

Heating and Cooling Early Retirement Net-to-Gross (RES 36)

Revised Final Report

Prepared for:

The Electric and Gas Program Administrators of Massachusetts
Part of the Residential Evaluation Program Area

Submitted by:
Navigant Consulting, Inc.
1375 Walnut Street
Suite 100
Boulder, CO 80302

303.728.2500
navigant.com

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EXECUTIVE SUMMARY

The evaluation team (ILLUME Advising, Navigant, and Cadeo) developed the following evaluation report for the Massachusetts Program Administrators (the PAs) and the Energy Efficiency Advisory Council (EEAC) consultants. This report provides net-to-gross (NTG) estimates for the Early Retirement HVAC program and additional context and process findings from research with participants, HVAC contractors, and energy specialists who provide Home Energy Assessments.

Evaluation Objectives and Methodology

Through the Home Energy Services (HES) and Cooling & Heating Initiatives, residential customers are eligible to receive incentives for the early retirement of their heating and cooling equipment. To qualify for the rebate, customers are required to receive a Home Energy Assessment. For early replacement of central air conditioners or heat pumps, customers can meet with an Airflow and Charge (AC) Check trained contractor.

The minimum age requirement, efficiency of new equipment, and rebate values vary by measure and fuel type, which includes electric, natural gas, and delivered fuels. These Early Retirement rebates are 2-3 times greater than the Standard program rebates, which assumes the customer replaces their equipment on failure.

The primary goal of this research was to inform the 2019-2021 planning cycle with NTG estimates for the Early Retirement offerings. While not a primary objective, the research also elicited process-related data and participants' subjective assessment of equipment condition and remaining useful life.

Evaluation Activities

In coordination with the PAs, the EEAC, and the Massachusetts cross-cutting evaluation team, the evaluation team developed an approach to assess net savings from the Early Retirement HVAC program. The previously delivered memo, *RES36 Early Retirement HVAC NTG Analysis Plan and Survey Development* documents the survey and analysis methodology and is included in Appendix A.

Following the established work plan, the evaluation team fielded three primary research efforts:

1. Participant survey
2. Contractor survey
3. Lead vendor/home performance contractor energy specialist survey

The evaluation team used participant survey results to develop free ridership (FR) estimates, NTG, and assessments of equipment condition and age. The contractor and energy specialist surveys provided context and process findings, but do not directly impact the net savings results. As agreed with the PAs and EEAC in planning stages, NTG results encompass free ridership only; the NTG ratio does not include spillover due to the nature of the program design which likely limits spillover. Therefore, NTG is estimated in this report at a measure level and overall, expressed as:

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

Findings and Recommendations

Below are the overall net-to-gross results by measure and fuel type.

Table 1. Net-to-Gross Results: Non-Electric (n=433)

Gas, Propane, and Oil-Fueled Measures	Completed Surveys	Preliminary NTG Results	Measure Level Relative Precision at 90% Confidence	Combined NTG Results	Overall Relative Precision at 90% Confidence
Furnace	150	86.6%	8.3%		
Hot water boiler (owner-occupied)	147	88.8%	7.7%	88.2 %	4.6%
Hot water boiler (non-owner-occupied)	44	89.5%	12.6%		
Steam boiler	92	86.9%	10.1%		

Source: Participant survey, net-to-gross battery

Table 2. Net-to-Gross Results: Electric (n=95)

Electric Measures	Completed Surveys	Preliminary NTG Results	Measure Level Relative Precision at 90% Confidence	Combined NTG Results	Overall Relative Precision at 90% Confidence
Central air conditioner	76	88.1%	10.9%		
Central heat pump (SEER >= 16, HSPF >= 8.5)	13	75.2%	38.2%	84.5%	11.3%
Central heat pump (SEER >= 18, HSPF >= 9.6)	6	78.3%	54.8%		

Source: Participant survey, net-to-gross battery NTG results were slightly lower for electric measures overall, and specifically for heat pumps (although it should be noted the sample size for heat pumps was small and precision low). Overall, these findings indicate the program is highly effective at encouraging customers to replace their old but working HVAC equipment before it fails.

Finding 1: Overall, NTG for the Early Retirement HVAC program is high. Across measures, the evaluation team found that the Early Retirement HVAC program is highly influential in customer decision-making to replace old but functioning equipment before it fails. Overall, NTG was 88% for non-electric measures and 85% for electric measures.

Finding 2: Participants reported that both HVAC contractors and energy specialists who provide Home Energy Assessments are influential in their decision to participate in the program. In general, participants reported that both their contractor and their experience with the Home Energy Assessment influenced their decision to participate in the program. Participant survey results indicate that contractors may be somewhat more involved than energy specialists in the actual specification and recommendation of specific equipment to install, but also commonly indicated that Home Energy Assessments are trusted sources of information for their decision, and may be where customers learn about other offerings, such as the HEAT loan.

Finding 3: A key motivation for customers to participate in the program is a desire to eliminate the risk of equipment failing at an inopportune time. The anxiety at the thought of their HVAC system failing at a bad time—such as in the middle of a cold winter—emerged as a key message that resonated with participants. In open-ended responses describing program influence, participants sometimes mentioned hearing this message from their HVAC contractors as a means of encouraging them to take advantage of the Early Retirement HVAC program. Contractors and energy specialists both mentioned this message as an effective motivator to participation.

***Recommendation:** Continue to promote the program benefit of eliminating the risk of equipment failure, in marketing and messaging through contractors and Home Energy Assessments.*

Finding 4: The various components of the Early Retirement HVAC program, including Mass Save marketing and HEAT loan offerings, all appear to be working well together to influence program participation. Both contractors and Home Energy Assessments appear to be educating and influencing customers to replace their equipment early through the program. However, when asked to describe the influence of the program, participants frequently reported complex decision-making processes that included multiple points of contact and several services. For some customers, the HEAT loan was a key influence to replace their equipment early. However, it does not appear that one factor is especially influential; rather, the combination of offerings of the Early Retirement HVAC program appears to be working together well to influence customer decision-making.

***Recommendation:** Continue to encourage both contractors and energy specialists to promote the HEAT loan offering to eligible customers, as this appears to be a key decision-making influence for some customers.*

Finding 5: Contractors report that some customers replace HVAC systems before failure outside of the program, most frequently because customers do not want to wait for a Home Energy Assessment. While the evaluation team did not quantify nonparticipant spillover, the evaluation team did explore whether contractors report customers replacing their HVAC equipment before failure outside the program, and, if so, why this occurs. Most frequently, contractors reported that installations occurring outside the program happen because customers do not want to wait for a Home Energy Assessment. However, it is unclear if that is because their equipment is closer to failing (and therefore actually ineligible for the program) or because customers simply do not want to wait for an assessment.

***Recommendation:** Consider exploring the prevalence of nonparticipating customers replacing their HVAC equipment early in more detail in future research to better understand the extent to which waiting for a Home Energy Assessment is limiting participation as well as the existence of spillover.*

Finding 6: Based on customer self-report of equipment age and condition, the evaluation team estimates that 37% of equipment rebated through the Early Retirement program should actually be categorized as replace-on-failure. The Early Retirement program seeks to incentivize the replacement of old, inefficient equipment that is still functioning well. The MA TRM¹ assumes a remaining useful life for the old replaced equipment to be between 6 to 10 years. Using an algorithm adapted from

¹ <http://ma-eeac.org/wordpress/wp-content/uploads/2016-2018-Plan-1.pdf>

the 2012 HVAC evaluation report², the evaluation team categorized participants into two “replacement types:” early replacement (ER), or replace-on-failure (ROF). Participants who fell into the ROF category indicated that their old equipment was in poor working condition, needed many repairs, and/or would not have continued working much longer. This information impacts the gross savings that the program claims for the Early Retirement program.

