	Higher
2	Lower
3	The same
88	(Don't Know)
99	(Refused)

ASK IF ES2c0 = 1 or 2

ES2c. If the Cool Smart program incentives, marketing and support had not existed, how many systems regardless of efficiency level do you think your company would have sold? [NUMERIC OPEN END]

ES2d0. In the absence of the program, do you think the percentage breakdown of your sales of CENTRAL AIR CONDITIONERS AND HEAT PUMPS across efficiency levels would have been different?

1	Yes
2	No
88	(Don't Know)
99	(Refused)

IF ES2d0=1

ES2d. What would the percentage breakdown of these CENTRAL AIR CONDITIONERS AND HEAT PUMPS look like in the past year across the following efficiency levels if the Cool Smart program incentives, marketing and support had not existed? The percentages should add up to 100%. We can go back and adjust your answers as necessary. [IF NEEDED: YOUR BEST ESTIMATE IS FINE]

a	Less than 14.5% SEER
b	Greater than or equal to 14.5 SEER but less than 15 SEER
c	Greater than or equal to 15 SEER but less than 16 SEER
d	Greater than or equal to 16 SEER
88	(Don't Know) [DO NOT READ]
99	(Refused) [DO NOT READ]

ASK IF ES2b "a" = ES2d "a":

ES2e. To confirm I understand, are you saying that the market share of high efficiency units over the last year would have remained the same if the Cool Smart program did not exist?

- a. Yes > Why is that? [RECORD OPEN ENDED]
- b. No > go back through ES2a – ES2f
- c. Don't know
- d. Refused

ASK IF ES2b “a” > ES2d “a”:

ES2f. To confirm I understand, are you saying that the market share of high efficiency units over the last year would have been larger if the Cool Smart program did not exist?

- a. Yes > Why is that? [RECORD OPEN ENDED]
- b. No > go back through ES2a – ES2f
- c. Don't know
- d. Refused

DUCTLESS MINI SPLIT HVAC SYSTEMS

[ASK IF ES1=9]

ES4a. How many residential ductless mini split systems did your company sell in Massachusetts in the PAST YEAR? [NOTE: Let respondent know they must answer question to receive incentive.]

- a ___ Amount of ductless mini split hvac systems
- 88 (Don't Know) [DO NOT READ] TERMINATE
- 99 (Refused) [DO NOT READ] TERMINATE

ES4b. Now, if you were to divide all your company's sales of the DUCTLESS MINI SPLIT SYSTEMS in the past year across the following SEER levels, what percent of your company's sales – in the State of Massachusetts - over the past year - were..? The percentages should add up to 100%. We can go back and adjust your answers as necessary. [IF NEEDED: YOUR BEST ESTIMATE IS FINE]

a	Less than 14.5% SEER
b	Greater than or equal to 14.5 SEER

88	(Don't Know) [DO NOT READ]
99	(Refused) [DO NOT READ]

ES4c0. You mentioned that your company installed [READ IN ES2a] MINI SPLIT HVAC SYSTEMS in the past year. In the absence of the program, do you think total sales this year would have been higher, lower, or the same?

1	Higher
2	Lower
3	The same
88	(Don't Know)
99	(Refused)

ASK IF ES4c0 = 1 or 2

ES4c. If the Cool Smart program incentives, marketing and support had not existed, how many systems do you think your company would have sold? [NUMERIC OPEN END]

ES4d0. In the absence of the program, do you think the percentage breakdown of your sales of MINI SPLIT HVAC SYSTEMS across efficiency levels would have been different?

1	Yes
2	No
88	(Don't Know)
99	(Refused)

IF ES4d0=1

ES4d. What would the percentage breakdown of these MINI SPLIT HVAC SYSTEMS look like in the past year across the following efficiency levels if the Cool Smart program incentives,

marketing and support had not existed? The percentages should add up to 100%. We can go back and adjust your answers as necessary. [IF NEEDED: YOUR BEST ESTIMATE IS FINE]

a	Less than 14.5% SEER
b	Greater than or equal to 14.5 SEER
88	(Don't Know) [DO NOT READ]
99	(Refused) [DO NOT READ]

ASK IF ES4b “a” = ES4d “a”:

ES4e. To confirm I understand, are you saying that the market share of high efficiency units would have remained the same over the last year if the Cool Smart program did not exist?

- a. Yes > Why is that? [RECORD OPEN ENDED]
- b. No > go back through ES4a – ES4f
- c. Don't know

ASK IF ES4b “a” > ES4d “a”:

ES4f. To confirm I understand, are you saying that the market share of high efficiency units over the last year would have been larger if the Cool Smart program did not exist?

- a. Yes > Why is that? [RECORD OPEN ENDED]
- b. No > go back through ES4a – ES4f
- c. Don't know
- d. Refused

GAS HEATING**[ASK IF ES1=1 OR 2, ELSE SKIP TO ES 11]**

ES5. How many residential gas heating systems of each of the following types did your company sell in Massachusetts in the PAST YEAR?

a	Natural gas furnaces	
b	Natural gas boilers	
88	(Don't Know) [DO NOT READ]	
99	(Refused) [DO NOT READ]	

[ASK IF ES5a>0]

ES6a. Now, if you were to divide all your company's sales of the NATURAL GAS FURNACES in the past year across the following AFUE levels, what percent of your company's NATURAL GAS FURNACE sales – in the State of Massachusetts - were..? The percentages should add up to 100%. We can go back and adjust your answers as necessary. [IF NEEDED: YOUR BEST ESTIMATE IS FINE]

a	Furnaces less than 92% AFUE
b	Furnaces greater than or equal to 92% but less than 95% AFUE
c	Furnaces greater than or equal to 95% AFUE
88	(Don't Know) [DO NOT READ]
99	(Refused) [DO NOT READ]

ES6b0. You mentioned that your company installed [READ IN ES2a] NATURAL GAS FURNACES in the past year. In the absence of the program, do you think total sales this year would have been higher, lower, or the same?

1	Higher
2	Lower

3	The same
88	(Don't Know)
99	(Refused)

ASK IF ES6b0 = 1 or 2

ES6b. If the Gas Networks High Efficiency Heating and Water Heating program incentives, marketing and support had not existed, how many systems do you think your company would have sold? [NUMERIC OPEN END]

ES6c0. In the absence of the program, do you think the percentage breakdown of your sales of NATURAL GAS FURNACES across efficiency levels would have been different?

1	Yes
2	No
88	(Don't Know)
99	(Refused)

IF ES6c0=1

ES6c. What would the percentage breakdown of these NATURAL GAS FURNACES look like in the past year across the following efficiency levels if the Gas Networks High Efficiency Heating and Water Heating program incentives, marketing and support had not existed? The percentages should add up to 100%. We can go back and adjust your answers as necessary. [IF NEEDED: YOUR BEST ESTIMATE IS FINE]

a	Furnaces less than 92% AFUE
b	Furnaces greater than or equal to 92% but less than 95% AFUE
c	Furnaces greater than or equal to 95% AFUE
88	(Don't Know) [DO NOT READ]

99	(Refused) [DO NOT READ]
----	-------------------------

ASK IF ES6 “a” = ES6b “a”:

ES6d. To confirm I understand, are you saying that the market share of high efficiency units would have remained the same over the last year if the Gas Networks High Efficiency Heating and Water Heating program did not exist?

- a. Yes > Why is that? [RECORD OPEN ENDED]
- b. No > go back through ES6a – ES6f
- c. Don’t know

ASK IF ES6 “a” > ES6b “a”:

ES6e. To confirm I understand, are you saying that the market share of high efficiency units over the last year would have been larger if the Gas Networks High Efficiency Heating and Water Heating program did not exist?

- a. Yes > Why is that? [RECORD OPEN ENDED]
- b. No > go back through ES6a – ES6f
- c. Don’t know
- d. Refused

[ASK IF ES5b>0]

ES7a. Now, if you were to divide all your company’s residential sales of the NATURAL GAS BOILERS in the past year across the following AFUE levels, what percent of your company’s NATURAL GAS BOILER sales – in the State of Massachusetts - were..? The percentages should add up to 100%. We can go back and adjust your answers as necessary. [IF NEEDED: YOUR BEST ESTIMATE IS FINE]

a	Boilers less than 90% AFUE
b	Boiler greater than or equal to 90% but less than 96% AFUE
c	Boilers greater than or equal to or greater than 96% AFUE
88	(Don’t Know) [DO NOT READ]
99	(Refused) [DO NOT READ]

ES7b0. You mentioned that your company installed [READ IN ES2a] NATURAL GAS BOILERS in the past year. In the absence of the program, do you think total sales this year would have been higher, lower, or the same?

1	Higher
2	Lower
3	The same
88	(Don't Know)
99	(Refused)

ASK IF ES7b0 = 1 or 2

ES7b. If the Gas Networks High Efficiency Heating and Water Heating program incentives, marketing and support had not existed, how many systems do you think your company would have sold? [NUMERIC OPEN END]

ES7c0. In the absence of the program, do you think the percentage breakdown of your sales of NATURAL GAS BOILERS across efficiency levels would have been different?

1	Yes
2	No
88	(Don't Know)
99	(Refused)

IF ES7c0=1

ES7c. What would the percentage breakdown of these NATURAL GAS BOILERS look like in the past year across the following efficiency levels if the Gas Networks High Efficiency Heating and Water Heating program incentives, marketing and support had not existed? The percentages should add up to 100%. We can go back and adjust your answers as necessary. [IF NEEDED: YOUR BEST ESTIMATE IS FINE]

a	Boilers less than 90% AFUE
b	Boiler greater than or equal to 90% but less than 96% AFUE
c	Boilers greater than or equal to or greater than 96% AFUE
88	(Don't Know) [DO NOT READ]
99	(Refused) [DO NOT READ]

ASK IF ES7a “a” = ES7c “a”:

ES7d. To confirm I understand, are you saying that the market share of high efficiency units would have remained the same over the last year if the Gas Networks High Efficiency Heating and Water Heating program did not exist?

- a. Yes > Why is that? [RECORD OPEN ENDED]
- b. No > go back through ES7a – ES7f
- c. Don't know

ASK IF ES7a “a” > ES7c “a”:

ES7a. To confirm I understand, are you saying that the market share of high efficiency units over the last year would have been larger if the Gas Networks High Efficiency Heating and Water Heating program did not exist?

- a. Yes > Why is that? [RECORD OPEN ENDED]
- b. No > go back through ES7a – ES7f
- c. Don't know
- d. Refused

GAS WATER HEATING

[ASK IF ES1=4, 5 or 6]

I would like to learn about the sales of the water heating equipment. You had mentioned earlier that you sell this equipment.

ES11a. How many residential water heating systems (storage, tankless, and condensing) did your company sell in Massachusetts in the PAST YEAR? [NOTE: Let respondent know they must answer question to receive incentive.]

a ___ Water heating systems88 (Don't Know) [DO NOT READ] TERMINATE

99 (Refused) [DO NOT READ] TERMINATE

ES11b. Now, if you were to divide all your company's sales of the residential WATER HEATING SYSTEMS in the past year across the following efficiency levels and system types, what percent of your company's sales – in the State of Massachusetts - were..? The percentages should add up to 100%. We can go back and adjust your answers as necessary. Please DO NOT include the installations of integrated heating and water heating systems. [IF NEEDED: YOUR BEST ESTIMATE IS FINE]

a	Storage Water Heaters with an Energy Factor of less 0.67
b	Storage Water Heaters with an Energy Factor of 0.67 or greater
c	Tankless Water Heaters
d	Condensing Water Heaters
88	(Don't Know) [DO NOT READ]
99	(Refused) [DO NOT READ]

ES11c0. You mentioned that your company installed [READ IN ES2a] WATER HEATING SYSTEMS in the past year. In the absence of the program, do you think total sales this year would have been higher, lower, or the same?

1	Higher
2	Lower
3	The same
88	(Don't Know)
99	(Refused)

ASK IF ES11c0 = 1 or 2

ES11c. If the Gas Networks High Efficiency Heating and Water Heating program incentives, marketing and support had not existed, how many systems do you think your company would have sold? [NUMERIC OPEN END]

ES11d0. In the absence of the program, do you think the percentage breakdown of your sales of WATER HEATING SYSTEMS across efficiency levels would have been different?

1	Yes	
2	No	
88	(Don't Know)	
99	(Refused)	

IF ES11d0=1

ES11d. What would the percentage breakdown of these WATER HEATING SYSTEMS look like in the past year across the following efficiency levels if the Gas Networks High Efficiency Heating and Water Heating program incentives, marketing and support had not existed? The percentages should add up to 100%. We can go back and adjust your answers as necessary. [IF NEEDED: YOUR BEST ESTIMATE IS FINE]

a	Storage Water Heaters with an Energy Factor of less 0.67
b	Storage Water Heaters with an Energy Factor of 0.67 or greater
c	Tankless Water Heaters
d	Condensing Water Heaters
88	(Don't Know) [DO NOT READ]
99	(Refused) [DO NOT READ]

ASK IF ES11b "a" = ES11e "a":

ES11e. To confirm I understand, are you saying that the market share of high efficiency water heating systems would have remained the same over the last year if the Gas Networks High Efficiency Heating and Water Heating program did not exist?

- d. Yes > Why is that? [RECORD OPEN ENDED]
- e. No > go back through ES11a – ES11f
- f. Don't know

ASK IF ES11b “a” > ES11e “a”:

ES11f. To confirm I understand, are you saying that the market share of high efficiency water heating systems over the last year would have been larger if the Gas Networks High Efficiency Heating and Water Heating program did not exist?

- e. Yes > Why is that? [RECORD OPEN ENDED]
- f. No > go back through ES11a – ES11f
- g. Don't know
- h. Refused

MARKET ASSESSMENT

Great. Now let me ask you about the role of the high efficiency equipment as we discussed in your business.

MA1. In the course of selling, bidding, or making recommendations to contractors who order residential cooling, heating or water heating equipment, how frequently do you promote high-efficiency options, those that go beyond the minimum efficiency available? [READ LIST]

1	Almost never	MA1a
2	Less than half the time	MA1a
3	About half the time	MA1a
4	More than half the time	MA1a
5	Almost always	MA1a
88	(Don't Know)	MA2
99	(Refused)	MA2

MA1a. What are the reasons for that?

77	RECORD VERBATIM	MA2
88	(Don't Know)	MA2
99	(Refused)	MA2

MA2 Do you receive support from manufacturers to promote the sale of high-efficiency cooling, heating or water heating equipment?

1	Yes - What kinds of support do you receive? RECORD VERBATIM	MA3
2	No	MA3
88	(Don't Know)	MA3
99	(Refused)	MA3

MA3 To what extent do you receive support from utility programs such as Mass Save, Cool Smart or GasNetworks High-Efficiency Heating & Water Heating to promote the sale of high-efficiency cooling, heating or water heating equipment?

77	RECORD VERBATIM	MA3a
88	(Don't Know)	MA3a
99	(Refused)	MA3a

MA3aa. Has this support influenced the types of equipment that you keep in inventory?

1	Yes	MA7a
2	No	MA8
88	(Don't Know)	MA8
99	(Refused)	MA8

IF ES1=7 or 9

AND IF MA3aa=1

MA3b.How has this support influenced the types of cooling equipment that you keep in inventory?

77	RECORD VERBATIM	MA3c
88	(Don't Know)	MA3c
99	(Refused)	MA3c

IF ES1=1 or 2

AND IF MA3aa=1

MA3c.How has this support influenced the types of heating equipment that you keep in inventory?

77	RECORD VERBATIM	MA3d
88	(Don't Know)	MA3d
99	(Refused)	MA3d

IF ES1=3, 4, 5 or 6

AND IF MA3aa=1

MA3d.How has this support influenced the types of water heating equipment that you keep in inventory?

77	RECORD VERBATIM	MA4
88	(Don't Know)	MA4
99	(Refused)	MA4

MA4 On a scale of 1 to 5, with 1 being not very important and 5 being very important, how important is the sale of high-efficiency heating, cooling and water heating equipment to your business? [READ]

4 or 5	Very important	MA4a
3	Somewhat important	MA4a
1 or 2	Not at all important	MA4a
77	Other (RECORD VERBATIM)	MA4a
88	(Don't Know)	MA5
99	(Refused)	MA5

MA4a. What were the reasons that you gave that rating?

77	RECORD VERBATIM	MA5
88	(Don't Know)	MA5
99	(Refused)	MA5

MA5 What types of promotional materials and strategies does your company use when recommending specific heating, cooling or water heating equipment to installation contractors?

77	RECORD VERBATIM	MA6
88	(Don't Know)	MA6
99	(Refused)	MA6

MA6 How, if at all, has the federally mandated SEER 13 minimum efficiency requirement for air-cooled split and packaged air conditioning units below 5.4 tons affected your business?

77	RECORD VERBATIM	MA7
88	(Don't Know)	MA7
99	(Refused)	MA7

MA7. Is the efficiency of the heating, cooling or water heating equipment you sell affected by local energy codes?

1	Yes	MA7a
2	No	MA8
88	(Don't Know)	MA8
99	(Refused)	MA8

MA7a. How do these local codes affect your equipment sales, please discuss any effects within and outside code jurisdiction areas?

77	RECORD VERBATIM	MA8
88	(Don't Know)	MA8
99	(Refused)	MA8

ASK IF ES1=1, 2 3

MA8a. On a scale of 1 to 5, with 1 being very difficult and 5 being very easy, how easily can a contractor purchase **heating** equipment less than 95% for furnaces and 90% for boilers **today**?

#	RECORD NUMERIC RESPONSE	MA9
88	(Don't Know)	MA9
99	(Refused)	MA9

MA8b. On a scale of 1 to 5, with 1 being very difficult and 5 being very easy, how easily could a contractor purchase **heating** equipment less than 95% for furnaces and 90% for boilers **two years ago**?

#	RECORD NUMERIC RESPONSE	MA10
88	(Don't Know)	MA10
99	(Refused)	MA10

MA8c. [ASK IF MA14 ≠ MA15, ELES SKIP TO CR1] What are the reasons for this change?

77	RECORD VERBATIM	CR1
88	(Don't Know)	CR1
99	(Refused)	CR1

MA8d. On a scale of 1 to 5, with 1 being not influential and 5 being very influential, considering the many possible reasons why equipment has become more energy efficient, how influential have utility rebates been in promoting high efficiency furnace and boiler sales? [REFER TO EFFICIENCY DEFINITIONS ABOVE]

#	RECORD NUMERIC RESPONSE	
88	(Don't Know)	
99	(Refused)	

MA8e. On the same scale of 1 to 5, with 1 being not influential and 5 being very influential, how influential have the other program components such as training and marketing materials been in promoting high efficiency furnace and boiler sales?

#	RECORD NUMERIC RESPONSE	
88	(Don't Know)	
99	(Refused)	

ASK IF ES1=7,8,9

MA9a. On a scale of 1 to 5, with 1 being very difficult and 5 being very easy, how easily can a contractor purchase **cooling** equipment less than SEER 14.5 today?

#	RECORD NUMERIC RESPONSE	MA9
88	(Don't Know)	MA9
99	(Refused)	MA9

MA9b. On a scale of 1 to 5, with 1 being very difficult and 5 being very easy, how easily could a contractor purchase **cooling** equipment less than SEER 14.5 two years ago?

#	RECORD NUMERIC RESPONSE	
88	(Don't Know)	MA10
99	(Refused)	MA10

MA9c. [ASK IF MA14 ≠ MA15, ELES SKIP TO CR1] What are the reasons for this change?

#	RECORD VERBATIM	
77		CR1
88	(Don't Know)	CR1
99	(Refused)	CR1

MA9d. On a scale of 1 to 5, with 1 being not influential and 5 being very influential, considering the many possible reasons why equipment has become more energy efficient, how influential have utility rebates been in promoting high efficiency cooling equipment sales? [REFER TO EFFICIENCY DEFINITIONS ABOVE]

#	RECORD NUMERIC RESPONSE	
88	(Don't Know)	
99	(Refused)	

MA9e. On the same scale of 1 to 5, with 1 being not influential and 5 being very influential, how influential have the other program components such as training and marketing materials been in promoting high efficiency cooling equipment sales?

#	RECORD NUMERIC RESPONSE	
88	(Don't Know)	
99	(Refused)	

ASK IF ES1=3,4,5,6

MA10a. On a scale of 1 to 5, with 1 being very difficult and 5 being very easy, how easily can a contractor purchase less efficient water heating equipment today (that's storage **water heaters** with an energy factor less than 0.67)?

#	RECORD NUMERIC RESPONSE	MA9
88	(Don't Know)	MA9
99	(Refused)	MA9

MA10b. On a scale of 1 to 5, with 1 being very difficult and 5 being very easy, how easily could a contractor purchase less efficient water heating equipment two years ago (that's storage **water heaters** with an energy factor less than 0.67)?

#	RECORD NUMERIC RESPONSE	MA10
88	(Don't Know)	MA10
99	(Refused)	MA10

MA10c. [ASK IF MA14 ≠ MA15, ELES SKIP TO CR1] What are the reasons for this change?

77	RECORD VERBATIM	CR1
88	(Don't Know)	CR1
99	(Refused)	CR1

MA10d. On a scale of 1 to 5, with 1 being not influential and 5 being very influential, considering the many possible reasons why equipment has become more energy efficient, how influential have utility rebates been in promoting high efficiency water heater sales? [REFER TO EFFICIENCY DEFINITIONS ABOVE]

#	RECORD NUMERIC RESPONSE	
88	(Don't Know)	
99	(Refused)	

MA10e. On the same scale of 1 to 5, with 1 being not influential and 5 being very influential, how influential have the other program components such as training and marketing materials been in promoting high efficiency water heater sales?

#	RECORD NUMERIC RESPONSE	
88	(Don't Know)	
99	(Refused)	

CIRCUIT RIDERS

CR1. On a scale from 1 to 5, where 1 is not influential and 5 is very influential, how influential do you think circuit riders are the sales of high efficiency equipment? [If prompted: Circuit Riders are utility employees who actively engage with distributors to discuss the energy efficiency programs. They can train sales people and leaves literature with distributors.]

#	RECORD NUMERIC RESPONSE	CR2
88	(Don't Know)	CR2
99	(Refused)	CR2

CR2. How are circuit riders effective in influencing the sales of high efficiency equipment?

#	RECORD VERBATIM	FF1
77		FF1
88	(Don't Know)	FF1
99	(Refused)	FF1

FINISH

FF0. What else can the program do to promote high efficiency equipment? [RECORD OPEN ENDED]

FF1. Thank you for taking time to speak to me today. In the event that we have additional questions, would it be OK for me to call you back in order to clarify any of comments that you have offered to me?

1	Yes	FF2
2	No	FF2

FF2. Those are all the questions I have for you today. Thank you very much for your time and help. Shall I address the incentive check and market analysis report to you at the company’s address?

1	Yes	FF3
2	No	FF2a

[ASK IF FF2=No]

FF2a. May I take down your mailing address?

Name	Record NAME	
Street Address	Record ADDRESS	
State	Record STATE	
Zip Code	Record ZIP CODE	FF3

FF3. Thank you again for completing this survey. The Massachusetts Program Administrators are also looking for additional sales data by efficiency level. We understand that individual manufacturer level data are proprietary and confidential, and are therefore not asking for that kind of data. We are simply seeking to augment the general sales data you provided in this survey with additional sales data by efficiency level from 2007 through 2012. It is a simple one-page worksheet, and all we require are approximate sales numbers. May I send the worksheet to

you via email? We'll increase the \$100 incentive we talked about at the beginning of this call to \$200 for completing the data table for each of the equipment types your company sells.

1	Yes	END
2	No	END

Massachusetts Contractor Survey (Non-QIV)

SAMPLE VARIABLES:

PART – PROGRAM PARTICIPANT

1=HEHE ONLY PARTICIPANT

2=HEHE AND COOLSMART PARTICIPANT (ALL COOL SMART PARTICIPANTS ARE NON-QIV)

3=COOLSMART ONLY PARTICIPANT (ALL COOL SMART PARTICIPANTS ARE NON-QIV)

4=NONPARTICIPANT

HEAT_FLAG=1 (INSTALLED HEATING EQUIPMENT THROUGH THE PROGRAM)

WH_FLAG=1 (INSTALLED WATER HEATING EQUIPMENT THROUGH THE PROGRAM)

COOL_FLAG=1 (INSTALLED COOLING EQUIPMENT THROUGH THE PROGRAM)

INT_HWH_FLAG=1 (INSTALLED INTEGRATED HEATING AND WATER HEATING EQUIPMENT THROUGH THE PROGRAM)

BOILER_FLAG=1 (INSTALLED BOILERS THROUGH THE PROGRAM)

FURNACE_FLAG=1 (INSTALLED FURNACES THROUGH THE PROGRAM)

CAC_FLAG=1 (INSTALLED CENTRAL AIR CONDITIONING SYSTEMS THROUGH THE PROGRAM)

HP_FLAG=1 (INSTALLED HEAT PUMPS THROUGH THE PROGRAM)

DUCTLESS_FLAG=1 (INSTALLED DUCTLESS MINI SPLIT SYSTEMS THROUGH THE PROGRAM)

STORAGE_WH_FLAG=1 (INSTALLED STORAGE WATER HEATERS THROUGH THE PROGRAM)

TANKLESS_WH_FLAG=1 (INSTALLED TANKLESS WATER HEATERS THROUGH THE PROGRAM)

Introduction

[READ IF CONTACT=1]

Hello, this is _____ from Opinion Dynamics. This is not a sales call. I am calling on behalf of Massachusetts utilities and Energy Efficiency program administrators. May I please speak with <CONTACT> or the person most knowledgeable about the sales and installation practices of heating, cooling, or water heating equipment at your company?

We are conducting a study with contractors involved in the sales, installation and maintenance of heating, cooling and water heating systems to learn about their equipment sales and stocking practices. The survey will take about 20 minutes of your time and, if you qualify and complete the survey, you will receive a \$100 check as a token of our appreciation of your time. You can choose to receive the money yourself or donate it to the Red Cross. The information that we gather will be used to improve energy efficiency programs in Massachusetts.

[READ IF NEEDED: THE INFORMATION THAT YOU PROVIDE WILL REMAIN STRICTLY CONFIDENTIAL. IT WILL BE USED FOR RESEARCH PURPOSES ONLY.]

[READ IF CONTACT=0]

Hello, this is _____ from Opinion Dynamics. This is not a sales call. I am calling on behalf of Massachusetts utilities and Energy Efficiency program administrators. May I please speak with the person most knowledgeable about your company's heating, cooling, or water heating sales and stocking practices?

We are conducting a study with contractors involved with sales, installation, and maintenance of heating, cooling, and water heating systems to learn about their equipment stocking and sales practices. The survey will take about 20 minutes of your time, and if you qualify and complete the survey, you will receive a \$100 check as a token of our appreciation of your time. You can choose to receive the money yourself or donate it to the Red Cross. The information that we gather will be used to improve energy efficiency programs in Massachusetts.

[READ IF NEEDED: THE INFORMATION THAT YOU PROVIDE WILL REMAIN STRICTLY CONFIDENTIAL. IT WILL BE USED FOR RESEARCH PURPOSES ONLY.]

[CONTINUE]

Screener

First, let's see if you qualify for the study.

- S1. Which of the following categories best describes your company?
01. HVAC contractor
 02. Plumbing contractor
 03. HVAC and Plumbing contractor
 00. or something else (specify)
 98. (Don't know)
 99. (Refused)
- S3. Does your company install any of the following types of equipment? [1=YES; 2=NO; 8=DK; 9=REF]
- a. Heating equipment [READ IF NEEDED: THIS INCLUDES FURNACES, BOILERS, OR INTEGRATED HEATING AND WATER HEATING SYSTEMS]
 - b. Water heating equipment
 - c. Cooling equipment [READ IF NEEDED: THIS INCLUDES CENTRAL AIR CONDITIONING SYSTEMS, AIR SOURCE HEAT PUMPS, OR DUCTLESS MINI-SPLIT SYSTEMS]

[IF ALL IN S3=2,8,9 THANK AND TERMINATE]

- S4. Does your company operate only in Massachusetts or does your company also operate in other states?
1. Massachusetts only
 2. Massachusetts and other states
 3. (Do not operate in Massachusetts) [THANK AND TERMINATE]
 8. (Don't know) [THANK AND TERMINATE]
 9. (Refused) [THANK AND TERMINATE]
- S5. Does your company work only with commercial customers, only with residential customers, or with both, commercial and residential customers?
1. Commercial only [THIS INCLUDES NOT-FOR-PROFIT CUSTOMERS]
 2. Residential only
 3. Both commercial and residential
 8. (Don't know)
 9. (Refused)

[IF S5=1,8,9 – THANK AND TERMINATE]

It is our understanding that your company installs heating, cooling or water heating equipment.

- S6. Do you install this equipment only in existing buildings, only new construction or both?
1. Existing building
 2. New construction
 3. Both
 8. (Don't know)
 9. (Refused)

[ASK IF S6=3]

- S7. In the past two years, what percent of your installations of heating, cooling, or water heating equipment were in new construction projects and what percent were in existing buildings?
- a. New construction [0%-100%; 998=DON'T KNOW; 999=REFUSED]
 - b. Existing buildings [0%-100%; 998=DON'T KNOW; 999=REFUSED]

[ASK IF PART=1 OR 2 AND HEAT_FLAG=1]

- S8. According to our records, your company installed high efficiency FURNACES OR BOILERS that received incentives through the GasNetworks High-Efficiency Heating and Water Heating program during the past two years. Is that correct?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

[ASK IF S8=2,8,9]

- S9. To the best of your knowledge, did your company install high efficiency FURNACES OR BOILERS that received incentives through the GasNetworks High-Efficiency Heating and Water Heating program PRIOR to TWO years ago?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

[ASK IF PART=1 OR 2 AND WH_FLAG=1]

S16. According to our records, your company installed high efficiency WATER HEATERS that received incentives through the GasNetworks High-Efficiency Heating and Water Heating program during the past two years. Is that correct?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF S16=2,8,9]

S17. To the best of your knowledge, did your company install high efficiency WATER HEATERS that received incentives through the GasNetworks High-Efficiency Heating and Water Heating program PRIOR to TWO years ago?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF PART=2 OR 3]

S10. According to our records, your company installed high efficiency cooling equipment that received incentives through the Massachusetts Cool Smart program during the past two years. Is that correct?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF S10=2,8,9]

S11. To the best of your knowledge, did your company install high efficiency cooling equipment that received incentives through Massachusetts Cool Smart program PRIOR to TWO years ago?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF PART=4 OR (HEAT_FLAG=1 AND WH_FLAG=0 AND S9=2,8,9) OR (HEAT_FLAG=0 AND WH_FLAG=1 AND S17=2,8,9) OR (HEAT_FLAG=1 AND WH_FLAG=1 AND S9=2,8,9 AND S17=2,8,9) OR PART=3]

PA1. Are you aware of the GasNetworks High-Efficiency Heating and Water Heating program that offers incentives for high efficiency heating and water heating equipment?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF PART=4 OR (PART=2,3 AND S11=2,8,9) OR PART=1]

PA1a. Are you aware of the Massachusetts Cool Smart program that offers incentives for high efficiency cooling equipment?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF PA1=1 AND PART=4 OR 3 AND S3A=1]

S12. To the best of your knowledge, did your company install high efficiency FURNACES OR BOILERS that received incentives through the GasNetworks High-Efficiency Heating and Water Heating program during the PAST TWO YEARS?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF S12=2,8,9]

S13. To the best of your knowledge, did your company install high efficiency FURNACES OR BOILERS that received incentives through the GasNetworks High-Efficiency Heating and Water Heating program PRIOR to TWO years ago?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF PA1=1 AND PART=3 OR 4 AND S3B=1]

S18. To the best of your knowledge, did your company install high efficiency WATER HEATERS that received incentives through the GasNetworks High-Efficiency Heating and Water Heating program during the PAST TWO YEARS?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF S18=2,8,9]

S19. To the best of your knowledge, did your company install high efficiency WATER HEATERS that received incentives through the GasNetworks High-Efficiency Heating and Water Heating program PRIOR to TWO years ago?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF PA1A=1 AND PART=1 OR 4 AND S3C=1]

S14. To the best of your knowledge, did your company install high efficiency cooling equipment that received incentives through the Massachusetts Cool Smart program during the PAST TWO YEARS?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF S14=2,8,9]

S15. To the best of your knowledge, did your company install high efficiency cooling equipment that received incentives through the Massachusetts Cool Smart program PRIOR to TWO years ago?

1. Yes
2. No
8. (Don't know)
9. (Refused)

GENERATE SEGMENT

1=HEHE ACTIVE PARTICIPANT, COOL SMART ACTIVE PARTICIPANT ((S8=1 OR S12=1 OR S16=1 OR S18=1) AND (S10=1 OR S14=1))

2=HEHE ACTIVE PARTICIPANT, COOL SMART INACTIVE PARTICIPANT ((S8=1 OR S12=1 OR S16=1 OR S18=1) AND (S11=1 OR S15=1))

3=HEHE ACTIVE PARTICIPANT, COOL SMART NONPARTICIPANT ((S8=1 OR S12=1 OR S16=1 OR S18=1) AND (S11<>1 AND S15<>1))

4=HEHE INACTIVE PARTICIPANT, COOL SMART ACTIVE PARTICIPANT ((S9=1 OR S13=1 OR S17=1 OR S19=1) AND (S10=1 OR S14=1))

5=HEHE INACTIVE PARTICIPANT, COOL SMART INACTIVE PARTICIPANT ((S9=1 OR S13=1 OR S17=1 OR S19=1) AND (S11=1 OR S15=1))

6=HEHE INACTIVE PARTICIPANT, COOL SMART NONPARTICIPANT ((S9=1 OR S13=1 OR S17=1 OR S19=1) AND (S11<>1 AND S15<>1))

7=HEHE NONPARTICIPANT, COOL SMART ACTIVE PARTICIPANT ((S9<>1 AND S13<>1 AND S17<>1 AND S19<>1) AND (S10=1 OR S14=1))

8=HEHE NONPARTICIPANT, COOL SMART INACTIVE PARTICIPANT ((S9<>1 AND S13<>1 AND S17<>1 AND S19<>1) AND (S11=1 OR S15=1))

9=HEHE NONPARTICIPANT, COOL SMART NONPARTICIPANT ((S9<>1 AND S13<>1 AND S17<>1 AND S19<>1) AND (S11<>1 AND S15<>1))

GENERATE VERIFIED_PART (VERIFIED PARTICIPANT)

1=HEHE ONLY PARTICIPANT (IF SEGMENT=2 OR 3)

2=HEHE AND COOL SMART PARTICIPANT (IF SEGMENT=1)

3=COOL SMART ONLY PARTICIPANT (IF SEGMENT=4 OR 7)

4=NONPARTICIPANT (IF SEGMENT=5 OR 6 OR 8 OR 9)

GENERATE ENDUSE.

1=COOLING

2=HEATING

3=WATER HEATING

IF VERIFIED_PART=2 OR 3, ENDUSE=1

IF VERIFIED_PART=1, AND (S8=1 OR S12=1) AND (S16<>1 AND S18<>1) ENDUSE=2

IF VERIFIED_PART=1, AND (S8<>1 AND S12<>1) AND (S16=1 OR S18=11) ENDUSE=3

IF VERIFIED_PART=1, AND (S8=1 OR S12=1) AND (S16=1 OR S18=11) RANDOMLY

ASSIGN ENDUSE 2 OR 3

IF VERIFIED_PART=4 AND IF S3A=1 AND S3B<>1 AND S3C<>1, ENDUSE=2

IF VERIFIED_PART=4 AND IF S3B=1 AND S3A<>1 AND S3C<>1, ENDUSE=3

IF VERIFIED_PART=4 AND IF S3C=1 AND S3A<>1 AND S3B<>1, ENDUSE=1

IF VERIFIED_PART=4 AND IF S3A=1 AND S3B=1 AND S3C<>1, RANDOMLY ASSIGN
ENDUSE 2 OR 3

IF VERIFIED_PART=4 AND IF S3B=1 AND S3C=1 AND S3A <>1, RANDOMLY ASSIGN
ENDUSE 1 OR 3

IF VERIFIED_PART=4 AND IF S3C=1 AND S3A=1 AND S3B<>1, RANDOMLY ASSIGN
ENDUSE 1 OR 2

IF VERIFIED_PART=4 AND IF S3A=1 AND S3B=1 AND S3C=1, RANDOMLY ASSIGN
ENDUSE 1,2,3

GENERATE CONSTR

1=EXISTING

2=NEW

IF S7A ≥50%, CONSTR=2, ELSE CONSTR=1

NOTE: THE STRATIFICATION APPROACH DESCRIBED ON PAGE 1 WILL APPLY SUCH THAT THE DESIRED QUOTAS BY END-USE AND CONSTRUCTION TYPE ARE MET. THIS MEANS SOME CONTRACTORS WILLING TO PARTICIPATE IN THE STUDY MIGHT BE TERMINATED AS WE GET CLOSE TO COMPLETING THE SURVEYS.

S8B. Would you be able to tell us about your company's installations of <ENDUSE> equipment in the past TWO years?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF S8B=2,8,9]

S8a. Is there anyone else at your company who would be able to provide me with this information?

- 00. Yes [RECORD CONTACT INFORMATION - TERMINATE]
- 96. No [THANK AND TERMINATE]
- 98. (Don't know) [THANK AND TERMINATE]
- 99. (Refused) [THANK AND TERMINATE]

Thank you, you qualify for this study and \$100 check upon completion of this survey.

[ASK ALL]

Firmographics

The first question is about your company.

- F1. What is your job title?
- 01. (Owner/President)
 - 02. (Vice President)
 - 03. (Chief Executive Officer)
 - 04. (Office Manager)
 - 05. (Bookkeeper)
 - 06. (Branch Manager)
 - 07. (Director)
 - 08. (Project Manager)
 - 09. (Sales Executive)
 - 10. (Installation Manager)
 - 00. (Other, specify)
 - 98. (Don't know)
 - 99. (Refused)

Program Awareness and Participation

[ASK IF VERIFIED_PART=1 OR VERIFIED_PART=2 OR (VERIFIED_PART=4 OR 3 AND PA1=1)]

- PA4. How knowledgeable would you say you are about the GasNetworks High-Efficiency Heating and Water Heating program?
- 1. Very knowledgeable
 - 2. Somewhat knowledgeable
 - 3. Not very knowledgeable
 - 4. Not at all knowledgeable
 - 8. (Don't know)
 - 9. (Refused)

[ASK IF VERIFIED_PART=3 OR VERIFIED_PART=2 OR (VERIFIED_PART=4 OR 1 AND PA1A=1)]

PA5. How knowledgeable would you say you are about the Cool Smart program?