Recommendation: *Incorporate the results from the replacement type analysis into future program planning and gross savings estimations.*

² http://ma-eeac.org/wordpress/wp-content/uploads/2012-Residential-Heating-Water-Heating-and-Cooling-Equipment-Evaluation_Net-to-Gross-Market-Effects-and-Equipment-Replacement-Timing-Volume-I-June-2013.pdf

1. INTRODUCTION

Through the Home Energy Services (HES) and Cooling & Heating Initiatives, residential customers are eligible to receive incentives for the early retirement of their heating and cooling equipment. To qualify for the rebate, customers are required to receive a Home Energy Assessment, or for early replacement of central air conditioners or heat pumps, they can meet with an Airflow and Charge (AC) Check trained contractor.

The minimum age requirement, efficiency of new equipment, and rebate values vary by measure and fuel type. Table 3 details the requirements and rebate values for these measures. The Early Retirement rebates are 2-3 times greater than the Standard program rebates, which assumes equipment is replaced on failure.

Table 3. Early Retirement Heating and Cooling Measures

Fuel Type	Equipment Type	Minimum Age	Efficiency Requirement	Rebate Amount
Natural Gas	Natural gas furnace with ECM blower	12 years	AFUE ≥95%	\$1,000
	Hot water boiler, owner-occupied	30 years	AFUE ≥90%	\$3,000
	Hot water boiler, non-owner-occupied	30 years	AFUE ≥90%	\$3,500
	Steam boiler	30 years	AFUE ≥82%	\$1,900
Electric	Central air conditioning	12 years	SEER≥16, EER≥13	\$750
	Central heat pump	12 years	SEER≥16, HSPF≥8.5	\$750
	Central heat pump	12 years	SEER≥18, HSPF≥9.6	\$1,000
Oil	Furnace with ECM blower	12 years	AFUE ≥86%	\$750
	Forced hot water boiler	30 years	AFUE ≥86%	\$1,700
	Steam boiler	30 years	AFUE ≥84%	\$1,900
Propane	Furnace with ECM blower	12 years	AFUE ≥95%	\$1,000
	Hot water boiler, owner-occupied	30 years	AFUE ≥90%	\$3,000
	Hot water boiler, non-owner-occupied	30 years	AFUE ≥90%	\$3,500
	Steam boiler	30 years	AFUE ≥82%	\$1,900

Source: Mass Save website (<https://www.Mass Save.com/en/saving/residential-rebates/early-heating-and-cooling>)

1.1 Study Objectives

The primary goal of the study’s research is to inform the 2019-2021 planning cycle with net-to-gross (NTG) estimates for the Early Retirement offering. Table 4 lists the research questions that were vetted and agreed upon at the outset of the project.

Table 4. Research Questions for Evaluation

Research Questions
What is the overall net-to-gross (NTG) of the Early Retirement heating and cooling rebate offerings?
How does NTG vary by equipment type, Home Energy Assessment contractor type, and other variables, if at all?
Are there specific measures where the program is more or less influential in encouraging early retirement of equipment?
How influential are specific elements of the program (e.g., Home Energy Assessment information/recommendations, incentive, etc.)?
How influential are these program offerings affecting a) timing of equipment replacement, and b) efficiency of replacement equipment, overall and compared with the non-early replacement option?
What portion of customers engaged with the Home Energy Assessment or AC Check after learning about the rebate requirements? For these customers, did the Home Energy Assessment or AC Check change their plans?
What is the age of equipment being replaced within the program and remaining effective useful life?
How does the equipment age replaced through the program compare to the market?

Source: Stage 3 RES36 Plan

In addition to these questions that were determined at the beginning of the planning process, later in the evaluation process the EEAC and PAs also identified a need to understand the incidence of equipment rebated through the program that may actually be closer to failure. Although this question primarily addresses gross impacts, this was added to the research questions addressed by this research:

- What proportion of program participants replaced equipment that is actually close to failure?

1.2 Summary of Evaluation Activities

In coordination with the Massachusetts Program Administrators (PAs), the Energy Efficiency Advisory Council (EEAC), and the Massachusetts cross-cutting evaluation team, the evaluation team developed an approach to assess net savings resulting from the Early Retirement HVAC program. The previously delivered memo, *RES36 Early Retirement HVAC NTG Analysis Plan and Survey Development* documents the survey and analysis methodology and is included in this report as 2.6.3 Appendix A.

Following the established work plan, the evaluation team fielded three primary research efforts:

1. Participant survey
2. Contractor survey
3. Lead vendor/home performance contractor energy specialist survey

The evaluation team used participant survey results to develop equipment replacement type, free ridership, NTG estimates. The contractor and LV/HPC surveys provided context and process findings, but do not directly impact the NTG value. As agreed with the PAs and EEAC in planning stages, NTG results encompass free ridership only; the NTG ratio does not include spillover.

1.2.1 Customer Survey

In January and February 2018, the evaluation team fielded a survey with Early Retirement HVAC program participants who participated in the program between July 2016 and July 2017. The survey period closed on February 16, 2018. Table 5 details the number of targeted and completed surveys by measure.

Table 5. Sample Targets and Completed Surveys

Measure	Target Survey Completes	Final Survey Completes
Furnace	160	150
Hot Water Boiler, owner-occupied	160	147
Hot Water Boiler, non-owner-occupied*	50	44
Steam Boiler*	120	92
Central air conditioning	80	76
Central heat pump (SEER >= 16, HSPF >= 8.5)*	12	13
Central heat pump (SEER >= 18, HSPF >= 9.6)*	11	6
Total	593	528**

**For these measures, the evaluation team took a census of all available sample points.*

***16 cases were dropped from the analysis because their equipment was not functioning at the time of replacement, making them ineligible for the program, and nine cases were dropped because of inconsistent responses.*

Source: Early Retirement tracking data, sample, and survey completes

1.2.1.1 Sampling

For measures with enough available sample, the evaluation team sought to achieve a minimum of 90/10 confidence and precision at the measure level for free ridership calculations. For the groups in Table 6 with limited sample, the evaluation team took a census of all available sample. The participant completes were increased slightly to attempt to capture sufficient sample to analyze differences by other variables. The furnace and boiler stratifications included all fuel types (natural gas, oil, and propane) and were sampled proportionally to the measures installed (Table 7).

Table 6. Proposed Sampling Strategy

Equipment Type	Population	Estimated Sample Size	Targeted Survey Completes	Population after Removing Do-Not-Call List	Actual Sample Size*	Targeted Survey Completes	90/10
Furnace with ECM blower	2,360	800	160	2,219	802	160	Yes
Hot water boiler, owner-occupied	3,748	800	160	3,568	799	160	Yes
Hot water boiler, non-owner-occupied	264	264	54	251	251	50	Yes, census
Steam boiler	641	641	128	602	602	120	Yes, census
Central air conditioning	1,175	400	80	1,107	360	80	Yes
Central heat pump (SEER≥16, HSPF≥8.5)	67	67	16	59	59	12	No, census
Central heat pump (SEER≥18, HSPF≥9.6)	68	68	17	56	56	11	No, census
Total	8,323	3,040	615	7,862	2,929	593	Yes

Source: Early Retirement tracking data, sample, and survey completes

Table 7. Fuel Type Distribution for Installed Measures in Population

Measure	Total	Natural Gas		Oil		Propane	
		Number of Customers	Percent	Number of Customers	Percent	Number of Customers	Percent
Furnace with ECM blower	2,360	1,934	82%	370	16%	56	2%
Hot water boiler	4,012	2,266	56%	1,706	43%	40	1%
Steam boiler	641	335	52%	305	48%	1	0%

Source: Early Retirement tracking data, sample, and survey completes

1.2.1.2 Survey Methodology

1.2.1.3 Free ridership and Net-to-Gross

The participant surveys included questions about the decision-making processes involved in replacing older, but functioning, HVAC equipment. Specifically, the NTG algorithm for this program focuses on the

timing of their decision given the importance of the decision to replace their equipment early in the design of the program. The full algorithm, including survey questions, is included in Appendix A. However, a few key questions from the survey battery are included below:

Key questions for timing:

- **D2.** If you had not participated in the program, when would you have replaced your [Measure]? Would it have been...(READ LIST)?
 - While it was still working reasonably well
 - When it began to have more major issues, or repairs were too costly or extensive, or
 - After it stopped working completely and became unrepairable
- **D8.** If you had not received the rebate, or recommendation from your contractor or home energy assessor, when would you have installed the [MEASURE]? Would it have been...(READ LIST)?
 - Within 6 months
 - Between 6 months and a year later
 - More than a year later

Key question for efficiency:

- **D11.** If you had not participated in the program, what level of efficiency do you think you would have installed when you replaced your [MEASURE]? Would it have been...(READ LIST)?
 - Higher efficiency
 - The same efficiency
 - A lower efficiency

Key questions for influence:

- **D14.** How influential was..... on the timing/efficiency of your decision?
 - The program rebate
 - Your contractor's recommendations
 - Information from your [ASSESSMENT]
 - Information from your utility or Mass Save marketing material or website
 - Previous experience with Mass Save programs
 - [IF STANDARD = 1] the rebate you received for another piece of equipment

The analysis calculated NTG results at the project level and assigned an NTG ratio to individual project level savings. These were then aggregated to the measure level, and further aggregated to the program level. Final NTG estimates are weighted by the proportion of savings to the reported overall net electric and non-electric savings. Prior to weighting, the overall net and gross savings values were adjusted to account for the appropriate assigned savings based on participant replacement type calculations. More information on this methodology is discussed in Section 2.2.2 below.

For non-owner-occupied boilers, the participant may be a landlord or property owner who owns multiple accounts. To address this, the evaluation team first reviewed the sample to determine if the participant was listed on multiple projects. Then, the evaluation team asked the respondent several questions to clarify the decision-making process across properties, and the results were used to populate the respondent's linked accounts.

As noted above, the evaluation team did not assess spillover for this evaluation. This was due to the PAs, EEAC, and evaluation team assessment that 1) program design would likely limit nonparticipant spillover (discussed in more detail in Section 2.5.3) and 2) like and unlike participant spillover would likely be

minimal. If desired, the program could explore the prevalence of unlike participant spillover in future evaluations.

1.2.1.4 Replacement Type Categorization

To assess the prevalence of equipment that was close to failure replaced through the Early Retirement program, the evaluation team characterized customers as early retirement or replace-on-failure using the following participant survey questions:

- Which describes the condition of your old equipment? (Working well, needed minor repairs, needed some repairs, needed major repairs, was not working at all)
- Prior to replacing your old system, had it undergone any repairs?
 - [IF YES] Approximately how many times did you have to repair the old system the year prior to replacement?
- How many years do you think your old system would have lasted?

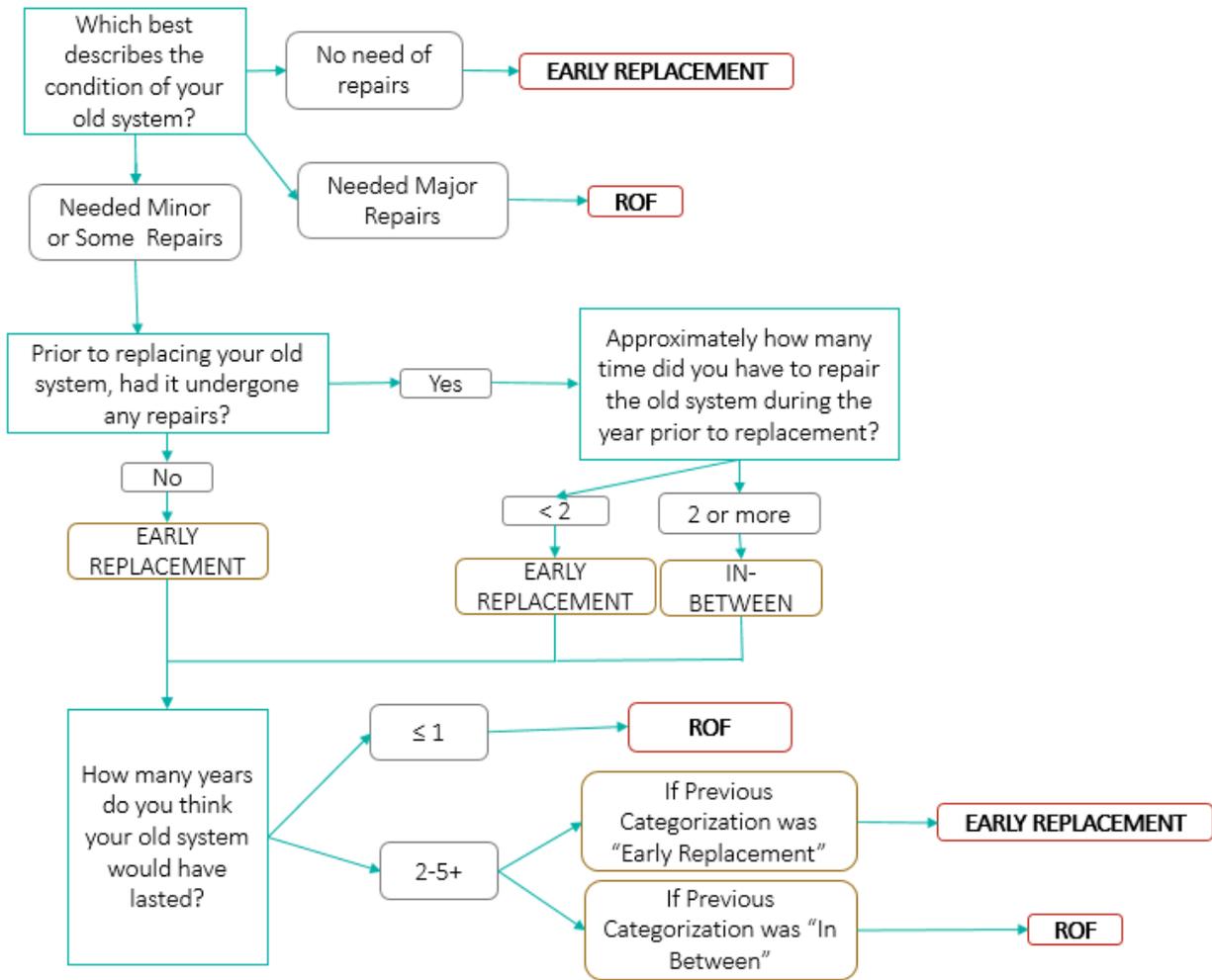
The 2012 HVAC net-to-gross evaluation³ considered the issue of replace-on-failure and early replacement and developed an algorithm to assign customers into replacement type groups using similar questions. The evaluation team referenced and incorporated this approach, making two main adjustments to the 2012 approach:

- The 2012 HVAC net-to-gross approach included the question “How important was the fact that your system might be reaching the end of life and might fail in the near future?” in the algorithm. The team excluded this question. Interviews with contractors identified that they use messaging that the equipment is coming close to the end of its useful life as a strong, and effective, marketing tactic. Open-ended responses in the participant surveys substantiated this finding. Therefore, the evaluation team is concerned that customers’ responses to this question could be reflective of the messaging, and in itself does not necessarily indicate that the equipment *truly* was at the end of its useful life.
- The prior study included an “in-between” category. The evaluation team, EEAC, and PAs agreed it would be ideal to have as few respondents in this category as possible. The evaluation team adjusted categorizations within the algorithm to more definitively assign respondents into either “replace-on-failure” and “early replacement” to reduce ambiguity.

These adjustments were discussed as a group and approved on June 7, 2018. Figure 1 below shows the final approach to replacement type categorization. Appendix E details both the original and adjusted approach to highlight the edits made to the categorization approach for this analysis.