1. Very knowledgeable
2. Somewhat knowledgeable
3. Not very knowledgeable
4. Not at all knowledgeable
8. (Don't know)
9. (Refused)

[ASK IF (VERIFIED_PART=2 OR 3) OR (VERIFIED_PART=4 OR 1 AND PA1A=1)]

PA6. Did you receive any training on quality installation of heating and cooling equipment from the Cool Smart program?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[GENERATE READ INS FOR PA9:

(S8=1 OR S12=1) AND (S16=2 OR MISSING) AND (S18=2 OR MISSING) = HEATING

(S16=1 OR S18=1) AND (S8=2 OR MISSING) AND (S12=2 OR MISSING) = WATER HEATING

(S8=2 OR MISSING) AND (S16=2 OR MISSING) AND (S12=2 OR MISSING) AND (S18=2 OR MISSING) = HEATING AND WATER HEATING]

[READ IF S4=2]

For the rest of the survey, I would like you to focus on installations ONLY IN RESIDENTIAL <CONSTR> and the work that you do ONLY in Massachusetts.

[READ IF S4=1]

For the rest of the survey, I would like you to focus on installations ONLY IN RESIDENTIAL <CONSTR>

Market Characterization

[ASK IF ENDUSE=1, ELSE SKIP TO NEXT SECTION]

Cooling

[READ IF VERIFIED_PART=4] You mentioned earlier that your company is involved in the installations of cooling equipment.

MCC1. How many cooling systems of each of the following types has your company installed in the state of Massachusetts in the PAST TWO YEARS? We are interested in all systems regardless of efficiency rating. [NUMERIC OPEN END; 99998= DON'T KNOW; 99999=REFUSED] [IF NEEDED, THIS INFORMATION WILL REMAIN STRICTLY CONFIDENTIAL AND WILL BE USED FOR RESEARCH PURPOSES ONLY.]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

[PLACE ALL RESPONSES ON ONE SCREEN]

- a. Central air conditioners
- b. Heat pumps
- c. Ductless mini split HVAC units

[ASK IF ANY IN MCC1A>0 OR MCC1B>0 AND MCC1A AND MCC1B ARE NOT DK/REFUSED]

MCC2. Now, if you were to divide all of your company's installations of the CENTRAL AIR CONDITIONING AND HEAT PUMP systems in the past two years across the following SEER levels, what percent of the installations were..?

[PLACE ALL RESPONSES ON ONE SCREEN]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

[NOTE TO INTERVIEWER: PLEASE DO NOT INCLUDE DUCTLESS MINI SPLIT SYSTEMS. I WILL ASK YOU ABOUT THOSE SHORTLY]

- a. Lower than SEER 14.5 [0%-100%; 998=DK; 999=REF]
- b. SEER 14.5 and less than SEER 15 [0%-100%; 998=DK; 999=REF]
- c. SEER 15 and less than SEER 16 [0%-100%; 998=DK; 999=REF]
- d. SEER 16 or higher [0%-100%; 998=DK; 999=REF]

[ASK IF MCC2 DOES NOT SUM UP TO 100%]

QMCCCCHECK. The percentage breakdown you just provided by SEER level does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percents with you one more time. [GO BACK TO MCC2]

[ASK IF VERIFIED_PART<>4 AND ANY IN MCC2>0% AND NOT DK/REF]

MCC15. What percent of your company's CENTRAL AIR CONDITIONING AND HEAT PUMP system

installations of each of the following types IN THE PAST TWO YEARS received incentives through the Cool Smart Program?

[PLACE ALL RESPONSES ON ONE SCREEN]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- b. [ASK IF MCC2B>0% AND NOT DK/REF] SEER 14.5 and less than SEER 15 [0%-100%; 998=DK; 999=REF]
- c. [ASK IF MCC2C>0% AND NOT DK/REF] SEER 15 and less than SEER 16 [0%-100%; 998=DK; 999=REF]
- d. [ASK IF MCC2D>0% AND NOT DK/REF] SEER 16 or higher [0%-100%; 998=DK; 999=REF]

[ASK IF MCC1C>0 BUT NOT DK/REF]

MCC5. Now, if you were to divide all of your company's installations of the DUCTLESS MINI SPLIT HVAC systems in the past two years across the following SEER levels, what percent of the installations were..?

[PLACE ALL RESPONSES ON ONE SCREEN]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- a. Lower than SEER 14.5 [0%-100%; 998=DK; 999=REF]
- b. SEER 14.5 or higher [0%-100%; 998=DK; 999=REF]

[ASK IF MCC5 DOES NOT SUM UP TO 100%]

QMCCCCHECK2. The percentage breakdown you just provided by SEER level does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percents with you one more time. [GO BACK TO MCC5]

[ASK IF VERIFIED_PART<>4 AND MCC5B>0% AND NOT DK/REF]

MCC18. What percent of your company's DUCTLESS MINI SPLIT HVAC SYSTEM installations of SEER

14.5 OR HIGHER IN THE PAST TWO YEARS received incentives through the Cool Smart Program? [0%-100%; 998=DK; 999=REF]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

There is a variety of factors that might have influenced the installation of high efficiency cooling and heat pump systems in the past two years. I would like to read you some of those factors and ask you about the influence of each on your company's installations of SPECIFIC systems.

[READ IF VERIFIED_PART=2,3 AND ANY IN MCC15 OR MCC18>0 AND NOT DK/REF AND ANY IN MCC15<100% OR MCC18<100%]

You mentioned earlier that your company installed cooling and heat pump systems that received incentives through the Cool Smart Program. When answering the following questions, I would

like for you to ONLY FOCUS on the systems that DID NOT receive incentives through the program.

[ASK IF MCC2B>0% AND MCC2B IS NOT DK/REFUSED AND (MCC15B<100% OR (VERIFIED_PART=4 AND MCC15B=MISSING))]

MCC9.[READ IF VERIFIED_PART<>4] How much influence on your company’s installations of CENTRAL AIR CONDITIONING SYSTEMS AND HEAT PUMPS WITH SEER 14.5 TO LESS THAN SEER 15 THAT DID NOT RECEIVE INCENTIVES THROUGH THE COOL SMART PROGRAM did each of the following have... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[READ IF VERIFIED_PART=4] How much influence on your company’s installations of CENTRAL AIR CONDITIONING SYSTEMS AND HEAT PUMPS WITH SEER 14.5 TO LESS THAN SEER 15 did each of the following have... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[REPEAT THIS SENTENCE IF NEEDED] How much influence on the installations of CENTRAL AIR CONDITIONING SYSTEMS AND HEAT PUMPS WITH SEER 14.5 TO LESS THAN SEER 15 had (the)... [REPEAT SCALE IF NEEDED]

[RANDOMIZE]

- c. Distributors stocking more high efficiency equipment models
- f. Your company’s recommendations to customers
- g. [READ IF (VERIFIED_PART=4 AND PA1A=1) OR VERIFIED_PART=2 OR 3] Incentives offered through the Cool Smart Program
- h. [READ IF (VERIFIED_PART=4 AND PA1A=1) OR VERIFIED_PART=2 OR 3] Marketing, advertising, education and other support offered through the Cool Smart Program

[ASK IF MCC2B>0% AND MCC2B IS NOT DK/REFUSED AND (MCC15B<100% OR (VERIFIED_PART=4 AND MCC15B=MISSING))]

MCC10.Are there any other factors aside from those that I have just mentioned that were of influence? [OPEN END]

[ASK IF MCC2D>0% AND MCC2D IS NOT DK/REFUSED AND (MCC15D<100% OR (VERIFIED_PART=4 AND MCC15D=MISSING))]

MCC11.[READ IF VERIFIED_PART<>4] Now, please think about CENTRAL AIR CONDITIONING SYSTEMS AND HEAT PUMPS WITH SEER 16 AND HIGHER that your company installed in the past two years THAT DID NOT RECEIVE INCENTIVES THROUGH THE COOL SMART PROGRAM. How much influence on your company's installations of these systems did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[READ IF VERIFIED_PART=4] Now, please think about CENTRAL AIR CONDITIONING SYSTEMS AND HEAT PUMPS WITH SEER 16 AND HIGHER that your company installed in the past two years. How much influence on your company's installations of these systems did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[REPEAT THIS SENTENCE IF NEEDED] How much influence on the installations of CENTRAL AIR CONDITIONING SYSTEMS AND HEAT PUMPS WITH SEER 16 AND HIGHER had (the)... [REPEAT SCALE IF NEEDED]

[RANDOMIZE]

- c. Distributors stocking more high efficiency equipment models
- f. Your company's recommendations to customers
- g. [READ IF (VERIFIED_PART=4 AND PA1A=1) OR VERIFIED_PART=2 OR 3] Incentives offered through the Cool Smart Program
- h. [READ IF (VERIFIED_PART=4 AND PA1A=1) OR VERIFIED_PART=2 OR 3] Marketing, advertising, education and other support offered through the Cool Smart Program

[ASK IF MCC2D>0% AND MCC2D IS NOT DK/REFUSED AND (MCC15D<100% OR (VERIFIED_PART=4 AND MCC15D=MISSING))]

MCC12.Are there any other factors aside from those that I have just mentioned that were of influence? [OPEN END]

[ASK IF MCC5B>0% AND MCC5B IS NOT DK/REFUSED AND (MCC18<100% OR (VERIFIED_PART=4 AND MCC18=MISSING))]

MCC13.[READ IF VERIFIED_PART<>4] Now, please think about DUCTLESS MINI SPLIT HVAC SYSTEMS WITH SEER 14.5 AND HIGHER that your company installed in the past two years THAT DID NOT RECEIVE INCENTIVES THROUGH THE COOL SMART PROGRAM. How much influence on your company's installations of these systems did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[READ IF VERIFIED_PART=4] Now, please think about DUCTLESS MINI SPLIT HVAC SYSTEMS WITH SEER 14.5 AND HIGHER that your company installed in the past two years. How much influence on your company's installations of these systems did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[REPEAT THIS SENTENCE IF NEEDED] How much influence on the installations of DUCTLESS MINI SPLIT HVAC SYSTEMS WITH SEER 14.5 AND HIGHER had (the)... [REPEAT SCALE IF NEEDED]

[RANDOMIZE]

- c. Distributors stocking more high efficiency equipment models
- f. Your company's recommendations to customers
- g. [READ IF (VERIFIED_PART=4 AND PA1A=1) OR VERIFIED_PART=2 OR 3] Incentives offered through the Cool Smart Program
- h. [READ IF (VERIFIED_PART=4 AND PA1A=1) OR VERIFIED_PART=2 OR 3] Marketing, advertising, education and other support offered through the Cool Smart Program

[ASK IF MCC5B>0% AND MCC5B IS NOT DK/REFUSED AND (MCC18<100% OR (VERIFIED_PART=4 AND MCC18=MISSING))]

MCC14.Are there any other factors aside from those that I have just mentioned that were of influence? [OPEN END]

[READ IF PA5=1,2,3 AND (MCC1A>0 AND NOT DK/REF OR MCC1B>0 AND NOT DK/REF OR MCC1C>0 AND NOT DK/REF)]

I would like to learn about the influence the Cool Smart program had on the installation of the cooling and heat pump systems in the PAST TWO YEARS.

[READ IF PA5=1,2,3 AND (MCC1A>0 AND NOT DK/REFUSED OR MCC1B>0 AND MCC1B IS NOT DK/REFUSED)]

Please think about ALL CENTRAL AIR CONDITIONING AND HEAT PUMP systems that your company installed in the past two years.

[ASK IF PA5=1,2,3 AND (MCC1A>0 AND MCC1A IS NOT DK/REFUSED OR MCC1B>0 AND MCC1B IS NOT DK/REFUSED)]

MCC24. Using a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence, please rate how much influence has the Cool Smart program had on how frequently you recommended central air conditioning and heat pump systems with SEER 14.5 or higher to your customers in the past two years?

[ASK IF PA5=1,2,3 AND (MCC1A>0 AND MCC1A IS NOT DK/REFUSED OR MCC1B>0 AND MCC1B IS NOT DK/REFUSED)]

MCC21. You mentioned earlier that your company installed [READ IN SUM MCC1A AND MCC1B]

central air conditioning and heat pump systems in the past two years. If the Cool Smart program incentives, marketing and support had not existed, how many systems do you think your company would have installed? [NUMERIC OPEN END]

[ASK IF PA5=1,2,3 AND (MCC1A>0 AND MCC1A IS NOT DK/REFUSED OR MCC1B>0 AND MCC1B IS NOT DK/REFUSED) AND MCC21 IS NOT DK/REF AND NOT 0]

MCC20. What would the percentage breakdown of these [READ IN RESPONSE FROM MCC21]

CENTRAL AIR CONDITIONING AND HEAT PUMP systems look like in the past two years across the following efficiency levels if the Cool Smart program incentives, marketing and support had not existed?

[PLACE ALL RESPONSES ON ONE SCREEN]

[INTERVIEWER – RESPONSES SHOULD ADD TO 100%]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

[READ IF NEEDED: WHAT PERCENT OF YOUR COMPANY'S INSTALLATIONS WOULD HAVE BEEN <READ RESPONSE> IF THE PROGRAM HAD NOT BEEN AVAILABLE?]

- a. Lower than SEER 14.5 [0%-100%; 998=DK; 999=REF]
- b. SEER 14.5 and less than SEER 15 [0%-100%; 998=DK; 999=REF]
- c. SEER 15 and less than SEER 16 [0%-100%; 998=DK; 999=REF]
- d. SEER 16 or higher [0%-100%; 998=DK; 999=REF]

[ASK IF MCC20 DOES NOT SUM UP TO 100%]

QMCCCCHECK3. The percentage breakdown you just provided by SEER level does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percents with you one more time. [GO BACK TO MCC20]

[READ IF PA5=1,2,3 AND MCC1C>0 AND MCC1C DK/REFUSED]

Please think about DUCTLESS MINI SPLIT HVAC systems that your company installed in the past two years.

[ASK IF PA5=1,2,3 AND MCC1C>0 AND MCC1C NOT DK/REFUSED]

MCC25. Using a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence, please rate how much influence have the Cool Smart program had on how frequently you recommended ductless mini split HVAC systems with SEER 14.5 or higher to your customers in the past two years?

[ASK IF PA5=1,2,3 AND MCC1C>0 AND MCC1C IS NOT DK/REFUSED]

MCC23. You mentioned earlier that your company installed [READ IN MCC1C] ductless mini split

HVAC systems in the past two years. If the Cool Smart program incentives, marketing and support had not existed, how many systems do you think your company would have installed? [NUMERIC OPEN END]

[ASK IF PA5=1,2,3 AND MCC1C>0 AND MCC1C NOT DK/REFUSED MCC23 NOT DK/REF AND NOT 0]

MCC22. What would the percentage breakdown of these [READ IN RESPONSE FROM MCC23]

DUCTLESS MINI SPLIT HVAC systems look like in the past two years across the following efficiency levels if the Cool Smart program incentives, marketing and support had not existed?

[PLACE ALL RESPONSES ON ONE SCREEN]

[INTERVIEWER – RESPONSES SHOULD ADD TO 100%]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

[READ IF NEEDED: WHAT PERCENT OF YOUR COMPANY’S INSTALLATIONS WOULD HAVE BEEN <READ RESPONSE> IF THE PROGRAM HAD NOT BEEN AVAILABLE?]

a. Lower than SEER 14.5 [0%-100%; 998=DK; 999=REF]

b. SEER 14.5 or higher [0%-100%; 998=DK; 999=REF]

[ASK IF MCC22 DOES NOT SUM UP TO 100%]

QMCCCCHECK4. The percentage breakdown you just provided by SEER level does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percents with you one more time. [GO BACK TO MCC22]

Gas Heating

[ASK IF ENDUSE=2, ELSE SKIP TO NEXT SECTION]

[READ IF VERIFIED_PART=4] You mentioned earlier that your company is involved in the installations of heating equipment.

MCH1. I would like to learn about the installations of the gas heating equipment. How many gas heating systems of each of the following types did your company install in Massachusetts in the PAST TWO YEARS? We are interested in all systems, not just energy efficient systems. Please DO NOT include integrated heating and water heating systems. [NUMERIC OPEN END; 99998=DON'T KNOW; 99999=REFUSED] [IF NEEDED, THIS INFORMATION WILL REMAIN STRICTLY CONFIDENTIAL AND WILL BE USED FOR RESEARCH PURPOSES ONLY.]
[PLACE ALL RESPONSES ON ONE SCREEN]
[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- a. Natural gas furnaces
- b. Natural gas boilers

[ASK IF MCH1A>0 AND MCH1A IS NOT DK/REFUSED]

MCH2. Now, if you were to divide all of your company's installations of the NATURAL GAS FURNACES in the past two years across the following AFUE levels, what percent of your installations were..?
[PLACE ALL RESPONSES ON ONE SCREEN]
[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- a. Furnaces with AFUE below 92% [0%-100%; 998=DK; 999=REF]
- b. Furnaces with AFUE of 92% and less than AFUE 95% [0%-100%; 998=DK; 999=REF]
- c. Furnaces with AFUE of 95% or greater [0%-100%; 998=DK; 999=REF]

[ASK IF MCH2 DOES NOT SUM UP TO 100%]

QMCCCCHECK5. The percentage breakdown you just provided by AFUE level does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percents with you one more time. [GO BACK TO MCH2]

[ASK IF VERIFIED_PART<>4 AND MCH2C>0% AND NOT DK/REF]

MCH16. What percentage of your company's NATURAL GAS FURNACE installations with AFUE of 95% or greater IN THE PAST TWO YEARS received incentives through the GasNetworks High-Efficiency Heating and Water Heating program?
[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

[ASK IF MCH2A>0]

MCH3a. Of the furnaces with AFUE below 92%, what percent had conditions that made installing a condensing system either impossible or prohibitively expensive to install? [IF NEEDED: MORE THAN \$5,000 IN EXTRA COSTS]

[ASK IF MCH1B>0 AND MCH1B IS NOT DK/REFUSED]

MCH5. Now, if you were to divide all of your company's installations of the NATURAL GAS BOILERS in the past two years across the following AFUE levels, what percent of your installations were..?

[PLACE ALL RESPONSES ON ONE SCREEN]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- a. Boilers with AFUE below 90% [NUMERIC OPEN END; 998=DK; 999=REF]
- b. Boilers with AFUE 90% and less than AFUE 96% [NUMERIC OPEN END; 998=DK; 999=REF]
- c. Boilers with AFUE of 96% or greater [NUMERIC OPEN END; 998=DK; 999=REF]

[ASK IF MCH5 DOES NOT SUM UP TO 100%]

QMCCCCHECK6. The percentage breakdown you just provided by AFUE level does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percents with you one more time. [GO BACK TO MCH5]

[ASK IF VERIFIED_PART<>4 AND ANY IN MCH5B OR MCH5C>0% AND NOT DK/REF]

MCH18. What percent of your company's NATURAL GAS BOILER installations of each of the following types IN THE PAST TWO YEARS received incentives through the GasNetworks High-Efficiency Heating and Water Heating program?