³ http://ma-eeac.org/wordpress/wp-content/uploads/2012-Residential-Heating-Water-Heating-and-Cooling-Equipment-Evaluation_Net-to-Gross-Market-Effects-and-Equipment-Replacement-Timing-Volume-I-June-2013.pdf

Figure 1. Replacement Type Categorization Approach



1.2.2 HVAC Contractor Survey

The evaluation team fielded surveys with 82 HVAC contractors who installed Early Retirement HVAC projects in 2016 and 2017. This survey was intended to provide high level context and process information on contractor perceptions of the effectiveness of the program. Due to considerable overlap in contractors who participate in both Standard and Early Retirement HVAC programs, the evaluation team combined the Early Retirement survey with the Massachusetts cross-cutting evaluation team TXC34 Standard HVAC contractor survey and fielded them together.

1.2.2.1 Sampling

As shown in Table 8, the evaluation team assigned contractors to participation strata based on the total number of projects they completed in 2016. The majority of the high-to-medium engaged trade allies submitted both Standard and Early Retirement rebates in 2016. The Standard and Early Retirement

HVAC teams sought to complete contractor surveys with the majority of high and medium engagement contractors, and supplemented with the larger population of low engagement contractors.

Table 8. Contractor Population by Number of Projects

	Number of Contractors per Stratum			Total
	Low Number of Projects (1-9)	Medium Number of Projects (10-49)	High Number of Projects (50+)	
Standard HVAC only	1,949	60	7	2,016
Early Retirement HVAC only	758	9	0	767
Standard and Early Retirement only	536	250	65	851
Standard, Early Retirement, and Commercial	37	41	19	97
Standard and Commercial only	59	5	2	66
Early Retirement and Commercial only	14	0	0	14
Total	3,353	365	93	3,811

Source: HVAC Contractor tracking data

1.2.2.2 Survey Methodology

Surveys were fielded from December 2017 to January 2018 and were conducted as a mixed mode survey with both online and telephone versions of the survey. As the Early Retirement HVAC contractor survey was fielded with the Standard HVAC contractor survey, the evaluation team monitored measure and fuel type coverage for the Early Retirement questions by contractor during survey fielding. The evaluation teams also stratified contractors by engagement level, using the number of projects they submitted in 2016. Table 9 shows the number of high, medium, and low engagement level contractors who completed surveys for the Early Retirement HVAC program.

Table 9. Contractor Survey Completes by Participation Level

Participation Level	Number of Contractors (Combined Standard/Early Retirement Projects)	Number of Contractors (Early Retirement Projects Only)
High (50+)	15	2
Medium (11-49)	23	16
Low (1-10)	44	64
Total	82	82

Source: Navigant analysis

The contractor surveys were intended to provide high level context, and included questions on:

- Scoping and recommendation process related to the Home Energy Assessment

- Influence of the Early Retirement HVAC program on customer decision-making
- Indications of early retirements happening outside of the program
- Perceptions on fuel-switching

1.2.3 Lead Vendor/Home Performance Contractor Energy Specialist Survey

The evaluation team completed surveys with energy specialists who provide Home Energy Assessments, both at LV and non-LV companies. The purpose of these surveys was to better understand the recommendation and scoping process for the Early Retirement HVAC program, and to gather context and feedback from energy specialists on the influence of the Early Retirement HVAC program on customer decision-making.

1.2.3.1 Sampling

The evaluation team identified an available population of approximately 355 total energy specialists. The evaluation team was able to initially identify contact information for 161 of the 355 identified. For those missing contact information, the evaluation team conducted lookups⁴ to search for additional contact information. The PAs also provided an updated list of email addresses for some of the LV energy specialists, which was incorporated into the survey fielding midstream. Given the population size and availability of contact information, the evaluation team took a census of all available energy specialists.

1.2.3.2 Survey Methodology

The energy specialist surveys were fielded via web survey (email invite) from January to February 2018. The evaluation team sent an initial email invite and two follow-up email invites, and was able to complete surveys with 36 energy specialists. Table 10 details the LVs/other firms that completed the survey.

Table 10. Energy Specialist Survey Completes by Company

Company	Count
CLEARresult (LV)	19
RISE Engineering (LV)	7
Other Contractors	10
Total	36

Source: Navigant analysis

The energy specialist surveys were intended to provide insight into customer eligibility and the decision-making process. Topics explored in this survey included:

- How energy specialists determine customer eligibility
- What situations an energy specialist would recommend early retirement as high or low priority

⁴ The team attempted to construct email addresses for lead vendor firms with known email structures (such as CLEARresult) where those emails were missing.

- The role of the HVAC contractor in making recommendations, compared to the role of the Home Energy Assessment
- What difference equipment type makes in program uptake, if any
- Perspectives on the effectiveness of the program in influencing decision-making

2. FINDINGS

This section includes detailed results for the participant, contractor, and energy specialist research completed by the evaluation team.

2.1 Summary Results by Research Questions

What is the overall NTG of the Early Retirement heating and cooling rebate offerings?

The evaluation team found high overall NTG results for the Early Retirement HVAC program, with an electric NTG ratio of 85% and a non-electric (gas, oil, and propane) NTG of 88%.

How does NTG vary by equipment type, Home Energy Assessment contractor type, and other variables, if at all?

The evaluation team found consistent NTG results across numerous variables, with NTG ratios for most measures between 87% and 90%. The evaluation team found slightly lower NTG ratios specifically, for heat pumps, at 75% to 78% (although it should be noted that this sample size is small, and this difference is not statistically significant). NTG remained similar across groups when examining other variables, including demographics.

Are there specific measures where the program is more or less influential in encouraging early retirement of equipment?

NTG results across measures were consistently high, with no statistically significant differences between measure level results. The evaluation team did find that NTG results for heat pumps were slightly lower as noted above (however, this measure had a small sample size and was not statistically significant). Additional sample would be needed to determine if the program is indeed less influential for this measure. Qualitatively, some contractors felt that the Early Retirement rebates are more effective at encouraging the early retirement of heating measures due to a desire to not be without heat in the winter. However, overall, the program appears to be effectively influencing the early retirement of all included measures.

How influential are specific elements of the program (e.g., Home Energy Assessment information/recommendations, rebates, etc.)?

Participants frequently mentioned that there were numerous influential factors in their decision, which highlights this program's complex decision-making process. Participants frequently mentioned both their HVAC contractor and their Home Energy Assessment energy specialist as very influential, and other factors including Mass Save outreach or marketing. The 0% interest HEAT loan was frequently mentioned as a key factor that swayed customer decision-making, especially in combination with the Early Retirement rebate. It does not appear that one factor is especially influential; rather, the combination of offerings of the Early Retirement HVAC program appears to be working together well to influence customer decision-making.

How influential are these program offerings affecting a) timing of equipment replacement, and b) efficiency of replacement equipment, overall and compared with the non-early replacement option?

Based on participant responses, the program appears to be highly influential in the timing of customer decisions, which aligns with the design of the program. Most participants stated that without the program, they would have waited until their equipment needed major or costly repairs, or failed completely, to replace it (78%). When participants were asked what the likelihood was that they would have installed the same high efficiency measure if they had waited until their old equipment failed and they received a lower

rebate, most said they would still be somewhat likely install the same efficiency measure (an average rating of 7.3 out of 10). Additionally, participants rated their contractor as somewhat more influential in their decision to install the level of efficiency they did, compared to their Home Energy Assessment. This indicates that the Early Retirement HVAC program is likely at least equally as effective at influencing the installation of high efficiency measures as the Standard HVAC program, and that the incremental increase in rebate and other program factors may be most effective at influencing the timing of the installation. Open-ended responses highlight the complex decision-making process for customers, and the timing and efficiency decisions are sometimes entwined in customer decision-making.

What portion of customers engaged with the Home Energy Assessment or AC Check after learning about the rebate requirements? For these customers, did the Home Energy Assessment or AC Check change their plans?

About half of participants first learned of the program from their contractor, prior to engaging in an HEA or AC Check, as reported by survey respondents, contractors, and energy specialists. For customers who hear about the program first from their contractor, the Home Energy Assessment appears to be a confirmation of their understanding from a trusted source, and may be where they hear about additional important decision-influencing factors, such as details on the 0% HEAT loan.

What is the age of equipment being replaced within the program and remaining effective useful life?

The tracking data utilized by the evaluation team did not track age of replaced equipment, so this analysis relied on participant self-report for age and condition. Across measures, participants reported the age of their old, replaced equipment to be 31 years old. Generally, the self-reported age and condition of equipment rebated through the Early Retirement HVAC program aligns with program requirements by measure. Most participants (64%) reported their equipment as being in either good condition or only needing minor repairs. However, a small proportion of customers stated their equipment was not working at all when they participated (3%). Additionally, 14% of hot water boiler participants reported their equipment was less than 30 years old. However, these results should be interpreted with caution given known inaccuracies in homeowner's self-reporting of equipment condition, and especially equipment age for home systems. These results may be worth exploring via more in-depth research, such as Home Energy Assessment ride-alongs or additional QA/QC. More discussion on how this information impacts replacement type characterization is included below.

How does the age of equipment being replaced through the program compare to the market?

The evaluation team reviewed results from the RES1 Baseline research to explore the average age of various HVAC measure types in Massachusetts. As expected, the average age of equipment replaced through the program (self-reported by participants) is considerably older than the reported age of equipment existing in the market. While question categories in the RES1 research did not align exactly with Early Retirement HVAC program requirements, the evaluation team found that, especially for boilers and oil-fueled furnaces, at least one-fifth of the baseline survey respondents said they had working equipment at least 20 years old or older. As the baseline research is supposed to be representative of the general population, these results indicate there is a relatively robust market for this program.

What proportion of program participants are replacing equipment that is actually close to failure?

While the program seeks to rebate equipment that is old but would have kept functioning for years to come, some customers reported that they felt their equipment was close to failure. This information impacts the gross savings claimed by the program. Although this analysis primarily examined net savings, the evaluation team also used these customer self-reports to categorize participants as either true early replacement (ER) or replace-on-failure (ROF) to help inform future planning. The evaluation team found

that 37% of respondents were actually classified as replace-on-failure, meaning their equipment was in poor condition, had been repaired frequently, and/or the respondent did not expect their equipment to last much longer. The remaining 63% were early replacement, meaning their equipment was in good condition and/or expected to last several more years.

2.2 Assessing Replace-On-Failure Prevalence Within the Early Retirement Program

Understanding the remaining useful life of the equipment is important for early retirement programs given the program claims a higher savings assuming a dual baseline. Under the theory that the program encourages older, less efficient equipment to be removed prior to its failing, the program claims a higher savings for the assumed remaining useful life period of that equipment (difference between the existing and high-efficiency equipment use), then adjusting to a traditional baseline calculation for the remainder of the efficient equipment's useful life (difference in standard and high efficiency equipment).

The gross savings, as defined through the 2016 – 2018 Massachusetts Technical Reference Manual (TRM)⁵ assumes that early retirement HVAC participants' equipment have a remaining useful life of 6 years (central air conditioning and furnaces) and 10 years (boilers)⁶. The program claims a higher savings for this remaining useful life period, reflective of the difference in energy use of the removed equipment and efficient equipment.

The evaluation team included several questions to assess equipment condition and assumed years of remaining operation. These questions were not included in the net-to-gross algorithm, but rather initially gathered as context into equipment condition. These data were not originally used in the net-to-gross ratios for two reasons. First, adjusting for remaining useful life seemed to be a gross, versus net, savings issue. Second, the evaluation team questioned how accurately customers could self-report remaining useful life of the equipment. However, as the survey data clearly indicated a portion of customers should not qualify for early retirement, the PAs and EEUC requested the evaluation team review this issue closer through the algorithm.

2.2.1 Replacement Type Categorization

Table 11 shows the proportion of participants categorized as replace on failure or early retirement by measure. Just over a third of HVAC participants categorize as replace on failure. With the exception of hot water boilers in non-owner-occupied homes, boilers have a similar replace on failure rate as the other HVAC equipment.

⁵ <http://ma-eeac.org/wordpress/wp-content/uploads/2016-2018-Plan-1.pdf>

⁶ Per the TRM, "Massachusetts Common Assumption: RUL is 1/3 of the EUL"

Table 11. Replace On Failure and Early Replacement Categorization by Measure

Measure	Replace on Failure		Early Retirement		Overall n
	Percent	n	Percent	n	
Central Air Conditioner	36%	27	64%	49	76
Furnace	45%	67	55%	83	150
Hot water boiler – non-owner-occupied	18%	8	82%	36	44
Hot water boiler - owner-occupied	33%	49	67%	98	147
Heat pump, SEER >= 16 HSPF >=8.5	38%	5	62%	8	13
Heat pump, SEER >= 18 HSPF >=9.6	0%	0	100%	6	6
Steam boiler	43%	40	57%	52	92
Total	37%	196	63%	332	528

Table 12 below also details the average self-reported age of measures by replace-on-failure/early replacement categorization. Based on this analysis, age is not an indicator of replacement type. In fact, the early replacement boilers are older than those categorized as replace on failure. This analysis also highlights that the program is removing older equipment, and in many cases equipment older than the estimated effective useful life.

Table 12. Self-Reported Age of Equipment by Replacement Type and Measure

Measure	Replace on Failure		Early Replacement		Overall n
	Average Age (Years)	n	Average Age (Years)	n	
Central Air Conditioner	20	26	19	48	74
Furnace	25	63	26	76	139
Hot water boiler – non-owner-occupied	33	7	35	36	43
Hot water boiler - owner-occupied	32	49	34	89	138
Heat pump, SEER >= 16 HSPF >=8.5	23	5	18	8	13
Heat pump, SEER >= 18 HSPF >=9.6	N/A	0	15	6	6
Steam boiler	42	38	46	45	83
Total	30	188	31	308	496

Table 13 below provides some context around the self-reported remaining useful life by measure. Some sample sizes are quite small and should be interpreted with caution. Most notably, those with steam boilers most frequently said they felt their equipment would fail very soon; this measure was also

estimated to be the oldest of all measures (between 42 and 46 years) which may impact respondents' perception that it would fail soon.

Table 13. Self-Reported Remaining Useful Life by Measure

Measure	Remaining Useful Life		Overall n
	One year, or less	Two years, or more	
Central Air Conditioner	33%	67%	72
Furnace	37%	63%	142
Hot water boiler – non-owner-occupied	24%	76%	42
Hot water boiler - owner-occupied	27%	73%	137
Heat pump, SEER >= 16 HSPF >=8.5	31%	69%	13
Heat pump, SEER >= 18 HSPF >=9.6	17%	83%	6
Steam boiler	45%	55%	85
Total	34%	66%	497

2.2.2 Impact on Gross and Net Savings

The evaluation team calculated these results to help inform future program planning. This adjustment is a gross savings adjustment; as the research described in this report is primarily exploring net savings impacts, this information will not be directly applied to the NTG results.

However, as this NTG analysis uses gross lifetime savings to weight results, the evaluation team did apply adjusted gross savings to both the sample and the population to more accurately reflect program savings. Per the MA TRM, early retirement HVAC measure deemed savings are developed by adding together a savings value for the new, efficient measure (EE) and a savings value for the early removal of the old, inefficient equipment (Retire).

For survey respondents who were categorized as Replace-on-Failure, the evaluation team adjusted their gross lifetime savings to remove the savings for the Retire measure, only keeping the lifetime savings associated with the EE measure. These adjusted gross weights were used to weight the net-to-gross results to more accurately reflect the proportion of gross savings by each individual measure. The calculation to come up with lifetime savings for both the Retire and EE measure are as follows:

$$\begin{aligned}
 \text{EE Measure Lifetime Savings} &= \text{First Year EE Savings} \times \text{Measure Life} \\
 \text{Retire Measure Lifetime Savings} &= \text{First Year Retire Savings} \times \text{Remaining Useful Life}
 \end{aligned}$$

Table 14 below also provides an example from the Massachusetts TRM savings for hot water gas boilers.