[PLACE ALL RESPONSES ON ONE SCREEN]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- b. [ASK IF MCH5B>0% AND NOT DK/REF] Boilers with AFUE 90% and less than AFUE 96% [0%-100%; 998=DK; 999=REF]
- c. [ASK IF MCH5C>0% AND NOT DK/REF] Boilers with AFUE of 96% or greater [0%-100%; 998=DK; 999=REF]

There is a variety of factors that might have influenced the installation of high efficiency gas heating systems in the past two years. I would like to read you some of those factors and ask you about the influence of each on your company's installations of SPECIFIC GAS HEATING systems.

[READ IF VERIFIED_PART=1,2 AND ANY IN MCH16 OR MCH18>0 AND NOT DK/REF AND MCH16<100% OR ANY IN MCH18<100%]

You mentioned earlier that your company installed natural gas heating systems that received incentives through the GasNetworks High Efficiency Heating and Water Heating program. When answering the following questions, I would like for you to ONLY FOCUS on the systems that DID NOT receive incentives through the program.

[ASK IF MCH2C>0% MCH2C IS NOT DK/REFUSED AND (MCH16<100% OR (VERIFIED_PART=4 AND MCH16=MISSING))]

MCH9. [READ IF VERIFIED_PART<>4] Now, please think about NATURAL GAS FURNACES with AFUE of 95% or greater that your company installed in the past two years THAT DID NOT RECEIVE incentives through the GasNetworks High Efficiency Heating and Water Heating program. How much influence on your company's installations of these NATURAL GAS FURNACES did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[READ IF VERIFIED_PART=4] Now, please think about NATURAL GAS FURNACES with AFUE of 95% or greater that your company installed in the past two years. How much influence on your company's installations of these NATURAL GAS FURNACES did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[REPEAT THIS SENTENCE IF NEEDED] How much influence on the installations of NATURAL GAS FURNACES with AFUE of 95% or greater had (the)... [REPEAT SCALE IF NEEDED]

[RANDOMIZE]

- c. Distributors stocking more high efficiency equipment models
- f. Your company's recommendations to customers
- g. [READ IF (VERIFIED_PART=4 AND PA1=1) OR VERIFIED_PART=1 OR 2] Incentives offered through the GasNetworks High-Efficiency Heating and Water Heating program
- h. [READ IF (VERIFIED_PART=4 AND PA1=1) OR VERIFIED_PART=1 OR 2] Marketing, advertising, education and other support offered through the GasNetworks High-Efficiency Heating and Water Heating program

[ASK IF MCH2C>0% MCH2C IS NOT DK/REFUSED AND (MCH16<100% OR (VERIFIED_PART=4 AND MCH16=MISSING))]

MCH10. Are there any other factors aside from those that I have just mentioned that were of influence? [OPEN END]

[ASK IF MCH5B>0% AND MCH5B IS NOT DK/REFUSED AND (MCH18B<100% OR (VERIFIED_PART=4 AND MCH18B=MISSING))]

MCH11. [READ IF VERIFIED_PART<4] Now, please think about NATURAL GAS

BOILERS with AFUE 90% and less than AFUE 96% that your company installed in the past two years THAT DID NOT RECEIVE incentives through the GasNetworks High Efficiency Heating and Water Heating program. How much influence on your company's installations of these NATURAL GAS BOILERS did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence

[READ IF VERIFIED_PART=4] Now, please think about NATURAL GAS BOILERS with AFUE 90% and less than AFUE 96% that your company installed in the past two years. How much influence on your company's installations of these NATURAL GAS BOILERS did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[REPEAT THIS SENTENCE IF NEEDED] How much influence on the installations of NATURAL GAS BOILERS with AFUE 90% and less than AFUE 96% had (the)...

[REPEAT SCALE IF NEEDED]

[RANDOMIZE]

- c. Distributors stocking more high efficiency equipment models
- f. Your company's recommendations to customers
- g. [READ IF (VERIFIED_PART=4 AND PA1=1) OR VERIFIED_PART=1 OR 2] Incentives offered through the GasNetworks High-Efficiency Heating and Water Heating program
- h. [READ IF (VERIFIED_PART=4 AND PA1=1) OR VERIFIED_PART=1 OR 2] Marketing, advertising, education and other support offered through the GasNetworks High-Efficiency Heating and Water Heating program

[ASK IF MCH5B>0% AND MCH5B IS NOT DK/REFUSED AND (MCH18B<100% OR (VERIFIED_PART=4 AND MCH18B=MISSING))]

MCH13. Are there any other factors aside from those that I have just mentioned that were of influence? [OPEN END]

[ASK IF MCH5C>0% AND MCH5C IS NOT DK/REFUSED AND (MCH18C<100% OR (VERIFIED_PART=4 AND MCH18C=MISSING))]

MCH14. [READ IF VERIFIED_PART<4] Now, please think about NATURAL GAS

BOILERS with AFUE of 96% or greater that your company installed in the past two years THAT DID NOT RECEIVE incentives through the GasNetworks High Efficiency Heating and Water Heating program. How much influence on your company's installations of these NATURAL GAS BOILERS did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[READ IF VERIFIED_PART=4] Now, please think about NATURAL GAS BOILERS with AFUE of 96% or greater that your company installed in the past two years. How much influence on your company's installations of these NATURAL GAS BOILERS did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[REPEAT THIS SENTENCE IF NEEDED] How much influence on the installations of NATURAL GAS BOILERS with AFUE of 96% or greater had (the)... [REPEAT SCALE IF NEEDED]

[RANDOMIZE]

- c. Distributors stocking more high efficiency equipment models
- f. Your company's recommendations to customers
- g. [READ IF (VERIFIED_PART=4 AND PA1=1) OR VERIFIED_PART=1 OR 2] Incentives offered through the GasNetworks High-Efficiency Heating and Water Heating program
- h. [READ IF (VERIFIED_PART=4 AND PA1=1) OR VERIFIED_PART=1 OR 2] Marketing, advertising, education and other support offered through the GasNetworks High-Efficiency Heating and Water Heating program

[ASK IF MCH5C>0% AND MCH5C IS NOT DK/REFUSED AND (MCH18C<100% OR (VERIFIED_PART=4 AND MCH18C=MISSING))]

MCH15. Are there any other factors aside from those that I have just mentioned that were of influence? [OPEN END]

[READ IF PA4=1,2,3 AND (MCH1A>0 AND NOT DK/REF OR MCH1B>0 AND NOT DK/REF)]

I would like to learn about the influence the GasNetworks High Efficiency Heating and Water Heating program had on the installation of the gas heating systems in the PAST TWO YEARS.

[READ IF PA4=1,2,3 AND MCH1A>0 AND MCH1A NOT DK/REF]

Please think about all NATURAL GAS FURNACES that your company installed in the past two years.

[ASK IF PA4=1,2,3 AND MCH1A>0 AND MCH1A IS NOT DK/REFUSED]

MCH24. Using a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence, please rate how much influence have the GasNetworks High Efficiency Heating and Water Heating program had on how frequently you recommended natural gas furnaces with AFUE of 95% or higher to your customers in the past two years?

[ASK IF PA4=1, 2,3 AND MCH1A>0 AND MCH1A IS NOT DK/REFUSED]

MCH21. You mentioned earlier that your company installed [READ IN MCH1A] NATURAL GAS

FURNACES in the past two years. If the GasNetworks High Efficiency Heating and Water Heating program incentives, marketing and support had not existed, how many systems do you think your company would have installed? [NUMERIC OPEN END]

[ASK IF PA4=1,2,3 AND MCH1A>0 AND MCH1A NOT DK/REFUSED AND MCH21 IS NOT DK/REF AND NOT 0]

MCH20. What would the percentage breakdown of these [READ IN RESPONSE FROM MCH21]

NATURAL GAS FURNACES look like in the past two years across the following efficiency levels if the GasNetworks High Efficiency Heating and Water Heating program incentives, marketing and support had not existed?

[PLACE ALL RESPONSES ON ONE SCREEN]

[INTERVIEWER – RESPONSES SHOULD ADD TO 100%]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

[READ IF NEEDED: WHAT PERCENT OF YOUR COMPANY’S INSTALLATIONS WOULD HAVE BEEN <READ RESPONSE> IF THE PROGRAM HAD NOT BEEN AVAILABLE?]

- a. Furnaces with AFUE below 92% [0%-100%; 998=DK; 999=REF]
- b. Furnaces with AFUE of 92% and less than AFUE 95% [0%-100%; 998=DK; 999=REF]
- c. Furnaces with AFUE of 95% or greater [0%-100%; 998=DK; 999=REF]

[ASK IF MCH20 DOES NOT SUM UP TO 100%]

QMCCCCHECK7. The percentage breakdown you just provided by AFUE level does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percents with you one more time. [GO BACK TO MCH20]

[READ IF PA4=1,2,3 MCH1B>0 AND MCH1B IS NOT DK/REFUSED]

Please think about NATURAL GAS BOILERS that your company installed in the past two years.

[ASK IF PA4=1,2,3 AND MCH1B>0 AND MCH1B IS NOT DK/REFUSED]

MCH25. Using a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence, please rate how much influence have the GasNetworks High Efficiency Heating and Water Heating program had on how frequently you recommended natural gas boilers with AFUE of 90% or higher to your customers in the past two years?

[ASK IF PA4=1,2,3 AND MCH1B>0 AND MCH1B IS NOT DK/REFUSED]

MCH23. You mentioned earlier that your company installed [READ IN MCH1B] natural gas NATURAL

GAS BOILERS in the past two years. If the GasNetworks High Efficiency Heating and Water Heating program incentives, marketing and support had not existed, how many systems do you think your company would have installed? [NUMERIC OPEN END]

[ASK IF PA4=1,2,3 AND MCH1B>0 AND MCH1B NOT DK/REFUSED AND MCH23 IS NOT DK/REF AND <0]

MCH22. What would the percentage breakdown of these [READ IN RESPONSE FROM MCH23]

NATURAL GAS BOILERS look like in the past two years across the following efficiency levels if the GasNetworks High Efficiency Heating and Water Heating program incentives, marketing and support had not existed?

[PLACE ALL RESPONSES ON ONE SCREEN]

[INTERVIEWER – RESPONSES SHOULD ADD TO 100%]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

[READ IF NEEDED: WHAT PERCENT OF YOUR COMPANY’S INSTALLATIONS WOULD HAVE BEEN <READ RESPONSE> IF THE PROGRAM HAD NOT BEEN AVAILABLE?]

- a. Boilers with AFUE below 90% [NUMERIC OPEN END; 99998=DK; 99999=REF]
- b. Boilers with AFUE 90% and less than AFUE 96% [NUMERIC OPEN END; 99998=DK; 99999=REF]
- c. Boilers with AFUE of 96% or greater [NUMERIC OPEN END; 99998=DK; 99999=REF]

[ASK IF MCH22 DOES NOT SUM UP TO 100%]

QMCCCCHECK8. The percentage breakdown you just provided by AFUE level does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percents with you one more time. [GO BACK TO MCH22]

[ASK IF ENDUSE=3, ELSE SKIP TO NEXT SECTION]

Gas Water Heating

[READ IF VERIFIED_PART=4] You mentioned earlier that your company is involved in the installations of water heating equipment.

MCW1. I would like to learn about the installations of the water heating equipment. How many water heating systems of each of the following kind did your company install in Massachusetts in the PAST TWO YEARS? We are interested in all systems, not just energy efficient systems. Please DO NOT include the installations of integrated heating and water heating systems. [NUMERIC OPEN END; 99998=DON'T KNOW; 99999=REFUSED] [IF NEEDED, THIS INFORMATION WILL REMAIN STRICTLY CONFIDENTIAL AND WILL BE USED FOR RESEARCH PURPOSES ONLY.] [PLACE ALL RESPONSES ON ONE SCREEN] [PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- a. Storage water heaters
- b. Tankless water heaters

[ASK IF MCW1A>0 AND MCW1A IS NOT DK/REFUSED]

MCW2. Now, if you were to divide all of your company's installations of STORAGE water heaters in the past two years across the following energy efficiency levels, what percent of your installations were..?

[PLACE ALL RESPONSES ON ONE SCREEN]
[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- a. Storage water heaters with Energy Factor of less than 0.67 [0%-100%; 998=DK; 999=REF]
- b. ENERGY STAR storage water heaters with Energy Factor of 0.67 and higher [0%-100%; 998=DK; 999=REF]

[ASK IF MCW2 DOES NOT SUM UP TO 100%]

QMCCCCHECK9. The percentage breakdown you just provided by Energy Factor level does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percents with you one more time. [GO BACK TO MCW2]

[ASK IF VERIFIED_PART<>4 AND MCW2B>0% AND NOT DK/REF]

MCW15. What percent of your company's ENERGY STAR storage water heaters with Energy Factor of

0.67 and higher IN THE PAST TWO YEARS received incentives through the GasNetworks High-Efficiency Heating and Water Heating program? [0%-100%; 998=DK; 999=REF] [PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

[ASK IF MCW1B>0 AND MCW1B IS NOT DK/REFUSED]

MCW10. Now, if you were to divide all of your company's installations of TANKLESS water heaters in the past two years across the following energy efficiency levels, what percent of your installations were..?

[PLACE ALL RESPONSES ON ONE SCREEN]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- a. Tankless water heaters with Energy Factor of less than or equal to 0.94 [0%-100%; 998=DK; 999=REF]
- b. Tankless water heaters with Energy Factor of 0.95 and higher [0%-100%; 998=DK; 999=REF]

[ASK IF MCW10 DOES NOT SUM UP TO 100%]

QMCCCCHECK10. The percentage breakdown you just provided by Energy Factor level does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percents with you one more time. [GO BACK TO MCW10]

[ASK IF VERIFIED_PART<>4 AND ANY IN MCW10A OR MCW10B>0% AND NOT DK/REF]

MCW17. What percent of your company's TANKLESS water heater installations of each of the following types IN THE PAST TWO YEARS received incentives through the GasNetworks High-Efficiency Heating and Water Heating program?

[PLACE ALL RESPONSES ON ONE SCREEN]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- a. [ASK IF MCW10A>0 AND NOT DK/REF] Tankless water heaters with Energy Factor of less than or equal to 0.94 [0%-100%; 998=DK; 999=REF]
- b. [ASK IF MCW10B>0 AND NOT DK/REF] Tankless water heater with Energy Factor of 0.95 and higher [0%-100%; 998=DK; 999=REF]

There is a variety of factors that might have influenced the installation of high efficiency water heating systems in the past two years. I would like to read you some of those factors and ask you about the influence of each on your company's installations of SPECIFIC WATER HEATING systems.

[READ IF VERIFIED_PART=1,2 AND ANY IN MCW15 OR MCH17>0 AND NOT DK/REF AND MCW15<100% OR ANY IN MCW17<100%]

You mentioned earlier that your company installed natural gas water heating systems that received incentives through the GasNetworks High Efficiency Heating and Water Heating program. When answering the following questions, I would like for you to ONLY FOCUS on the systems that DID NOT receive incentives through the program.

[ASK IF MCW2B>0% AND MCW2B IS NOT DK/REFUSED AND (MCW15<100% OR (VERIFIED_PART=4 AND MC15=MISSING))]

MCW6. [READ IF VERIFIED_PART<>4] Please think about ENERGY STAR STORAGE WATER HEATERS WITH ENERGY FACTOR OF 0.67 AND HIGHER that that your company installed in the past two years THAT DID NOT RECEIVE incentives through the GasNetworks High Efficiency Heating and Water Heating program. How much influence on your company’s installations of these storage water heaters did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[READ IF VERIFIED_PART=4] Please think about ENERGY STAR STORAGE WATER HEATERS WITH ENERGY FACTOR OF 0.67 AND HIGHER that that your company installed in the past two years. How much influence on your company’s installations of these storage water heaters did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[REPEAT THIS SENTENCE IF NEEDED] How much influence on the installations of ENERGY STAR STORAGE WATER HEATERS WITH ENERGY FACTOR OF 0.67 AND HIGHER had (the)... [REPEAT SCALE IF NEEDED]

[RANDOMIZE]

- c. Distributors stocking more high efficiency equipment models
- f. Your company’s recommendations to customers
- g. [READ IF (VERIFIED_PART=4 AND PA1=1) OR VERIFIED_PART=1 OR 2] Incentives offered through the GasNetworks High-Efficiency Heating and Water Heating program
- h. [READ IF (VERIFIED_PART=4 AND PA1=1) OR VERIFIED_PART=1 OR 2] Marketing, advertising, education and other support offered through the GasNetworks High-Efficiency Heating and Water Heating program

[ASK IF MCW2B>0% AND MCW2B IS NOT DK/REFUSED AND (MCW15<100% OR (VERIFIED_PART=4 AND MC15=MISSING))]

MCW7. Are there any other factors aside from those that I have just mentioned that were of influence? [OPEN END]

[ASK IF MCW10A>0% AND MCW10A IS NOT DK/REFUSED AND (MCW17A<100% OR (VERIFIED_PART=4 AND MC17A=MISSING))]

MCW8. [READ IF VERIFIED_PART<>4] Now, please think about TANKLESS WATER HEATERS with Energy Factor of less than or equal to 0.94 that your company installed in the past two years THAT DID NOT RECEIVE incentives through the GasNetworks High Efficiency Heating and Water Heating program. How much influence on your company's installations of these tankless water heaters did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[READ IF VERIFIED_PART=4] Now, please think about TANKLESS WATER HEATERS with Energy Factor of less than or equal to 0.94 that your company installed in the past two years. How much influence on your company's installations of these tankless water heaters did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[REPEAT THIS SENTENCE IF NEEDED] How much influence on the installations of TANKLESS WATER HEATERS WITH ENERGY FACTOR OF LESS THAN OR EQUAL TO 0.94 had (the)... [REPEAT SCALE IF NEEDED]

[RANDOMIZE]

- c. Distributors stocking more of high efficiency equipment models
- f. Your company's recommendations to customers
- g. [READ IF (VERIFIED_PART=4 AND PA1=1) OR VERIFIED_PART=1 OR 2] Incentives offered through the GasNetworks High-Efficiency Heating and Water Heating program
- h. [READ IF (VERIFIED_PART=4 AND PA1=1) OR VERIFIED_PART=1 OR 2] Marketing, advertising, education and other support offered through the GasNetworks High-Efficiency Heating and Water Heating program

[ASK IF MCW10A>0% AND MCW10A IS NOT DK/REFUSED AND (MCW17A<100% OR (VERIFIED_PART=4 AND MC17A=MISSING))]

MCW9. Are there any other factors aside from those that I have just mentioned that were of influence? [OPEN END]

[ASK IF MCW10B>0% AND MCW10B IS NOT DK/REFUSED AND (MCW17B<100% OR (VERIFIED_PART=4 AND MC17B=MISSING))]

MCW13. [READ IF VERIFIED_PART<>4] Now, please think about TANKLESS WATER HEATERS WITH ENERGY FACTOR OF 0.95 AND HIGHER that that your company installed in the past two years THAT DID NOT RECEIVE incentives through the GasNetworks High Efficiency Heating and Water Heating program. How much influence on your company's installations of these tankless water heaters did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[READ IF VERIFIED_PART=4] Now, please think about TANKLESS WATER HEATERS WITH ENERGY FACTOR OF 0.95 AND HIGHER that that your company installed in the past two years. How much influence on your company's installations of these tankless water heaters did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[REPEAT THIS SENTENCE IF NEEDED] How much influence on the installations of TANKLESS WATER HEATERS WITH ENERGY FACTOR OF 0.95 AND HIGHER had (the)... [REPEAT SCALE IF NEEDED]

[RANDOMIZE]

- c. Distributors stocking more high efficiency equipment models
- f. Your company's recommendations to customers
- g. [READ IF (VERIFIED_PART=4 AND PA1=1) OR VERIFIED_PART=1 OR 2] Incentives offered through the GasNetworks High-Efficiency Heating and Water Heating program
- h. [READ IF (VERIFIED_PART=4 AND PA1=1) OR VERIFIED_PART=1 OR 2] Marketing, advertising, education and other support offered through the GasNetworks High-Efficiency Heating and Water Heating program

[ASK IF MCW10B>0% AND MCW10B IS NOT DK/REFUSED AND (MCW17B<100% OR (VERIFIED_PART=4 AND MC17B=MISSING))]

MCW14. Are there any other factors aside from those that I have just mentioned that were of influence? [OPEN END]

[READ IF PA4=1,2,3 AND (MCW1A>0 AND NOT DK/REF OR MCW1B>0 AND NOT DK/REF)]

I would like to learn about the influence those programs had on the installation of the gas water heating systems in the PAST TWO YEARS.

[ASK IF PA4=1,2,3 AND MCW1A>0 AND MCW1A IS NOT DK/REFUSED AND]

MCW24. Using a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence, please

rate how much influence have GasNetworks High Efficiency Heating and Water Heating program had on how frequently you recommended STORAGE GAS WATER HEATERS with energy factor of 0.67 or higher to your customers in the past two years?

[ASK IF PA4=1,2,3 AND MCW1B>0 AND MCW1B IS NOT DK/REFUSED]

MCW25. Using a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence, please

rate how much influence have GasNetworks High Efficiency Heating and Water Heating program had on how frequently you recommended TANKLESS GAS WATER HEATERS to your customers in the past two years?

[ASK IF PA4=1,2,3 AND ((MCW1A>0 AND NOT DK/REF) OR (MCW1B>0 AND NOT DK/REF))]

MCW21. You mentioned earlier that your company installed [READ IN SUM MCW1] natural gas water

heaters in the past two years. If the GasNetworks High Efficiency Heating and Water Heating program incentives, marketing and support had not existed, how many systems, either storage or tankless, do you think your company would have installed? [NUMERIC OPEN END]

[ASK IF PA4=1,2,3 AND (MCW1A>0 AND NOT DK/REF OR MCW1B>0 AND NOT DK/REF) AND MCW21 NOT DK/REF AND NOT 0]

MCW20. What would the percentage breakdown of these [READ IN MCW21] GAS WATER HEATERS

look like in the past two years across the following systems and efficiency levels if the GasNetworks High Efficiency Heating and Water Heating program incentives, marketing and support had not existed?

[PLACE ALL RESPONSES ON ONE SCREEN]

[INTERVIEWER – RESPONSES SHOULD ADD TO 100%]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

[READ IF NEEDED: WHAT PERCENT OF YOUR COMPANY’S INSTALLATIONS WOULD HAVE BEEN <READ RESPONSE> IF THE PROGRAM HAD NOT BEEN AVAILABLE?]

- a. Storage water heaters with Energy Factor of less than 0.67 [0%-100%; 998=DK; 999=REF]
- b. Storage water heaters with Energy Factor of 0.67 and higher [0%-100%; 998=DK; 999=REF]
- c. Tankless water heaters with Energy Factor of less than or equal to 0.94 [0%-100%; 998=DK; 999=REF]
- d. Tankless water heater with Energy Factor of 0.95 and higher [0%-100%; 998=DK; 999=REF]

[ASK IF MCW20 DOES NOT SUM UP TO 100%]

QMCCCCHECK11. The percentage breakdown you just provided by Energy Factor level does not

equal 100%. To make sure we have the most accurate information, let me go back and go over the percents with you one more time. [GO BACK TO MCW20]

Integrated Heating and Water Heating Systems

[ASK IF ENDUSE=2 OR 3, ELSE SKIP TO NEXT SECTION]

MCI1. In the past two years, did your company install any standalone integrated heating and water heating systems?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF MCI1=1 ELSE SKIP TO IP1]

MCI2. How many standalone integrated heating and water heating systems did your company sell or install in the past two years? [NUMERIC OPEN END; 99998= DON'T KNOW; 99999=REFUSED] [IF NEEDED, THIS INFORMATION WILL REMAIN STRICTLY CONFIDENTIAL AND WILL BE USED FOR RESEARCH PURPOSES ONLY.] [PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

[ASK IF MCI2>0 AND MCI2 IS NOT DK/REFUSED]

MCI3. If you were to divide all of your company's installations of standalone integrated heating and water heating systems in the past two years across the following efficiency levels, what percent of installations of integrated heating and water heating systems were..?

[PLACE ALL RESPONSES ON ONE SCREEN]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- a. Standalone integrated heating and water heating systems without a condensing boiler [0%-100%; 998=DK; 999=REF]
- b. Standalone integrated heating and water heating systems with a condensing boiler [0%-100%; 998=DK; 999=REF]

[ASK IF MCI3 DOES NOT SUM UP TO 100%]

QMCCCCHECK12. The percentage breakdown you just provided does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percents with you one more time. [GO BACK TO MCI3]

[ASK IF VERIFIED_PART<>4 AND MCI3B>0% AND NOT DK/REF]

MCI8. What percent of your company's installations of STANDALONE INTEGRATED HEATING AND WATER HEATING systems with a condensing boiler IN THE PAST TWO YEARS received incentives through the GasNetworks High-Efficiency Heating and Water Heating program?

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

There is a variety of factors that might have influenced the installation of standalone integrated heating and water heating systems in the past two years. I would like to read you some of those factors and ask you about the influence of each on your company's installations of STANDALONE INTEGRATED HEATING AND WATER HEATING SYSTEMS WITH A CONDENSING BOILER.

[READ IF VERIFIED_PART=2,3 AND MCI8>0% AND <100%]

You mentioned earlier that your company installed natural gas water heating systems that received incentives through the GasNetworks High Efficiency Heating and Water Heating program. When answering the following questions, I would like for you to ONLY FOCUS on the systems that DID NOT receive incentives through the program.

[ASK IF MCI3B>0% AND MCI3B IS NOT DK/REFUSED AND (MCI8<100% OR (VERIFIED_PART=4 AND MCI8=MISSING))]

MCI6. [READ IF VERIFIED_PART<>4] How much influence on your company's installations of the integrated systems THAT DID NOT receive incentives through the GasNetworks High Efficiency Heating and Water Heating program in the past two years did each of the following have... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[READ IF VERIFIED_PART=4]How much influence on your company's installations of these integrated systems in the past two years did each of the following have ... When answering, please use a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence.

[REPEAT THIS SENTENCE IF NEEDED] How much influence on the installations of STANDALONE INTEGRATED HEATING AND WATER HEATING SYSTEMS WITH A CONDENSING BOILER had..? [REPEAT SCALE IF NEEDED]

[RANDOMIZE]

- c. Distributors stocking more of high efficiency equipment models
- f. Your company's recommendations to customers
- g. [READ IF (VERIFIED_PART=4 AND PA1=1) OR VERIFIED_PART=1 OR 2] Incentives offered through the GasNetworks High-Efficiency Heating and Water Heating program
- h. [READ IF (VERIFIED_PART=4 AND PA1=1) OR VERIFIED_PART=1 OR 2] Marketing, advertising, education and other support offered through the GasNetworks High-Efficiency Heating and Water Heating program

[ASK IF MCI3B>0% AND MCI3B IS NOT DK/REFUSED AND (MCI8<100% OR (VERIFIED_PART=4 AND MCI8=MISSING))]

MCI7. Are there any other factors aside from those that I have just mentioned that were of influence? [OPEN END]

[READ IF PA4=1,2,3 AND MCI2>0 AND NOT DK/REFUSED]

I would like to learn about the influence the GasNetworks High Efficiency Heating and Water Heating program had on the installation of the standalone integrated heating and water heating systems in the PAST TWO YEARS.

[ASK IF PA4=1,2,3 AND MCI2>0 AND NOT DK/REF]

MCI22. Using a scale of 1 to 5, where 1 is no influence and 5 is a great deal of influence, please rate how much influence have the GasNetworks High Efficiency Heating and Water Heating program had on how frequently you recommended standalone integrated heating and water heating systems WITH A CONDENSING BOILER to your customers in the past two years?

[ASK IF PA4=1, 2,3 AND MCI2>0 AND NOT DK/REF]

MCI21. You mentioned earlier that your company installed [READ IN MCI2] standalone integrated

heating and water heating systems in the past two years. If the GasNetworks High Efficiency Heating and Water Heating program incentives, marketing and support had not existed, how many systems do you think your company would have installed?

[NUMERIC OPEN END]

[ASK IF PA4=1,2,3 AND MCI2>0 AND MCI2 IS NOT DK/REFUSED AND MCI21 NOT DK/REF AND NOT 0]

MCI20. What would the percentage breakdown of these [READ IN FROM MCI21] STANDALONE

INTEGRATED HEATING AND WATER HEATING SYSTEMS look like in the past two years across the following efficiency levels if the GasNetworks High Efficiency Heating and Water Heating program incentives, marketing and support had not existed?

[PLACE ALL RESPONSES ON ONE SCREEN]

[INTERVIEWER – RESPONSES SHOULD ADD TO 100%]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

[READ IF NEEDED: WHAT PERCENT OF YOUR COMPANY’S INSTALLATIONS WOULD HAVE BEEN <READ RESPONSE> IF THE PROGRAM HAD NOT BEEN AVAILABLE?]

- a. Standalone integrated heating and water heating systems without a condensing boiler [0%-100%; 998=DK; 999=REF]
- b. Standalone integrated heating and water heating systems with a condensing boiler [0%-100%; 998=DK; 999=REF]

[ASK IF MCI20 DOES NOT SUM UP TO 100%]

QMCCCCHECK13. The percentage breakdown you just provided does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percents with you one more time. [GO BACK TO MCI20]

Installation Practices

Manual J

[ASK IF ENDUSE=1 OR 2, ELSE SKIP TO NEXT SECTION]

In this section we will ask you about installation practices. Thinking about the PAST TWO YEARS...

IP1. For what percent of your <ENDUSE> installations did you use the following to size equipment? [INTERVIEWER - SHOULD ADD TO 100%] [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]
[PLACE ON ONE SCREEN. DO NOT ALLOW IF SUM<>100%]

- a. Rules of thumb, such as like for like size or tons per square foot
- b. Manual J software [READ IF NEEDED: WHICH ESTIMATES HEAT LOSS AND HEAT GAIN FOR RESIDENTIAL STRUCTURES, DETERMINING LOAD CALCULATIONS FOR EACH ROOM TO MAXIMIZE COMFORT, EFFICIENCY AND RELIABILITY]
- c. Other software

[ASK IF IP1B>0 BUT NOT DK/REFUSED OR IP1C>0 BUT NOT DK/REFUSED AND ENDUSE=1, ELSE SKIP TO IP3A]

IP2a. In practice, approximately what percent of the COOLING equipment you installed in the past two years that was sized with Manual J or another software was within one half ton of the size recommended by the software? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF IP1B>0 BUT NOT DK/REFUSED OR IP1C>0 BUT NOT DK/REFUSED AND ENDUSE=2, ELSE SKIP TO IP3A]

IP2b. In practice, approximately what percent of the HEATING equipment you installed in the past two years that was sized with Manual J or another software is within 15% of the size recommended by software? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF IP1B>0 OR IP1C>0 AND IP1B AND IP1C ARE NOT DK/REFUSED]

IP3a. Did any of the following prompt your company to begin using Manual J or similar software? [1=YES; 2=NO; 8=DK; 9=REF]

- a. Customer demand
- c. [READ IF (VERIFIED_PART=4 AND PA1A=1) OR VERIFIED_PART=2 OR 3] Availability of Mass Save or Cool Smart incentives or training
- d. Availability of training from manufacturers, distributors or trade associations
- e. Ability to reduce customer requests for repeat visits
- f. Other reason(s) – specify

[ASK IF IP3AC=1]

IP3b. On a scale of 1 to 5, with 1 meaning not at all influential and 5 meaning very influential, how influential was the availability of Mass Save or Cool Smart incentives or training on your company's decision to begin using Manual J or other equipment sizing software?
[SCALE 1-5, 8=DK, 9=REF]

[ASK IF IP1A>0 AND NOT DK/REF]

IP4. What were the reasons that you chose NOT to use Manual J or other sizing software in some cases? [MULTIPLE RESPONSE. ACCEPT UP TO THREE]

01. (If my company installed the original equipment)
02. (If I have used Manual J in the same model of house)
03. (Heating/cooling load dictated by other equipment)
00. (Other, specify)
98. (Don't know)
99. (Refused)

[ASK IF IP1B>0 AND NOT DK/REF]

IP4A. When did you start using Manual J calculations? [RECORD RESPONSE IN NUMBER OF YEARS AND MONTHS]

Duct Sealing

[ASK IF ENDUSE=1 OR 2 AND (MCC1A>0 OR MCC1B>0 OR MCH1A>0) ELSE SKIP TO NEXT SECTION]

IP5. In the past two years, in what percent of central air conditioning, heat pump, and gas furnace installations did you test for duct tightness? [IF NEEDED: USING A DUCTBLASTER OR A SIMILAR TEST] [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF IP5>0 AND NOT DK/REF]

IP16. What tools does your company use to test for duct leakage? [MULTIPLE RESPONSE. ACCEPT UPT TO THREE]

01. Blower door test
02. Duct-blower test (also known as Duct Blaster test)
03. Pressure pan test
00. (Other, specify)
98. (Don't know)
99. (Refused)

[ASK IF IP5>0 BUT NOT DK/REFUSED, ELSE SKIP TO IP7]

IP6a. Did any of the following prompt your company to begin testing for duct tightness?
[1=YES; 2=NO; 8=DK; 9=REF]

- a. Customer demand
- c. [READ IF (VERIFIED_PART=4 OR 1 AND PA1A=1) OR VERIFIED_PART=2 OR 3] Availability of Mass Save or Cool Smart incentives or training
- d. Availability of training from manufacturers, distributors or trade associations
- e. Ability to reduce customer requests for repeat visits
- f. Other reason(s) – specify

[ASK IF IP6AC=1]

IP6b. On a scale of 1 to 5, with 1 meaning not at all influential and 5 meaning very influential, how influential was the availability of Mass Save or Cool Smart incentives or training on your company's decision to begin testing for duct tightness? [SCALE 1-5, 8=DK, 9=REF]

[ASK IF IP5<100]

IP7. What were the reasons that you did NOT test for duct tightness in some cases? [MULTIPLE RESPONSE]

00. (Other, specify)
98. (Don't know)
99. (Refused)

[ASK IF IP5<>0 OR DON'T KNOW OR REFUSED]

IP7a. When did you start offering duct testing as a service? [RECORD RESPONSE IN NUMBER OF YEARS AND MONTHS]

IP14. Are you aware of the IECC duct leakage standards?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF IP14=1]

IP15. Where did you learn about the IECC duct leakage standards? [OPEN END]

Air Flow Testing

[ASK IF ENDUSE=1, ELSE SKIP TO NEXT SECTION]

IP8. For the past two years, in what percent of cooling equipment installations did you test for proper airflow balance? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF IP8>0 BUT NOT DK/REFUSED, ELSE SKIP TO IP10]

IP9a. Did any of the following prompt your company to begin testing for proper airflow balance? [1=YES; 2=NO; 8=DK; 9=REF]

- a. Customer demand
- c. [READ IF (VERIFIED_PART=4 OR 1 AND PA1A=1) OR VERIFIED_PART=2 OR 3] Availability of Mass Save or Cool Smart incentives or training
- d. Availability of training from manufacturers, distributors or trade associations
- e. Ability to reduce customer requests for repeat visits
- f. Other reason(s) – specify

[ASK IF IP9AC=1]

IP9b. On a scale of 1 to 5, with 1 meaning not at all influential and 5 meaning very influential, how influential was the availability of Mass Save or Cool Smart incentives or training on your company's decision to begin testing for proper airflow balance? [SCALE 1-5, 8=DK, 9=REF]

[ASK IF IP8<100]

IP10. What were the reasons that you did not test for proper airflow balance in some cases? [MULTIPLE RESPONSE]

00. (Other, specify)
98. (Don't know)
99. (Refused)

[ASK IF IP8 <>0 998 999]

IP10a. When did you start offering air flow testing as a service? [RECORD RESPONSE IN NUMBER OF YEARS AND MONTHS]

Refrigerant Charge Testing

[ASK IF ENDUSE=1, ELSE SKIP TO THE NEXT SECTION]

IP11. In the past two years, in what percent of the cooling equipment installations did you check for proper refrigerant charge? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF IPC11>0 BUT NOT DK/REFUSED, ELSE SKIP TO IP13]

IP12a. Did any of the following prompt your company to begin testing for proper refrigerant charge? [1=YES; 2=NO; 8=DK; 9=REF]

- a. Customer demand
- c. [READ IF (VERIFIED_PART=4 OR 1 AND PA1A=1) OR VERIFIED_PART=2 OR 3] Availability of Mass Save or Cool Smart incentives or training
- d. Availability of training from manufacturers, distributors or trade associations
- e. Ability to reduce customer requests for repeat visits
- f. Other reason(s) – specify

[ASK IF IP12AC=1]

IP12b. On a scale of 1 to 5, with 1 meaning not at all influential and 5 meaning very influential, how influential was the availability of Mass Save or Cool Smart incentives or training on your company's decision to begin testing for proper refrigerant charge? [SCALE 1-5, 8=DK, 9=REF]

[ASK IF IP11<100]

IP13. What were the reasons that you did not test for proper refrigerant levels in some cases? [MULTIPLE RESPONSE]

00. (Other, specify)
98. (Don't know)
99. (Refused)

[ASK IF IP11 <>0 998 999]

IP13a. When did you start offering refrigerant charge testing as a service? [RECORD RESPONSE IN NUMBER OF YEARS AND MONTHS]

Early Replacement

[ASK IF CONSTR=1, ELSE SKIP TO THE NEXT SECTION]

ER1. In the past two years, what percentage of your service calls in existing homes resulted in a recommendation for early replacement of their <ENDUSE> even though their current system was still functioning properly? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF ER1>0 BUT NOT DK/REFUSED, ELSE SKIP TO THE NEXT SECTION]

ER1a. On average, how much longer would these systems have operated if they were not replaced? [INTERVIEWER PLEASE RECORD IN YEARS AND MONTHS] [NUMERIC OPEN END] [PROBE FOR BEST ESTIMATE] [IF NEEDED: PROBE FOR AVERAGE]

ER2a. Did any of the following prompt your company to begin recommending early replacements? [1=YES; 2=NO; 8=DK; 9=REF]

- a. Customer demand
- c. [READ IF (VERIFIED_PART=4 OR 1 AND PA1A=1) OR VERIFIED_PART=2 OR 3] the Mass Save or Cool Smart incentives or training
- d. [READ IF (VERIFIED_PART=4 OR 3 AND PA1=1) OR VERIFIED_PART=1 OR 2] the GasNetworks High-Efficiency Heating and Water Heating program
- e. Other reason(s) - specify

[ASK IF ER2AC=1]

ER2b. On a scale of 1 to 5, with 1 meaning not at all influential and 5 meaning very influential, how influential was the availability of the Mass Save or Cool Smart incentives or training on your company's decision to begin recommending early replacements? [SCALE 1-5, 8=DK, 9=REF]

[ASK IF ER2AD=1]

ER2c. On a scale of 1 to 5, with 1 meaning not at all influential and 5 meaning very influential, how influential was the availability of the GasNetworks High-Efficiency Heating and Water Heating program incentives or training on your company's decision to begin recommending early replacements? [SCALE 1-5, 8=DK, 9=REF]

[ASK IF ER1>0 AND NOT DK/REF]

ER3. In the past two years, what percentage of the RECOMMENDED early replacements ACTUALLY RESULTED IN CUSTOMERS FOLLOWING THROUGH and replacing their <ENDUSE> equipment? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF ER1>0 AND NOT DK/REF]

- ER4. How influential do you think your COMPANY'S RECOMMENDATIONS were in moving customers to replace <ENDUSE> equipment early? Please use a scale of 1 to 5, with one meaning not at all influential and 5 meaning very influential. [SCALE 1-5, 8=DK, 9=REF]

Customer Interactions

I would now like to learn a little bit about the customers you completed projects for in the past two years.