Table 14. Example Savings Calculation for Early Retirement and Replace on Failure Measures

Measure	Remaining Lifetime Savings, Retired Measure (MMBtu)	Measure Life Savings, EE Measure (MMBtu)	Total Combined Gross Savings (MMBtu)
Hot water boiler, Gas - Early Retirement	70	228	298
Hot water boiler, Gas - Replace on Failure	N/A	228	228

2.3 Net-to-Gross Results

The evaluation team calculated NTG results by measure and summed at the electric and non-electric fuel levels. Calculated NTG results are weighted by the proportion of measure savings to report overall electric and non-electric savings.

2.3.1 Net-to-Gross by Measure

Overall, the evaluation team found relatively low free ridership for the Early Retirement HVAC program. Measure level NTG ratios ranged from 75% to 90%. Table 15 and Table 16 detail measure and aggregated level NTG results and precision. These results have been weighted by measure level lifetime savings.

Table 15. Net-to-Gross Results: Non-Electric (n=433)

Gas, Propane, and Oil-Fueled Measures	Completed Surveys	Preliminary NTG Results	Measure Level Relative Precision at 90% Confidence	Combined NTG Results	Overall Relative Precision at 90% Confidence
Furnace	150	86.6%	8.3%	88.2 %	4.6%
Hot water boiler (owner-occupied)	147	88.8%	7.7%		
Hot water boiler (non-owner-occupied)	44	89.5%	12.6%		
Steam boiler	92	86.9%	10.1%		

Source: Participant survey, net-to-gross battery

Table 16. Net-to-Gross Results: Electric (n=95)

Electric Measures	Completed Surveys	Preliminary NTG Results	Measure Level Relative Precision at 90% Confidence	Combined NTG Results	Overall Relative Precision at 90% Confidence
Central air conditioner	76	88.1%	10.9%	84.5%	11.3%
Central heat pump (SEER >= 16, HSPF >= 8.5)	13	75.2%	38.2%		
Central heat pump	6	78.3%	54.8%		

(SEER >= 18, HSPF >= 9.6)

Source: Participant survey, net-to-gross battery NTG results were slightly lower for electric measures overall, and specifically for heat pumps (although it should be noted the sample size for heat pumps was small and precision low). Overall, these findings indicate the program is highly effective at encouraging customers to replace their old but working HVAC equipment before it fails.

The evaluation team examined NTG results by several variables to explore any differences by participant responses or characteristics. Overall, NTG results remained relatively similar across these analyses. The evaluation team did not observe notable differences in overall NTG by measure, survey mode (online versus telephone), age of home, type of home, or year of participation (2016 or 2017).⁷ The evaluation team also examined the results for any differences in NTG results by fuel type for furnaces and boilers. While the evaluation team found that propane measures had somewhat lower NTG results, the sample size for propane measures is small and these results were not statistically significant.

Table 17. Net-To-Gross by Fuel Type (n=429)

Fuel Type	Unweighted Net-To-Gross	Number of Respondents
Natural Gas	90%	281
Oil	86%	129
Propane	79%	19

Source: Participant survey, net-to-gross battery by fuel type

As noted, the evaluation team included several open-ended questions gathering program influence in the participant survey and reviewed these responses in detail to provide consistency checks and additional context. In addition to providing a consistency check for NTG calculations, the open-ended responses in the participant survey provide a rich narrative to provide context to understand the complexities of the customer decision-making processes. The following are some verbatim responses highlighting the varying levels of influence of the program on customer decision-making processes.

Verbatim responses from customers who were 0% free riders through the NTG analysis:

*“It was very influential. **My boiler worked well, but I was always nervous that due to its age it would fail on me in the middle of the winter.** I also kept getting mailings from National Grid comparing my efficiency to my neighbors and I was always in the least efficient group, so I wanted to help lower my usage and my monthly heating costs. I had done an energy assessment originally to help better insulate my house and during that, the Mass Save person mentioned that there could be potential carbon monoxide issues and the house couldn’t be insulated until that was resolved. These three concerns, coupled with the 0% loan option, is what motivated me to replace my otherwise functioning boiler.”*

*“Without the program, I would have kept and repaired my heater for some additional time. **The rebate was decisive as to installing at the time I did.**”*

*“All combined it was **extremely influential.** Had it not been for the Home Energy Assessment and the contractors’ knowledge about the rebate and the furnace itself, then I wouldn’t have replaced it at all.”*

⁷ One key research question was to explore influence by the different lead vendors who provide the Home Energy Assessments. As this information was not consistently tracked within the participant data, the evaluation team was unable to conduct this analysis.

Verbatim responses from participants who were partial free riders through the NTG analysis:

*"I was in the process of renovating my home and decided to replace the steam boiler for greater efficiency and reliability. And in the case of one boiler, to change the fuel source to gas. **The program was a significant factor, but not the sole factor.**"*

*"It was **not timing, it was the efficiency** of the system that I purchased."*

*"Our boiler was in bad shape with failure imminent. We were going to replace it no matter what so as not to be caught in the cold weather with no boiler. **The rebate program was responsible for increasing the efficiency of the boiler we chose.** Our contractor was very knowledgeable about the rebate program. We might not have heard about it otherwise despite the mailing. Mailings are easy to ignore."*

Verbatim responses from participants who were full free riders through the NTG analysis:

*"I'd purchased a new home and decided I wanted to have a new hot water boiler and **regardless of whether there was a rebate, I was determined to do it.**"*

*"**The rebate was an added benefit** that made me feel good about replacing my boiler and increasing the efficiency."*

*"The most influential was the age of the air conditioner, **the rebate just added to it** and was great."*

2.3.2 Program Influence on Timing and Efficiency

The evaluation team asked participants to rate how likely they would be to install the same high efficiency equipment if they had waited until their equipment failed, and would have received a lower rebate through the Standard HVAC program. This was intended to explore the influence of the incremental additional rebate that participants received for participating in the Early Retirement HVAC program on their decision to install high efficiency equipment.

Table 18 shows the average customer response by measure and overall. On average, customers indicated they would still be somewhat likely (mean = 7.3 on a scale of 0 of 10) to purchase and install the same equipment if they had waited until their equipment failed and they received a lower rebate through the Standard HVAC program. This indicates that the Early Retirement HVAC program is generally equally effective at encouraging the installation of high efficiency equipment as the Standard HVAC program. However, customers who installed electric measures—central air conditioners and heat pumps—indicated they would be slightly less likely than those who installed non-electric measures to install the same high efficiency measures through the Standard program. Given the shorter cooling season and relatively cooler climate in Massachusetts, customers may be more likely to prioritize the necessity of high efficiency heating equipment and the incrementally higher rebate for cooling measures within the Early Retirement HVAC program may be more effective at encouraging a higher efficiency measure.

Table 18. Likelihood of Still Installing Same Equipment if Waited until Failure (n=528)

Measure	Likelihood of Still Installing Same Equipment Through Standard Program	Number of Respondents
Furnace	7.4	150
Hot water boiler	7.2	191
Steam boiler	7.9	92
Central air conditioner	6.7	76
Heat pump	6.6	19
Total	7.3	528

Source: Participant survey, question D13

2.4 Customer Experience and Decision-Making

The evaluation team explored several topics with participants to understand customer experiences with the Early Retirement HVAC program and to provide context around NTG findings. Topics included how participants became aware of the program, their interactions with their contractor(s) and Home Energy Assessment energy specialists, the age and repair history of their old equipment, their interactions with other Mass Save programs or initiatives, and any other motivations to participation in the program. The following sections explore these topics in more detail.

2.4.1 Program Awareness

When asked how they first heard of the Early Retirement HVAC program, respondents gave a variety of responses. Approximately one-quarter of respondents first learned about the program from their HVAC contractor, and another one-quarter first learned of the program through their Home Energy Assessment. A considerable percentage (17%) first heard of the program through word of mouth. A smaller percentage (11%) mentioned their utility website, the Mass Save website, or the internet, and 5% mentioned a bill insert or other mailing.

Table 19. First Source of Program Awareness (n=528)

Source	Percent
Contractor	26%
Home Energy Assessment/energy specialist	25%
Friend/relative/neighbor/word of mouth	17%
Internet	6%
Bill insert/mailing	5%
Utility website	4%
Retailer/dealer	3%
Radio/TV	2%
Oil/Propane supplier	2%
Other advertising	2%
Previous participant	1%
Own research	1%
Realtor	1%
Mass Save website	1%
Other	1%
Not sure	3%

Source: Participant survey, question B2

For those respondents who said they first heard of the Early Retirement HVAC program through their contractor (and received a Home Energy Assessment), the evaluation team clarified if this was before they received a Home Energy Assessment. Most of these respondents (81%) said yes; their contractor informed them before they had a Home Energy Assessment. The remaining 19% said no, they learned of the program via their contractor after they had already received a Home Energy Assessment.

Respondents who received a Home Energy Assessment, but did not mention it as the way they first heard of the program, were asked if the energy specialist mentioned the Early Retirement HVAC rebates when they were in their home. A majority of these respondents (90%) said that they did; 10% said they did not or were not sure.

Respondents were also asked if they received Mass Save marketing materials for the program, or if they visited their PA's or the Mass Save website to learn more about the program. Overall, a little over two-thirds of respondents (69%) said they remembered receiving Mass Save marketing materials, and a similar proportion (69%) searched out additional information on the Mass Save website or their PA's website.

2.4.2 Influence of the Home Energy Assessment and HVAC Contractor

A key question for this evaluation was to understand the role of the energy specialists, the Home Energy Assessment, and the HVAC contractors in participants' decision-making process. As noted, participants

are required to receive either a Home Energy Assessment or AC Check to participate in the program to verify eligibility. However, as HVAC contractors are frequently involved in discussing HVAC options with customers, the evaluation team wanted to explore what role both the HVAC contractor and Home Energy Assessment play in encouraging replacement of old but functioning HVAC equipment.

The survey included questions about participant experiences with the Home Energy Assessment. First, upon reviewing tracking data, it was not always clearly documented if a customer had received a Home Energy Assessment. Therefore, the evaluation team added a question to confirm whether customers received a Home Energy Assessment or AC Check. Overall, the majority of respondents recalled receiving a Home Energy Assessment (93%). A small proportion (2%) stated they received an AC Check. A small group of respondents (5%) did not recall receiving either an AC Check or a Home Energy Assessment. Approximately one-quarter of respondents heard of the program via their Home Energy Assessment. Respondents who installed furnaces were significantly more likely to say they heard of the program first through the Home Energy Assessment (31%) than those who installed hot water boilers (20%).

The evaluation team asked two general questions about the influence of various factors on respondents' decisions. When asked who or what was the most influential in their decision to replace their old equipment at the time they did, respondents frequently said "me/myself" (33%) or the availability of the rebate (28%). Smaller proportions said their contractor (14%) or the Home Energy Assessment (14%). However, when asked who or what was the most influential in identifying the efficiency level to install, almost half of respondents mentioned their contractor (46%), with 22% mentioning their Home Energy Assessment.

As part of the NTG algorithm, the evaluation team asked participants to rate the influence of various factors on the timing and efficiency of their decision on a scale of 0 to 10, where 0 was not at all influential and 10 was very influential (Table 20). Participants rated both their HVAC contractor and Home Energy Assessment relatively high for the timing of their decision. However, participants rated their contractor's influence as higher than their Home Energy Assessment's for the part of their decision that involved selecting an efficiency level, further supporting that contractors may be more involved than energy specialists in the scoping and recommendation process for the specific efficiency level of equipment chosen through the program.

Table 20. Influence of Contractor/Home Energy Assessment on Timing/Efficiency (Scale of 0 to 10)

	HVAC Contractor (n=528)	Home Energy Assessment (n=501)
The timing of your decision	7.3	7.0
The efficiency of your decision	7.8	7.0

Source: Participant survey, questions D14b and D14c

Overall, it appears that the Home Energy Assessment and HVAC contractor are working well together to influence customer decision-making, although the contractor may be more involved in scoping the specific efficiency level of the equipment installed. Below are some verbatim responses that highlight this finding.

“Everything discussed at the Home Energy Assessment fell in line with what my contractor suggested. With both individuals supporting the program’s literature too, it seemed like a perfect time to take advantage of the program’s loan and well-versed participants.”

“Wanted to have peace of mind by replacing aging system. Contractor [was] very influential and guided timing of replacement and drove rebate process. We did reference info from our Home Energy Assessment but the contractor was our primary contact for updated rebate information since they do this on a daily basis.”

“Honestly, I was not in the market to change or ‘fix’ something that was not broken. However, when you took the time to listen to the Home Energy Assessment and contractor, taking advantage of the program and rebates available, I was going to come away with a more efficient system that made my home more comfortable (and it sure has!) as well as give me peace of mind. You cannot put a price tag on that! And what a year to have a new furnace. With the cold snap of January 2018, I can tell you that my home has never been warmer, and my gas bill has still gone down! It has been a great experience overall.”

2.4.3 Equipment Condition and Repair History

The evaluation team collected information in the participant survey to inform the age, condition, and repair history of the replaced equipment. While not intended to assess gross impacts or develop a robust assessment of remaining useful life, these questions provide insight related to participant understanding of the age and condition of their old equipment, and context for future evaluation or research needs.

First, the evaluation team asked respondents to estimate how old they thought their previous equipment was. Table 21 highlights the average estimated age of old equipment by measure. As aligns with program requirements, the hot water and steam boilers that were replaced through the program tended to be considerably older than other measures. Steam boilers were estimated on average to be 45 years old. However, it is notable that while replacement requirements for furnaces are 12 years or older, on average respondents estimated their old equipment was over twice that age, at 26 years old.

Table 21. Self-Reported Age of Old Appliance (n=505)

Sample Measure	Average Self-Reported Age	Number of Respondents
Central Air Conditioner	19	74
Furnace	26	142
Heat Pump	18	19
Hot Water Boiler	34	185
Steam Boiler	45	85
Overall, all responses combined	31	505

Source: Participant survey, question C1

For the majority of respondents across measures, the estimated age of their old equipment was within the program requirements laid out in Table 3. However, a varying percentage of respondents estimated that their old equipment was younger than would be eligible for the program, ranging from 2% of respondents who estimated their furnace was less than 12 years old, to 14% of respondents who estimated their hot

water boiler was less than 30 years old. Ten percent of those who replaced central air conditioners or heat pumps estimated their equipment was less than 12 years old, and 7% of those with steam boilers estimated their equipment was less than 30 years old. It should be noted that these are homeowner estimates; especially with measures that have long measure lives and those that the current homeowner may not have installed themselves, there are likely to be estimation errors.

To understand participant perceptions and their understanding of the state of old equipment, the evaluation team asked participants how long they think their old HVAC equipment would have lasted if they had not replaced it through the Early Retirement HVAC program. Overall, about two-thirds (63%) of customers felt their HVAC unit would have continued working for approximately 2 or more years. About one-third (32%) felt their HVAC equipment would have lasted approximately 1 year or less. The remaining 5% were not sure how long their equipment would have lasted.

Similarly, about two-thirds (64%) of participants said their equipment was working well or only had minor issues. A smaller proportion (15%) said their equipment needed some repairs, and 17% said their equipment needed major repairs. Three percent of respondents said their equipment was not working at all when they participated in the program, and these respondents were dropped from the analysis.