- CI1. I am going to ask you about two different types of customers and would like to know the percentage of your customers that fall into each of the following categories. The percentages should add up to 100%. We can go back and adjust your answers as necessary. When selling or installing <ENDUSE> equipment...[IF NEEDED: YOUR BEST ESTIMATE IS FINE]
- a. What percent of your customers had not decided on a specific product before contacting you for services? [0%-100%; 998=DK; 999=REF]
 - b. What percent of your customers had decided on a specific product before contacting you for services? [0%-100%; 998=DK; 999=REF]

COMPUTE ENDUSE2

[ENDUSE=1, ENDUSE2=CENTRAL AIR CONDITIONERS, HEAT PUMPS OR DUCTLESS MINI SPLIT SYSTEMS WITH SEER 14.5 AND HIGHER.

[IF ENDUSE=2, ENDUSE2=GAS FURNACES WITH AFUE OF 95% AND HIGHER OR GAS BOILERS WITH AFUE OF 90% OR HIGHER.

[IF ENDUSE=3, ENDUSE2=STORAGE WATER HEATERS WITH ENERGY FACTOR OF 0.67 OR GREATER AND TANKLESS WATER HEATERS].

I would like to once again ask about high efficiency <ENDUSE2>.

- CI2. Of the customers who have selected equipment prior to approaching you with a request for service, about what percent specifically requested <ENDUSE2>? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

These are all the questions that I have for you.

- GC2. Would you prefer for the \$100 check to be issued to you or would you prefer to donate it to the Red Cross?
1. \$100 check
 2. Red Cross
 8. (Don't know)
 9. (Refused)

[ASK IF GC2=1]

GC3. Please tell me the name that the check should be issued to and the address we should mail the check to..

- a. [OPEN END, name]
- b. [OPEN END, street number]
- c. [OPEN END, street name]
- d. [OPEN END, street suffix]
- e. [OPEN END, city]
- f. [OPEN END, zip]

99. (REFUSED) [TERMINATE]

GC4. Are there any other heating, cooling, or water heating contractors that might be interested in completing this survey with us for a \$100 incentive?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF GC4=1]

GC5. What is the name and the contact information for that person? [RECORD FIRST AND LAST NAME, COMPANY NAME, AND CONTACT PHONE NUMBER]

Thank you very much again for your time. You should receive your check within the next 3 weeks. If you do not receive your check please call us at 617-301-4667. Have a good day.

Massachusetts QIV Contractor Survey

Hello, this is _____ from (Navigant Consulting). I am calling on behalf of Massachusetts utilities and Energy Efficiency program administrators. This is not a sales call. We are conducting a study with contractors who participated in Quality Installation and Verification training. May I please speak with <CONTACT> or the person most knowledgeable about the sales and installation practices of heating, cooling, or water heating equipment at your company?

The survey will take about 30 minutes of your time and, if you qualify and complete the survey, you will receive a \$250 Visa gift-card as a token of our appreciation of your time. You can choose to receive the money yourself or donate it to the Red Cross. The information that we gather will be used to improve energy efficiency programs in Massachusetts. Do you have time to take this survey?

[READ IF NEEDED: THE INFORMATION THAT YOU PROVIDE WILL REMAIN STRICTLY CONFIDENTIAL. IT WILL BE USED FOR RESEARCH PURPOSES ONLY.]

Screener

First, let's see if you qualify for the study.

- S0. When did you or your employees first receive training on quality installation of heating and cooling equipment from the Cool Smart program?
1. Record Year
 2. Did not receive training [THANK AND TERMINATE]
 998. (Don't know: ask for other contact at company who might know more about QIV)
 999. (Refused)
- S1. Which of the following categories best describes your company?
01. HVAC contractor
 02. Plumbing contractor
 03. HVAC and Plumbing contractor
 00. Something else (specify)
 998. (Don't know)
 999. (Refused)
- S3. Does your company install any of the following types of equipment?
[1=YES; 2=NO; 998=DK; 999=REF]
- a. Heating equipment [READ IF NEEDED: THIS INCLUDES FURNACES, BOILERS]
 - b. Cooling equipment [READ IF NEEDED: THIS INCLUDES CENTRAL AIR CONDITIONING SYSTEMS, AIR SOURCE HEAT PUMPS, OR DUCTLESS MINI-SPLIT SYSTEMS]

[IF ALL IN S3=2,998,999 THANK AND TERMINATE]

- S4. Does your company operate only in Massachusetts or does your company also operate in other states?
1. Massachusetts only
 2. Massachusetts and other states
 3. (Do not operate in Massachusetts) [THANK AND TERMINATE]
998. (Don't know) [THANK AND TERMINATE]
999. (Refused) [THANK AND TERMINATE]
- S5. Does your company work only with commercial customers, only with residential customers, or with both, commercial and residential customers?
1. Commercial only [THIS INCLUDES NOT-FOR-PROFIT CUSTOMERS] [THANK AND TERMINATE]
 2. Residential only
 3. Both commercial and residential
998. (Don't know) [THANK AND TERMINATE OR ASK FOR ANOTHER CONTACT]
999. (Refused) [THANK AND TERMINATE]

[IF S5=1,998,999 – THANK AND TERMINATE]

- S6. Do you install this equipment only in existing buildings, only new construction or both?
1. Existing building
 2. New construction
 3. Both
998. (Don't know)
999. (Refused)

[ASK IF S6=3]

- S7. In the past year, what percent of your installations of heating and cooling equipment were in new construction projects and what percent were in existing buildings?
- a. New construction [0%-100%; 998=DON'T KNOW; 999=REFUSED]
 - b. Existing buildings [0%-100%; 998=DON'T KNOW; 999=REFUSED]

GENERATE ENDUSE.

1=COOLING

2=HEATING

3=BOTH COOLING AND HEATING

IF S3A<>1 AND S3B=1, ENDUSE=1

IF S3A=1 AND S3B<>1, ENDUSE=2

IF S3A=1 AND S3B=1, ENDUSE=3

GENERATE CONSTR

1=EXISTING

2=NEW

IF S7A ≥50%, CONSTR=2, ELSE CONSTR=1

S8A. Do you have knowledge about your company's installations of <ENDUSE> equipment in the past two years?

1. Yes
2. No
998. (Don't know)
999. (Refused)

[ASK IF S8A=2,998,999]

S8B. Is there anyone else at your company who would be able to provide me with this information?

00. Yes [RECORD CONTACT INFORMATION - TERMINATE]
96. No [THANK AND TERMINATE]
998. (Don't know) [THANK AND TERMINATE]
999. (Refused) [THANK AND TERMINATE]

Thank you, you do qualify for this study -- now I will begin the survey itself and you will receive \$100 Visa card upon completion of this survey or you can choose to donate the money to the Red Cross.

[ASK ALL]

Firmographics

The first question is about your company.

- F1. What is your job title?
01. (Owner/President)
 02. (Vice President)
 03. (Chief Executive Officer)
 04. (Office Manager)
 05. (Bookkeeper)
 06. (Branch Manager)
 07. (Director)
 08. (Project Manager)
 09. (Sales Executive)
 10. (Installation Manager)
 00. (Other, specify)
 998. (Don't know)
 999. (Refused)

[READ IF S4=2]

For the rest of the survey, I would like you to focus on installations ONLY IN RESIDENTIAL <CONSTR> and the work that you do ONLY in Massachusetts.

[READ IF S4=1]

For the rest of the survey, I would like you to focus on installations ONLY IN RESIDENTIAL
<CONSTR>

Installation Practices

Manual J - COOLING

[ASK IF ENDUSE=1 OR 3, ELSE SKIP TO NEXT SECTION]

In this section we will ask you about installation practices for COOLING equipment. Thinking about installations in the past year...

IPC1. For what percent of your installations did you use the following to size COOLING equipment? [INTERVIEWER - SHOULD ADD TO 100%] [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[PLACE ON ONE SCREEN. DO NOT ALLOW IF SUM<>100%]

- a. Rules of thumb, such as like for like size or tons per square foot
- b. Manual J software [READ IF NEEDED: WHICH ESTIMATES HEAT LOSS AND HEAT GAIN FOR RESIDENTIAL STRUCTURES, DETERMINING LOAD CALCULATIONS FOR EACH ROOM TO MAXIMIZE COMFORT, EFFICIENCY AND RELIABILITY]
- c. Other software

[ASK IF IPC1B>0 BUT NOT DK/REFUSED OR IP1C>0 BUT NOT DK/REFUSED, ELSE SKIP TO IP4A]

IPC2a. What percent of the COOLING equipment installations that DID RECEIVE Mass Save or Cool Smart incentives were sized with Manual J software? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED] [PLACE ALL RESPONSES ON ONE SCREEN]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- a. Ductless Mini Split Heat Pumps with installations of only one or two at the same time [0%-100%; 998=DK; 999=REF]
- b. Heat Pumps or Central Air Conditioning units which received no other incentives [0%-100%; 998=DK; 999=REF]

[ASK IF IPC1B>0 BUT NOT DK/REFUSED OR IP1C>0 BUT NOT DK/REFUSED, ELSE SKIP TO IP4A]

IPC2b. What percent of the COOLING equipment installations that DID NOT receive Mass Save or Cool Smart incentives were sized with Manual J software? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED] [PLACE ALL RESPONSES ON ONE SCREEN]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- a. Ductless Mini Split Heat Pumps with installations of only one or two at the same time [0%-100%; 998=DK; 999=REF]

- b. Heat Pumps or Central Air Conditioning units which received no other incentives [0%-100%; 998=DK; 999=REF]

[ASK IF (IPC1B>0 BUT NOT DK/REFUSED) , ELSE SKIP TO NEXT SECTION]

IPC3a. In practice, approximately what percent of the COOLING equipment you installed in the past year that was sized with Manual J or other software was within one half ton of the size recommended by the software? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF IPC3A>0 BUT NOT DK/REFUSED, ELSE SKIP TO IPC3C]

IPC3b. Of the COOLING equipment you installed in the past year that was sized with Manual J or another software and was within one half ton of the sized recommended by the software, approximately what percentage did you receive an incentive for using this estimation technique? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF IPC1B>0 BUT NOT DK/REFUSED OR IPC1C>0 BUT NOT DK/REFUSED, ELSE SKIP TO IP4A]

IPC3c. In practice, approximately what percent of the COOLING equipment you installed in the past year that was sized with Manual J or other software was within 15% of the size recommended by software? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF IPC1B>0 OR IPC1C>0 AND IP1B AND IPC1C ARE NOT DK/REFUSED]

IPC4a. Did any of the following prompt your company to begin using Manual J or similar software on your COOLING equipment installations? [1=YES; 2=NO; 998=DK; 999=REF]

- a. Customer demand
- b. QIV Training
- c. Availability of Mass Save or Cool Smart incentives
- d. Availability of training from manufacturers, distributors or trade associations
- e. Ability to reduce customer requests for repeat visits
- f. Other reason(s) – specify

[ASK IF IPC1A>0 AND NOT DK/REF]

IPC5. What were the reasons that you chose NOT to use Manual J or other sizing software in some cases on your COOLING equipment installations? [MULTIPLE RESPONSES - ACCEPT UP TO THREE]

01. My company did not install the original equipment
02. I have used Manual J in the same model of house and did not need to repeat the sizing procedure
03. Cooling/cooling load dictated by other equipment
00. Other, specify
998. Don't know
999. Refused

Manual J – HEATING

[ASK IF ENDUSE= 2 or 3, ELSE SKIP TO NEXT SECTION]

In this section we will ask you about installation practices regarding HEATING equipment. Thinking about installations in the past year...

IPH1. For what percent of your HEATING equipment installations did you use the following to size equipment? [INTERVIEWER - SHOULD ADD TO 100%] [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[PLACE ON ONE SCREEN. DO NOT ALLOW IF SUM<>100%]

- a. Rules of thumb, such as like for like size or tons per square foot
- b. Manual J software [READ IF NEEDED: WHICH ESTIMATES HEAT LOSS AND HEAT GAIN FOR RESIDENTIAL STRUCTURES, DETERMINING LOAD CALCULATIONS FOR EACH ROOM TO MAXIMIZE COMFORT, EFFICIENCY AND RELIABILITY]
- c. Other software

[ASK IF IPH1B>0 BUT NOT DK/REFUSED OR IPH1C>0 BUT NOT DK/REFUSED AND ENDUSE=2 OR 3, ELSE SKIP TO IPH3A]

IPH2a. In practice, approximately what percent of the HEATING equipment you installed in the past year that was sized with Manual J or other software was within one half ton of the size recommended by the software? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF IPH1B>0 BUT NOT DK/REFUSED OR IPH1C>0 BUT NOT DK/REFUSED, ELSE SKIP TO IPH3A]

IPH2b. In practice, approximately what percent of the HEATING equipment you installed in the past year that was sized with Manual J or other software is within 15% of the size recommended by software? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF IPH1B>0 OR IPH1C>0 AND IPH1B AND IPH1C ARE NOT DK/REFUSED]

IPH3a. Did any of the following prompt your company to begin using Manual J or similar software? [1=YES; 2=NO; 998=DK; 999=REF]

- a. Customer demand
- b. QIV Training
- c. Availability of Mass Save or Cool Smart incentives
- d. Availability of training from manufacturers, distributors or trade associations
- e. Ability to reduce customer requests for repeat visits
- f. Other reason(s) – specify

[ASK IF IPH1A>0 AND NOT DK/REF]

- IPH4. What were the reasons that you chose NOT to use Manual J or other sizing software in some cases? [MULTIPLE RESPONSES - ACCEPT UP TO THREE]
01. My company did not install the original equipment
 02. I have used Manual J in the same model of house and did not need to repeat the sizing procedure
 03. Heating/HEATING load dictated by other equipment
 00. Other, specify
 998. Don't know
 999. Refused

Duct Sealing

- IPD1. For installations in the past year, in what percent of HVAC installations did you test for duct tightness? [IF NEEDED: USING A DUCTBLASTER OR A SIMILAR TEST]
[PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF IPD1>0 AND NOT DK/REF]

- IPD2. What tools does your company use to test for duct leakage? [MULTIPLE RESPONSES - ACCEPT UP TO THREE]
01. Blower door test
 02. Duct-blower test (also known as Duct Blaster test)
 03. Pressure pan test
 00. Other, specify
 998. Don't know
 999. Refused

[ASK IF IPD1>0 BUT NOT DK/REFUSED, ELSE SKIP TO IPD5]

- IPD3. Did any of the following prompt your company to begin testing for duct tightness?
[1=YES; 2=NO; 998=DK; 999=REF]

- a. Customer demand
- b. QIV Training
- c. Availability of Mass Save or Cool Smart incentives
- d. Availability of training from manufacturers, distributors or trade associations
- e. Ability to reduce customer requests for repeat visits
- f. Other reason(s) – specify

[ASK IF IPD1<100]

IPD5. What were the reasons that you did NOT test for duct tightness in some cases?

[MULTIPLE RESPONSE]

00. Other, specify
998. Don't know
999. Refused

IPD7. Are you aware of the International Energy Conservation Code duct leakage standards?

[NOTE TO INTERVIEWER: THESE STANDARDS ARE THE TESTING PROTOCOLS TO DETERMINE THE EFFECTIVENESS OF DUCT SEALING PER THE ABOVE MENTIONED ENERGY CODE]

1. Yes
2. No
998. (Don't know)
999. (Refused)

[ASK IF IPD7=1]

IPD8. Where did you learn about the IECC duct leakage standards? [OPEN END]

1. [RECORD RESPONSE]
998. (Don't know)
999. (Refused)

Air Flow Testing

[ASK IF ENDUSE=1 or 3, ELSE SKIP TO NEXT SECTION]

IPA1. For the past year, in what percent of ducted cooling equipment installations did you test for proper airflow balance? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF IPA1>0 BUT NOT DK/REFUSED, ELSE SKIP TO IPA5]

IPA2. Did any of the following prompt your company to begin testing for proper airflow balance? [1=YES; 2=NO; 998=DK; 999=REF]

- a. Customer demand
- c. Availability of Mass Save or Cool Smart incentives or training
- d. Availability of training from manufacturers, distributors or trade associations
- e. Ability to reduce customer requests for repeat visits
- f. Other reason(s) – specify

[ASK IF IPA1<100]

IPA5. What were the reasons that you did not test for proper airflow balance in some cases?

[MULTIPLE RESPONSE]

00. (Other, specify)
998. (Don't know)
999. (Refused)

Refrigerant Charge Testing

[ASK IF ENDUSE=1, ELSE SKIP TO THE NEXT SECTION]

IPR1. In the past year, in what percent of the cooling equipment installations did you check for proper refrigerant charge? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF IPR1>0 BUT NOT DK/REFUSED, ELSE SKIP TO IPR5]

IPR2. Did any of the following prompt your company to begin testing for proper refrigerant charge? [1=YES; 2=NO; 998=DK; 999=REF]

- a. Customer demand
- b. QIV training
- c. Availability of Mass Save or Cool Smart incentives
- d. Availability of training from manufacturers, distributors or trade associations
- e. Ability to reduce customer requests for repeat visits
- f. Other reason(s) – specify

[ASK IF IPR1<100]

IPR5. What were the reasons that you did not test for proper refrigerant levels in some cases?

[MULTIPLE RESPONSE]

00. Other, specify

998. Don't know

999. Refused

Questions on all QIV Methods

IPALL1. On a scale of 1 to 5, with 1 meaning not at all influential and 5 meaning very influential, how influential was the availability of Mass Save or Cool Smart incentives on your company's decision to begin:

- a) [ASK IF IPC4A=b and ENDUSE=1 or 3] Using Manual J or other equipment sizing software on your COOLING equipment installations?
- b) [ASK IF IPH3A=b and ENDUSE=2 or 3] Using Manual J or other equipment sizing software on your HEATING equipment installations?
- c) [ASK IF IPA2=C] Testing for proper airflow balance?
- d) [ASK IF IPR2=C] Testing for proper refrigerant charge?

[SCALE 1-5, 998=DK, 999=REF]

IPALL2. On a scale of 1 to 5, with 1 meaning not at all influential and 5 meaning very influential, how influential was the QIV Training on your company's decision to begin:

- a) [ASK IF IPC4A=b and ENDUSE=1 or 3] Using Manual J or other equipment sizing software on your COOLING equipment installations?
- b) [ASK IF IPH3A=b and ENDUSE=2 or 3] Using Manual J or other equipment sizing software on your HEATING equipment installations?
- c) [ASK IF IPA2=C] Testing for proper airflow balance?
- d) [ASK IF IPR2=C] Testing for proper refrigerant charge?

[SCALE 1-5, 998=DK, 999=REF]

IPALL3. For each of the following, did you start offering the service BEFORE or AFTER your employees began to take QIV training?

- a) [ASK IF IPC4A=b and ENDUSE=1 or 3] Using Manual J calculations on your COOLING equipment installations
- b) [ASK IF IPH3A=b and ENDUSE=2 or 3] Using Manual J calculations on your HEATING equipment installations
- c) [ASK IF IPA2=C] Offering air flow testing
- d) [ASK IF IPR2=C] Offering refrigerant charge testing

[01=AFTER, 02=BEFORE, 00=OTHER, SPECIFY, 998=DK, 999=REF]

IPALL4: For each of the following, did you conduct the procedure with the SAME rigor, LESS rigor or MORE rigor after your employees began to take QIV training:

- a) [ASK IF IPALL3A=2] Use Manual J calculations on your COOLING equipment installations
 - b) [ASK IF IPALL3B=2] Use Manual J calculations on your HEATING equipment installations
 - c) [ASK IF IPALL3D=2] Conduct air flow testing
 - d) [ASK IF IPALL3E=2] Conduct refrigerant charge testing
- [01=LESS, 02=SAME, 03=MORE, 00=OTHER, SPECIFY, 998=DK, 999=REF]

Early Replacement - Cooling

[ASK IF CONSTR=1 AND ENDUSE <> 2, ELSE SKIP TO THE NEXT SECTION]

[ASK IF MCC1a > 0 OR MCC1b > 0, ELSE SKIP TO ERC11]

ERC1a. What percentage of the Central Air Conditioning and Heat Pump COOLING equipment that you replaced would you say were

PLACE ALL RESPONSES ON ONE SCREEN]

[INTERVIEWER – RESPONSES SHOULD ADD TO 100%]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

1. Working with no need of repair [0%-100%; 9998=DK; 9999=REF]
2. Working with need of *minor* repairs [0%-100%; 9998=DK; 9999=REF]
3. Working with need of *major* repairs [0%-100%; 9998=DK; 9999=REF]
4. Not working [0%-100%; 9998=DK; 9999=REF]

[ASK IF ERC1a DOES NOT SUM UP TO 100%]

ERCHECK1a. The percentage breakdown you just provided by replacement condition does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percentages with you one more time. [GO BACK TO ER1a]

ERC2. What percentage of non-working Central Air Conditioning and Heat Pump COOLING equipment could have been repaired to restore it to working condition? [0%-100%; 9998=DK; 9999=REF]

[ASK IF ERC1B <> (9998 or 9999)]

ERC3. What percentage of those replacements that were not working could have been repaired with minor or major repairs?

PLACE ALL RESPONSES ON ONE SCREEN]

[INTERVIEWER – RESPONSES SHOULD ADD TO 100%]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

1. Minor repairs [0%-100%; 9998=DK; 9999=REF]
2. Major repairs [0%-100%; 9998=DK; 9999=REF]

[ASK IF ERC3 DOES NOT SUM UP TO 100%]

ERCHECK3. The percentage breakdown you just provided by repair need does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percentages with you one more time. [GO BACK TO ERC1c]

ERC4. If the training available through the Quality Installation and Verification Program had not been

available, how much later do you think your customers would have replaced the Central Air Conditioning and Heat Pump COOLING equipment?

- | | |
|------|--|
| 1 | More than one but less than 2 years later |
| 2 | At least two but less than three years later |
| 3 | At least three but less than four than years later |
| 4 | At least four more years later |
| 9998 | Don't know |
| 9999 | Refused |

ERC5. Did any of the following prompt your company to begin recommending early replacements? [1=YES; 2=NO; 998=DK; 9=REF]

- a. Customer demand
- b. QIV Training
- c. Mass Save or Cool Smart incentives
- d. Other reason(s) - specify

[ASK IF ERC5C=1]

ERC6. On a scale of 1 to 5, with 1 meaning not at all influential and 5 meaning very influential, how influential was the availability of the Mass Save or Cool Smart incentives or training on your company's decision to begin recommending early replacements? [SCALE 1-5, 998=DK, 9=REF]

[ASK IF ERC5A, ERC5B, ERC5C, ERC5D <> (0 or 998 or 999)]

ERC7a. In what year did you start recommending early replacement of equipment?
[RECORD RESPONSE IN NUMBER OF YEARS AND MONTHS]

ERC7b. Did you start recommending early replacement of equipment before or after your employees began to take QIV training?

01. After
02. Before
00. Other, specify
998. Don't know
999. Refused

[ASK IF ERC7B<>01]

- ERC7c. Did you recommend early replacement of equipment with the same regularity, less regularity or greater regularity after your employees began to take QIV training?
- 01. Less than
 - 02. Same
 - 03. Greater
 - 00. Other, specify
 - 998. Don't know
 - 999. Refused

[ASK IF ERC5A, ERC5B, ERC5C, ERC5D <> (0 or 998 or 999)]

- ERC8. In the past year, what percentage of the RECOMMENDED early replacements ACTUALLY RESULTED IN CUSTOMERS FOLLOWING THROUGH and replacing their Central Air Conditioning and Heat Pump COOLING equipment? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF ERC8 <> (998, 999)]

- ERC9. How influential do you think your COMPANY'S RECOMMENDATIONS were in moving customers to replace Central Air Conditioning and Heat Pump COOLING equipment early? Please use a scale of 1 to 5, with one meaning not at all influential and 5 meaning very influential. [SCALE 1-5, 998=DK, 999=REF]

- ERC10. In your own words, what are the reasons that you think your customers choose to replace rather than repair their Central Air Conditioning and Heat Pump COOLING equipment? [OPEN END]

[ASK IF MCC1c, ELSE SKIP TO NEXT SECTION]

ERC11. What percentage of the Ductless Mini-Split COOLING equipment that you replaced would you say were

PLACE ALL RESPONSES ON ONE SCREEN]

[INTERVIEWER – RESPONSES SHOULD ADD TO 100%]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- a. Working with no need of repair [0%-100%; 9998=DK; 9999=REF]
- b. Working with need of *minor* repairs [0%-100%; 9998=DK; 9999=REF]
- c. Working with need of *major* repairs [0%-100%; 9998=DK; 9999=REF]
- d. Not working [0%-100%; 9998=DK; 9999=REF]

[ASK IF ERC1 DOES NOT SUM UP TO 100%]

ERC11. The percentage breakdown you just provided by replacement condition does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percentages with you one more time. [GO BACK TO ER1a]

ERC12. What percentage of non-working Ductless Mini-Split COOLING equipment could have been repaired to restore it to working condition? [0%-100%; 9998=DK; 9999=REF]

[ASK IF ERC11B <> (9998 or 9999)]

ERC13. What percentage of those replacements that were not working could have been replaced with minor or major repairs?

PLACE ALL RESPONSES ON ONE SCREEN]

[INTERVIEWER – RESPONSES SHOULD ADD TO 100%]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

- a. Minor repairs [0%-100%; 9998=DK; 9999=REF]
- b. Major repairs [0%-100%; 9998=DK; 9999=REF]

[ASK IF ERC3 DOES NOT SUM UP TO 100%]

ERC13. The percentage breakdown you just provided by repair need does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percentages with you one more time. [GO BACK TO ERC11c]

ERC14. If the training available through the Quality Installation and Verification Program had not been available, how much later do you think your customers would have replaced the Ductless Mini-Split COOLING equipment?

- 1 More than one but less than years later
- 2 At least two but less than three years later
- 3 At least three but less than four than years later
- 4 At least four more years later
- 9998 Don't know
- 9999 Refused

ERC15. Did any of the following prompt your company to begin recommending early replacements? [1=YES; 2=NO; 998=DK; 9=REF]

- c. Customer demand
- d. QIV Training
- c. Mass Save or Cool Smart incentives
- d. Other reason(s) - specify

[ASK IF ERC15C=1]

ERC16. On a scale of 1 to 5, with 1 meaning not at all influential and 5 meaning very influential, how influential was the availability of the Mass Save or Cool Smart incentives or training on your company's decision to begin recommending early replacements? [SCALE 1-5, 998=DK, 9=REF]

[ASK IF ERC15A, ERC15B, ERC15C, ERC15D <> (0 or 998 or 999)]

ERC17a. In what year did you start recommending early replacement of equipment? [RECORD RESPONSE IN NUMBER OF YEARS AND MONTHS]

ERC17b. Did you start recommending early replacement of equipment before or after your employees began to take QIV training?

- 01. After
- 02. Before
- 00. Other, specify
- 998. Don't know
- 999. Refused

[ASK IF ERC17B<>01]

- ERC17c. Did you recommend early replacement of equipment with the same regularity, less regularity or greater regularity after your employees began to take QIV training?
- 01. Less than
 - 02. Same
 - 03. Greater
 - 00. Other, specify
 - 998. Don't know
 - 999. Refused

[ASK IF ERC15A, ERC15B, ERC15C, ERC15D <> (0 or 998 or 999)]

- ERC18. In the past year, what percentage of the RECOMMENDED early replacements ACTUALLY RESULTED IN CUSTOMERS FOLLOWING THROUGH and replacing their Ductless Mini-Split COOLING equipment? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF ERC18 <> (998, 999)]

- ERC19. How influential do you think your COMPANY'S RECOMMENDATIONS were in moving customers to replace Ductless Mini-Split COOLING equipment early? Please use a scale of 1 to 5, with one meaning not at all influential and 5 meaning very influential. [SCALE 1-5, 998=DK, 999=REF]

- ERC20. In your own words, what are the reasons that you think your customers choose to replace rather than repair their Ductless Mini-Split COOLING equipment? [OPEN END]

Early Replacement - Heating

[ASK IF CONSTR=1 AND ENDUSE <> 1, ELSE SKIP TO THE NEXT SECTION]

[ASK IF MCH1A>0, ELSE SKIP TO ERH11]

ERH1. What percentage of the NATURAL GAS FURNACE equipment that you replaced would you say were

PLACE ALL RESPONSES ON ONE SCREEN]

[INTERVIEWER – RESPONSES SHOULD ADD TO 100%]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

1. Working with no need of repair [0%-100%; 9998=DK; 9999=REF]
2. Working with need of *minor* repairs [0%-100%; 9998=DK; 9999=REF]
3. Working with need of *major* repairs [0%-100%; 9998=DK; 9999=REF]
4. Not working [0%-100%; 9998=DK; 9999=REF]

[ASK IF ERH1 DOES NOT SUM UP TO 100%]

ERHCHECK1. The percentage breakdown you just provided by replacement condition does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percentages with you one more time. [GO BACK TO ER1a]

ERH2. What percentage of non-working equipment could have been repaired to restore it to working condition? [0%-100%; 9998=DK; 9999=REF]

[ASK IF ERH1B <> (9998 or 9999)]

ERH3. What percentage of those replacements that were not working could have been replaced with minor or major repairs?

PLACE ALL RESPONSES ON ONE SCREEN]

[INTERVIEWER – RESPONSES SHOULD ADD TO 100%]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

1. Minor repairs [0%-100%; 9998=DK; 9999=REF]
2. Major repairs [0%-100%; 9998=DK; 9999=REF]

[ASK IF ERH3 DOES NOT SUM UP TO 100%]

ERHCHECK3. The percentage breakdown you just provided by repair need does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percentages with you one more time. [GO BACK TO ERC1c]

ERH4. If the training available through the Quality Installation and Verification Program had not been available, how much later do you think your customers would have replaced the NATURAL GAS FURNACE equipment?

- | | |
|------|--|
| 1 | More than one but less than years later |
| 2 | At least two but less than three years later |
| 3 | At least three but less than four than years later |
| 4 | At least four more years later |
| 9998 | Don't know |
| 9999 | Refused |

ERH5. Did any of the following prompt your company to begin recommending early replacements on furnaces? [1=YES; 2=NO; 998=DK; 999=REF]

1. Customer demand
2. QIV Training
3. GasNetworks High-Efficiency Heating and Water Heating program
4. Other reason(s) - specify

[ASK IF ERH5C=1]

ERH6. On a scale of 1 to 5, with 1 meaning not at all influential and 5 meaning very influential, how influential was the availability of the Gas Networks High-Efficiency Heating and Water Heating program incentives on your company's decision to begin recommending early replacements? [SCALE 1-5, 998=DK, 999=REF]

[ASK IF ERH5A, ERH5B, ERH5C, ERH5D <> (0 or 998 or 999)]

ERH7a. In what year did you start recommending early replacement of furnace equipment? [RECORD RESPONSE IN NUMBER OF YEARS AND MONTHS]

ERH7b. Did you start recommending early replacement of furnace equipment before or after your employees began to take QIV training?

01. After
02. Before
00. Other, specify
998. Don't know
999. Refused

[ASK IF ERH7B<>01]

ERH7c. Did you recommend early replacement of furnace equipment with the same regularity, less regularity or greater regularity after your employees began to take QIV training?

- 01. Less than
- 02. Same
- 03. Greater
- 00. Other, specify
- 998. Don't know
- 999. Refused

[ASK IF ERH5A, ERH5B, ERH5C, ERH5D <> (0 or 998 or 999)]

ERH8. In the past year, what percentage of the RECOMMENDED early replacements ACTUALLY RESULTED IN CUSTOMERS FOLLOWING THROUGH and replacing their NATURAL GAS FURNACE equipment? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF ERC8 <> (998, 999)]

ERH9. How influential do you think your COMPANY'S RECOMMENDATIONS were in moving customers to replace NATURAL GAS FURNACE equipment early? Please use a scale of 1 to 5, with one meaning not at all influential and 5 meaning very influential. [SCALE 1-5, 998=DK, 999=REF]

ERH10. In your own words, what are the reasons that you think your customers choose to replace rather than repair their NATURAL GAS FURNACE equipment? [OPEN END]

ERH11. What percentage of the NATURAL GAS BOILERS equipment that you replaced would you say were

PLACE ALL RESPONSES ON ONE SCREEN]

[INTERVIEWER – RESPONSES SHOULD ADD TO 100%]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

1. Working with no need of repair [0%-100%; 9998=DK; 9999=REF]
2. Working with need of minor repairs [0%-100%; 9998=DK; 9999=REF]
3. Working with need of major repairs [0%-100%; 9998=DK; 9999=REF]
4. Not working [0%-100%; 9998=DK; 9999=REF]

ERH12. What percentage of non-working equipment could have been repaired to restore it to working condition? [0%-100%; 9998=DK; 9999=REF]

[ASK IF ERH11B <> (9998 or 9999)]

ERH13. What percentage of those replacements that were not working could have been replaced with minor or major repairs?

PLACE ALL RESPONSES ON ONE SCREEN]

[INTERVIEWER – RESPONSES SHOULD ADD TO 100%]

[PROBE IF NEEDED: YOUR BEST ESTIMATE IS FINE]

1. Minor repairs [0%-100%; 9998=DK; 9999=REF]
2. Major repairs [0%-100%; 9998=DK; 9999=REF]

[ASK IF ERH13 DOES NOT SUM UP TO 100%]

ERHCHECK13. The percentage breakdown you just provided by repair need does not equal 100%. To make sure we have the most accurate information, let me go back and go over the percentages with you one more time. [GO BACK TO ERC1c]

ERH14. If the training available through the Quality Installation and Verification Program had not been available, how much later do you think your customers would have replaced the NATURAL GAS BOILER equipment?

- 1 More than one but less than years later
- 2 At least two but less than three years later
- 3 At least three but less than four than years later
- 4 At least four more years later

9998 Don't know

9999 Refused

ERH15. Did any of the following prompt your company to begin recommending early replacements for boilers? [1=YES; 2=NO; 998=DK; 999=REF]

- e. Customer demand
- f. QIV Training
- c. GasNetworks High-Efficiency Heating and Water Heating program
- d. Other reason(s) - specify

[ASK IF ERH15C=1]

ERH16. On a scale of 1 to 5, with 1 meaning not at all influential and 5 meaning very influential, how influential was the availability of the Gas Networks High-Efficiency Heating and Water Heating program incentives on your company's decision to begin recommending early replacements? [SCALE 1-5, 998=DK, 999=REF]

[ASK IF ERH15A, ERH15B, ERH15C, ERH15D <> (0 or 998 or 999)]

ERH17a. In what year did you start recommending early replacement of equipment? [RECORD RESPONSE IN NUMBER OF YEARS AND MONTHS]

ERH17b. Did you start recommending early replacement of equipment before or after your employees began to take QIV training?

- 01. After
- 02. Before
- 00. Other, specify
- 998. Don't know
- 999. Refused

[ASK IF ERH17B<>01]

ERH17c. Did you recommend early replacement of equipment with the same regularity, less regularity or greater regularity after your employees began to take QIV training?

- 01. Less than
- 02. Same
- 03. Greater
- 00. Other, specify
- 998. Don't know
- 999. Refused

[ASK IF ERH15A, ERH15B, ERH15C, ERH15D <> (0 or 998 or 999)]

ERH18. In the past year, what percentage of the RECOMMENDED early replacements ACTUALLY RESULTED IN CUSTOMERS FOLLOWING THROUGH and replacing their NATURAL GAS BOILER equipment? [PERCENTAGE: 0-100; 998= DON'T KNOW; 999=REFUSED]

[ASK IF ERC18 <> (998, 999)]

ERH19. How influential do you think your COMPANY'S RECOMMENDATIONS were in moving customers to replace NATURAL GAS BOILER equipment early? Please use a scale of 1 to 5, with one meaning not at all influential and 5 meaning very influential.
[SCALE 1-5, 998=DK, 999=REF]

ERH20. In your own words, what are the reasons that you think your customers choose to replace rather than repair their NATURAL GAS BOILER equipment? [OPEN END]

Final Questions

These are all the questions that I have for you.

GC2. Would you prefer for the \$250 Visa card to be issued to you or would you prefer to donate it to the Red Cross?

1. \$250 check
2. Red Cross

998. (Don't know)
999. (Refused)

[ASK IF GC2=1]

GC3. Please tell me the name that the check should be issued to and the address we should mail the check to..

- a. [OPEN END, name]
- b. [OPEN END, street number]
- c. [OPEN END, street name]
- d. [OPEN END, street suffix]
- e. [OPEN END, city]
- f. [OPEN END, zip code]

999. (REFUSED) [TERMINATE]

Thank you very much again for your time. You should receive your check within the next 3 weeks. If you do not receive your check please call us at (303)-728-2527. Have a good day.

Participant Survey

SAMPLE VARIABLES:

Program:

High Efficiency Heating and Water Heating
Cool Smart

Program type:

Heating
Cooling
Water heating

Equipment:

BOILER_FLAG=1 <ENERGY EFFICIENT BOILER>
FURNACE_FLAG=1 <ENERGY EFFICIENT FURNACE>
CAC_FLAG=1 <ENERGY EFFICIENT CENTRAL A/C SYSTEM>
HP_FLAG=1 <ENERGY EFFICIENT HEAT PUMP>
DUCTLESS_FLAG=1 <DUCTLESS MINI SPLIT A/C>
STORAGE_WH_FLAG=1 <WATER HEATER>
TANKLESS_WH_FLAG=1 <TANKLESS WATER HEATER>
INTEGRATED_HW_SYSTEM_FLAG=1 <INTEGRATED HEATING AND WATER HEATING SYSTEM>
QIV_FLAG=1 <QUALITY INSTALLATION VERIFICATION>

Introduction

Hello, this is _____ from Opinion Dynamics. This is not a sales call. I am calling on behalf of <PA> and Massachusetts Energy Efficiency program administrators. May I please speak with <CONTACT>?

We are conducting a study with Massachusetts residents that recently received a rebate for installing energy efficient heating or cooling equipment. The survey will take about 10 minutes of your time and the information that we gather will be used to improve energy efficiency programs in Massachusetts.

[READ IF NEEDED: THE INFORMATION THAT YOU PROVIDE WILL REMAIN STRICTLY CONFIDENTIAL. IT WILL BE USED FOR RESEARCH PURPOSES ONLY.]

Screener**[ASK IF FURNACE_FLAG=1]**

- S1. According to our records, you recently installed a high efficiency furnace that received a rebate through the High Efficiency Heating and Water Heating program. Is that correct?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

[ASK IF BOILER_FLAG=1]

- S2. According to our records, you recently installed a high efficiency boiler that received a rebate through the High Efficiency Heating and Water Heating program. Is that correct?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

[ASK IF HP_FLAG=1]

- S3. According to our records, you recently installed a high efficiency heat pump that received a rebate through the CoolSmart program. Is that correct?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

[ASK IF CAC_FLAG=1]

- S4. According to our records, you recently installed a high efficiency central A/C system that received a rebate through the CoolSmart program. Is that correct?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

[ASK IF DUCTLESS_FLAG=1]

- S5. According to our records, you recently installed a high efficiency ductless mini split A/C system that received a rebate through the CoolSmart program. Is that correct?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

[ASK IF STORAGE_WH_FLAG=1]

- S6. According to our records, you recently installed a high efficiency water heater that received a rebate through the High Efficiency Heating and Water Heating program. Is that correct?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

[ASK IF TANKLESS_WH_FLAG=1]

- S7. According to our records, you recently installed a tankless water heater that received a rebate through the High Efficiency Heating and Water Heating program. Is that correct?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

[ASK IF INTEGRATED_HW_SYSTEM_FLAG=1]

- S8. According to our records, you recently installed an integrated heating and water heating system that received a rebate through the High Efficiency Heating and Water Heating program. Is that correct?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

[TERMINATE IF NO MEASURE VERIFIED]

COMPUTE <MEASURE> BASED ON VERIFIED MEASURES AND PRIORITY IN SAMPLE.

SET <PROGRAM> TO THE PROGRAM ASSOCIATED WITH THE SELECTED VERIFIED MEASURE

[READ IF MORE THAN ONE MEASURE TYPE]

For the rest of the survey I would like for you to focus on the <MEASURE>.

- V1. Our records show that you installed <QTY> <MEASURE>s through the program. Is this correct?
1. (Yes)
 2. (No, different quantity)
 8. (Don't know)
 9. (Refused)

[ASK IF V1=2]

- V2. How many <MEASURE> did you install through the program?
[NUMERIC OPEN END]
998. (Don't know)

999. (Refused)

E3a. Is this <MEASURE> still in use? [IF NEEDED: In use during the appropriate heating or cooling season]

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF E3A=2]

E3b. Why is it not in use?

01. (Under repair)
02. (Being replaced)
03. (Still waiting to receive)
04. (Have not yet installed)
00. (Other, specify)
98. (Don't know)
99. (Refused)

[ASK IF MEASURE=CAC, OR HP OR DUCTLESS MINI SPLIT]

E4. Did you have a central cooling system in your home before you installed new [IF MEASURE=HP, "HEATING AND COOLING"; ELSE "COOLING"] equipment?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF MEASURE=FURNACE OR BOILER]

E5. Was the installation of the <MEASURE> a part of the oil to gas conversion?

1. Yes
2. No
8. (Don't know)
9. (Refused)

Program Awareness

A1. How did you first learn about the availability of <PROGRAM> program rebates for the high efficiency <MEASURE>?

01. (Contractor)
02. (Utility website)
03. (Retailer/dealer)
04. (Friend/relative/neighbor/word of mouth)
05. (Internet)
06. (Bill insert/mailing)

- 00. (Other, specify)
- 98. (Don't know)
- 99. (Refused)

A2. Did you receive any marketing materials from your utility or Mass Save about the benefits of high efficiency heating, cooling, or water heating equipment?

- 1. Yes
- 2. No
- 8. (Don't know)
- 9. (Refused)

A3. Did you visit your utility's or Mass Save website to learn more about the benefits of high efficiency heating, cooling, or water heating equipment?

- 1. Yes
- 2. No
- 8. (Don't know)
- 9. (Refused)

[SKIP IF A1=1]

A4. Did you work with the contractor to install the high efficiency <MEASURE> for which you received the rebate?

- 1. Yes
- 2. No
- 8. (Don't know)
- 9. (Refused)

[ASK IF A1=1 OR A4=1, ELSE SKIP TO A9]

- A5. Where did you find the contractor who installed the high efficiency <MEASURE> for which you received the rebate through the <PROGRAM> program?
01. (Mass Save website)
 02. (Friend/relative/neighbor/word of mouth)
 03. (Contractor search/referral service)
 04. (Yellow pages)
 05. (Same contractor I use to service my old equipment)
 00. (Other, specify)
 98. (Don't know)
 99. (Refused)
- A6. What were the main reasons why you chose your contractor?
01. (Lowest quote)
 02. (Referral from previous customer of contractor)
 03. (Used this contractor before)
 04. (Contractor was listed on the Mass Save website/contractor is program trained and certified)
 00. (Other, specify)
 98. (Don't know)
 99. (Refused)
- A7. Did your contractor talk to you about the <PROGRAM> program and available rebates?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

[ASK IF A7=1]

- A8. Before speaking with your contractor, were you considering installing a HIGH EFFICIENCY <MEASURE>?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)
- A9. Who was the most influential in identifying and recommending the efficiency level of the equipment that you installed through the <PROGRAM> program?
01. (Me/myself)
 02. (Contractor)
 03. (Friend/family/word of mouth)
 00. (Other, specify)
 98. (Don't know)
 99. (Refused)

- A10. Did you receive a tax credit or rebate from the government for the <MEASURE> that you installed?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

Early Replacement and Free-Ridership

I have a few questions about what led you to install the <MEASURE>.
 [READ IF E5=1] You mentioned earlier that the installation of the high efficiency <MEASURE> was a part of the oil to gas conversion. When answering the following questions, please think about your decision to install HIGH efficiency <MEASURE> instead of less efficient <MEASURE>, and not about your decision to convert from oil to gas.

[IF MEASURE = BOILER, FURNCE, STORAGE_WH, TANKLESS_WH, OR INTEGRATED_WH SKIP TO J0D]

[ASK IF MEASURE=CAC, DUCTLESS MINI SPLIT OR HEAT PUMP]

[ASK IF E4=1]

- J0a. Did your new <MEASURE> replace an old <MEASURE>?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

[ASK IF J0A = 2]

- J0aa. How did you cool your home before you installed <MEASURE>?
01. Central AC System
 02. Heat Pump
 03. Room ACs
 00. (Other, specify)
 96. (Nothing)
 98. (Don't know)
 99. (Refused)

[ASK IF MEASURE=CAC, DUCTLESS MINI SPLIT OR HEAT PUMP AND J0A=1 OR JOAA = 1 OR J0AA = 2 ELSE SKIP TO J1]

[ASK IF BOILER, FURNCE, STORAGE_WH, TANKLESS_WH, OR INTEGRATED_WH]

- J0d. At the time that you replaced your old system with a <MEASURE> through the <PROGRAM> program, was your old system still working?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

[ASK IF J0D=1]

- J0e. Which of the following best describes the condition of your old system?
1. The old system was working with no need of repair
 2. The old system was working with need of minor repair
 3. The old system was working with need of major repair
 8. (Don't know)
 9. (Refused)

[ASK IF J0D=2,8 or 9]

- J0f. Was your old system repairable or was it beyond repair?
1. Repairable
 2. Beyond repair
 8. (Don't know)
 9. (Refused)

[ASK IF J0F=1]

- J0ff. Was this a major or minor repair?
1. Major repair
 2. Minor repair
 8. (Don't know)
 9. (Refused)

- J0g. How old was your existing system? (IF NEEDED: In years)
(NUMERIC OPEN END)
998. (Don't know)
 999. (Refused)

[ASK IF J0G=998, 999]

- J0h. What would you estimate the approximate age of your old system to be?
1. Less than 2 years
 2. Between 2 and 5 years
 3. Between 5 and 10 years
 4. Between 10 and 15 years
 5. Or more than 15 years
 8. (Don't know)
 9. (Refused)

- J0i. Prior to replacing your old system, had it undergone any repairs?
1. Yes
 2. No
 8. (Don't know)
 9. (Refused)

[ASK IF J0i=1]

- J0iii. Approximately how many times did you have to repair the old system during the year prior to replacement?
(NUMERIC OPEN END)
8. (Don't know)
 9. (Refused)

- J0j. How long do you think your old system would have lasted if you had made the necessary repairs? Would you say..?
1. 1 year or less
 2. 2 to 3 years
 3. 4-5 years
 4. or more than five years
 8. (Don't know)
 9. (Refused)

[ASK IF J0J=2-4]

- J0k. There is a variety of reasons why people replace their existing systems. How important of a reason for you was the fact that your system might be reaching the end of life and might fail in the near future? Please use a scale of 1 to 5 where 1 is not at all important and 5 is very important?
(ANSWER ON SCALE 1-5)
8. (Don't know)
 9. (Refused)

J01. Why did you decide to install the HIGH EFFICIENCY <MEASURE>? [ENTER ALL THAT APPLY]

01. (Old equipment could not be repaired)
02. (Old equipment was too old and not worth fixing)
03. (Repairs required to fix the old equipment were too high)
04. (To increase efficiency level)
05. (Wanted to add A/C/heating to house/room)
06. (Part of a new addition to the house)
07. (I thought the rebate might not be there when my unit failed in the future)
08. (Contractor indicated the unit would fail soon.)
00. (Other, specify)
98. (Don't know)
99. (Refused)

Now I would like to ask you some questions about what motivated you to install the HIGH EFFICIENCY <MEASURE> through the <PROGRAM> program.

[READ IF E5=1] Again, when answering the following questions, please think about your decision to install HIGH efficiency <MEASURE> instead of less efficient <MEASURE>, and not about your decision to convert from oil to gas.

J1. When did you learn about the rebate? Was it before you installed the high efficiency <MEASURE> or after you installed it?

01. Before installed equipment
02. After installed equipment
00. (Other, specify)
98. (Don't know)
99. (Refused)

[ASK IF J1=2]

J1a. Just to be clear, did you install your <MEASURE> and then later learn that you could receive a rebate?

1. Yes [SKIP TO Q10]
2. No
8. (Don't know)
9. (Refused)

J13. Before learning about the <PROGRAM> program, were you already planning on installing the <MEASURE>, of ANY efficiency level?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF J13=1]

J13a. And, before learning about the <PROGRAM> program, were you already planning on installing the HIGH EFFICIENCY <MEASURE>?

1. Yes
2. No
8. (Don't know)
9. (Refused)

J2. Did the availability of the rebate cause you to install your high efficiency <MEASURE> EARLIER than you were planning or did it have no influence on when you installed it?

1. Installed earlier because of the rebate
2. Did not change when installed
3. (Would not have installed the equipment at all without rebate)
8. (Don't know)
9. (Refused)

[ASK IF J2=3]

J2a. Just to confirm, if the rebate had not been available, you would not have installed the <MEASURE> at all, is that correct?

1. Yes [SKIP TO Q10]
2. No
8. (Don't know)
9. (Refused)

[ASK IF J2=1]

J5. If you had not received the rebate, when would you have installed the high efficiency <MEASURE>?

1. Within 6 months
2. Between 6 months and a year later
3. More than a year later
8. (Don't know)
9. (Refused)

[ASK IF QTY>1]

J6. If you had not received the rebate, would you still have installed <QTY> HIGH EFFICIENCY <MEASURE> or would you have installed fewer?

1. Same quantity
2. Fewer
3. (Would not have installed measure at all)
8. (Don't know)
9. (Refused)

[ASK IF J6=3]

J6a. Just to confirm, if the rebate had not been available, you would not have installed the <MEASURE> at all, is that correct?

1. Yes [SKIP TO Q11]
2. No
8. (Don't know)
9. (Refused)

[ASK IF J6=2]

- J7. How many high efficiency <MEASURE> would you have installed?
(NUMERIC OPEN END)
998. (Don't know)
 999. (Refused)

- J9. On a scale of 1 to 5 where 1 is not at all influential and 5 is very influential, how influential was each of the following on your decision to install the high efficiency <MEASURE>?
- a. Program rebate
 - b. Salesperson or contractor recommendations
 - c. Information from your utility or Mass Saves marketing materials or websites

(ANSWER ON SCALE 1-5)

8. (Don't know)
 9. (Refused)
- J10. If the <PROGRAM> program had not been available, what is the likelihood that you would still have installed the SAME efficiency <MEASURE>? Please use a scale of 1 to 5 where 1 is not at all likely and 5 is very likely.
(ANSWER ON SCALE 1-5)
8. (Don't know)
 9. (Refused)

[ASK IF (J9A, B, OR C=4 OR 5 AND J10=4 OR 5) OR (J9A, B, OR C=1 OR 2 AND J10=1 OR 2)]

- J11. Just to make sure I understand, please explain the importance of the rebate you received through the <PROGRAM> program on your decision to install the <MEASURE>?
(OPEN END)

[ASK IF A10=1]

- J12. You mentioned earlier that you received the rebate through the <PROGRAM> program AND a government tax credit or rebate for the installation of high efficiency <MEASURE>. Using a scale of 1 to 5, where 1 is not at all likely and 5 is very likely, how likely is it that you would have installed the same efficiency <MEASURE> had neither tax rebates or credits NOR the <PROGRAM> rebate been available?
(ANSWER ON SCALE 1-5)
8. (Don't know)
 9. (Refused)

Quality Installation

[ASK OF COOL SMART PROGRAM PARTICIPANTS, ELSE SKIP TO Q15]

As part of the CoolSmart program, additional rebates are available for proper installation and testing of <MEASURE>.

QI0. Were you aware of the existence of this additional rebate when you were installing your high efficiency <MEASURE>?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[SKIP IF QI0<>1]

QI1. Do you remember receiving an additional \$150 rebate for proper installation and testing of the <MEASURE>?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[SKIP IF QI0<>1]

QI2. How did you learn about this additional rebate?

01. (Mass Save website)
02. (Contractor)
03. (Rebate application form)
00. (Other, specify)
98. (Don't know)
99. (Refused)

[SKIP IF QI0<>1]

QI3. Did your contractor offer to perform the additional tests that would qualify your <MEASURE> for an additional rebate or did you ask your contractor for this additional service yourself?

01. Contractor offered service
02. Asked for service myself
00. (Other, specify)
98. (Don't know)
99. (Refused)

[ASK IF QI1<>1]

QI4. Why did you decide NOT to have your <MEASURE> go through additional testing to receive the additional rebate?
(OPEN END)

QI5. How familiar are you with what proper installation of <MEASURE> means? Would you say you are very familiar, somewhat familiar, not very familiar, or not at all familiar?

1. Very familiar
2. Somewhat familiar
3. Not very familiar
4. Not at all familiar
8. (Don't know)
9. (Refused)

[ASK IF QI5=1,2]

QI6. Please tell me what you think proper <MEASURE> installation includes? [PROBE IF NEEDED: WHAT TYPE OF ADDITIONAL WORK DO YOU THINK NEEDS TO BE PERFORMED TO ENSURE PROPER INSTALLATION?]

[ASK IF A4=1 OR A1=1]

QI7. Did your contractor discuss the size of your <MEASURE> with you?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF QI7=1 AND J0A=1]

QI8. Did your contractor recommend you put in a replacement system that was larger, the same size, or smaller than your previous unit?

1. Larger
2. Same size
3. Smaller
8. (Don't know)
9. (Refused)

Demographics

We're almost finished. I just have a few questions about your household.

- D1. What type of residence do you live in? [\[READ CATEGORIES\]](#)
- 01. Single-family
 - 02. Duplex or two-family
 - 03. Apartment/condo in a 2-4 unit building
 - 04. Apartment/condo in a >4 unit building
 - 05. Townhouse or row house (adjacent walls to another house)
 - 06. Mobile home, house trailer
 - 00. (Other, specify)
 - 98. (Don't Know)
 - 99. (Refused)
- D2. Approximately, when was this home first built? [\[READ LIST IF NEEDED\]](#)
- 01. (Before 1950)
 - 02. (Between 1950 and 1959)
 - 03. (Between 1960 and 1969)
 - 04. (Between 1970 and 1978)
 - 05. (Between 1979 and 1988)
 - 06. (Between 1989 and 2001)
 - 07. (Between 2002 and 2007)
 - 08. (2008 or later)
 - 98. (Don't Know)
 - 99. (Refused)
- D3. What is your home's primary heating fuel? [\[PROMPT IF NECESSARY\]](#)
- 01. (Gas)
 - 02. (Propane)
 - 03. (Fuel oil)
 - 04. (Kerosene)
 - 05. (Coal)
 - 06. (Wood)
 - 07. (Pellet wood)
 - 08. (Electricity)
 - 00. (Other, specify)
 - 98. (Don't Know)
 - 99. (Refused)
- D4. In what year were you born?
(NUMERIC OPEN END)
- 9998. (Don't Know)
 - 9999. (Refused)

- D5. What is the highest level of education you completed?
1. Less than a high school diploma
 2. Completed high school diploma or equivalent (GED)
 3. Some college
 4. Completed a 2 year or technical degree/certification
 5. Completed a 4 year degree
 6. Graduate or professional degree
 8. (Don't Know)
 9. (Refused)

This completes the survey. Your responses are very important to <PA> and will help as they design future energy efficiency programs. We appreciate your participation and thank you for your time. Have a good evening.