The survey also asked participants about the repair history of their equipment. A little over one-third (36%) said their equipment had been repaired at least once in the past year. It should be noted that the survey did not collect information on the extent or degree of these repairs, and it should also be noted that the evaluation team observed that some participants included equipment tune-ups or maintenance as “repairs” during pretests. The evaluation team added additional language clarifying repairs, but it is possible customers may still confuse them with maintenance.

Finally, the evaluation team reviewed the baseline data collected for the RES1 study on HVAC equipment to understand what the current age of HVAC equipment in the market is. Response categories do not exactly align with program age requirements; Table 22 shows the results by measure. A considerable number of baseline survey respondents had older equipment, especially boilers and oil-fueled furnaces, where at least 20% of respondents stated their equipment was at least 20 years old. However, a considerable percentage did not know how old their equipment was, highlighting the difficulty some homeowners have in estimating the age of their heating and cooling systems.

Table 22. RES1 Baseline HVAC Equipment Age Self-Reported Results

	Furnace - Natural Gas (n=492)	Furnace - Oil (n=103)	Boiler - Natural Gas (n=119)	Boiler - Oil (n=32)	Central Heat Pump - Ducted (n=66)	Central Air Conditioning (n=1,199)
Less than 2 years	12%	11%	14%	13%	20%	14%
3-5 years	16%	8%	11%	3%	11%	16%
6-10 years	20%	21%	20%	16%	20%	22%
11-20 years	23%	22%	14%	19%	15%	24%
More than 20 years	11%	21%	22%	28%	6%	7%
Do not know	17%	17%	18%	22%	29%	16%

Source: RES1 Baseline Data, questions Q26, Q31, Q93, and Q98

2.4.4 Standard Program Participation

When reviewing the Early Retirement HVAC evaluation sample, the evaluation team noted that a considerable proportion (approximately 20%) had also participated in the Standard HVAC program to replace other equipment during the sample period. To explore the relationship shared by the two programs—and if participation in one program influences the other—the evaluation team included several questions in the survey to gather feedback on how participants experienced both programs.

First, all participants were asked if they were aware that they received a higher rebate for participating in the Early Retirement HVAC program than they would if they had participated in the Standard HVAC program. Slightly less than half of participants (46%) said they were aware of this, while the rest (54%) said they were not aware or were unsure.

For those who participated in both programs, the evaluation team included questions regarding the influence of Standard program participation in customers' decisions to replace old but functioning equipment through the Early Retirement HVAC program. Anecdotally, the evaluation team heard from Home Energy Assessment energy specialists that it can sometimes be a compelling selling point for customers replacing failed equipment through the Standard program to also replace old but working equipment through the Early Retirement HVAC program (for example, replacing a failed central air conditioning unit through the Standard program and an old but working furnace unit through the Early Retirement program all at once).

Overall, the influence of the Standard program was rated relatively low—it had an average rating of 5.7 on a ten-point scale on customers' decision on timing, and 5.5 rating on customers' decisions on efficiency. This may be because not all customers replaced their equipment on the same timeframe; these installations could also have been done separately.

To further explore this, the evaluation team asked respondents to respond to an open-ended question on the influence of the Standard program in their decision to participate in the Early Retirement HVAC program. Some respondents noted that their participation in both programs was not connected or did not influence each other. However, those who said that it was connected frequently gave two key reasons for participating in both programs: 1) wanting to get it done all at once for convenience or peace of mind, or 2) the equipment was connected in some way (such as boilers and water heater tanks). The following are a few verbatim responses:

*"My contractor was very energy conscious and recommended I overhaul my boiler at the same time as my furnace replacement. The boiler worked well enough but, all things considered, the contractors were right here working and **it was the most expedient thing to do**. I'm sure a few years later, I would've had to begin the process of replacing my boiler so...it all came together well."*

*"Hot water storage tank went hand-in-hand with the boiler replacement—**made sense to have an extra zone on the boiler and use that to heat the hot water**. No brainer between something that is 96% efficient versus approximately 60% efficient."*

*"I wanted a more efficient heating system and a gas hot water heater. My dream was to have central air conditioning. **Through the Mass Save program with rebates and no finance loan I was able to afford all three!** I have my dream home! Thank you Mass Save!"*

2.4.4.1 HEAT Loan Participation

A finding from the survey data is the importance of the availability of the 0% interest HEAT loan available through Mass Save. This Mass Save offering provides interest-free financing to cover the remaining cost of the HVAC, water heater, insulation, and window installation after the rebate is applied.

While the survey did not explicitly ask any questions about the HEAT loan, participants mentioned the availability of this financing in open-ended responses about program influence. Via a text analysis, the evaluation team documented instances where respondents mentioned the availability of the HEAT loan in the influence of their decision to install the energy efficient equipment. Overall, 12% of respondents mentioned the availability of the HEAT loan or financing as influential in their decision to install high efficiency equipment when they did.

The following are some verbatim responses highlighting the influence of the HEAT loan.

“When our contractor told us, the boiler was too old, he also told us about the rebate and interest-free loan program. We called Mass Save immediately, had the home assessment, and their information and help made us decide to replace both boilers in our two-family home. They were both over 30 years old, and on their last legs.”

*“It was a difficult decision to make when I first heard of the condition of my furnace. I was having a lot of other bills at the time **so I was happy to hear of the rebate program and the availability of a no-interest loan.** It made my decision easier and was glad it was mandatory to have the efficiency rating that was required as it has made a huge difference in my heating bill. Thank you.”*

“The 0% interest HEAT loan was a big factor in replacing our HVAC when we did. If not for the availability of the loan, we may not have replaced the unit when we did.”

*“When I had the heater inspected, I realized that I had a 45-year old unit. I wanted a cheap replacement. The contractor came out and explained the options to me. **The most efficient unit came with a rebate, interest-free loan, and, in theory, would pay for itself** due to the higher efficiency/lower costs. So it was a good investment for my house.”*

*“I knew my aging system was not going to last. The contractor and the Home Energy Assessment discussion was the most helpful. I was concerned about costs and **the HEAT loan clinched the deal for me.**”*

2.4.4.2 Other Motivations to Participation

In consideration of other participation motivations, the survey also asked how important the fact that their equipment was nearing the end of its life, and could fail in the near future, was in their decision to replace their old HVAC system. Overall, respondents indicated that they found it very important (75%).

Table 23 details the responses to this question.

Table 23. Importance of Equipment Age in Decision-Making (n=528)

Text Response	Percent
Not at all important	1%
Somewhat unimportant	2%
Neither important nor unimportant	3%
Somewhat important	19%
Very important	75%
Not sure	0.2%

Source: Participant survey, question C6

When asked to describe in an open-ended question how the program influenced their decision to replace their equipment early, respondents frequently noted that they knew their equipment was old and would need to be replaced soon. Respondents also described feelings of anxiety or fear that their old equipment would fail at an inopportune time. Several respondents noted that hearing this type of messaging from their Home Energy Assessment energy specialists or HVAC contractors motivated them to participate. Below are some open-ended responses from participants highlighting this finding.

*“As my air conditioning units seemed to be close to the end of their useful life, all of the above were influential in helping me make the decision to install when we did and the efficiency of the unit. **I did not want to take a chance that one or both of the units would fail during the heat of summer** so I began the process in the late fall. As I had two previous Mass Save energy assessments, I was very aware of the benefits of the program and how high efficiency would lower costs. The available rebates certainly helped me to purchase the units I did and have them installed before the cooling season began.”*

*“I knew that my furnace was getting old and would have to be replaced in the near future. **I wanted to get that done before something could happen in the middle of winter and not have any heat.** I received an estimate from my contractor and also found out about the rebate if the furnace was still working when replaced which seemed to work with my situation. I was very happy to know that I could get a rebate because the whole process was very expensive.”*

*“Very influential as I knew our old unit probably wouldn’t make it through another winter. I prayed every time I heard it kick on. The rebate and 0% financing were critical in replacing when we did. **The relief and peace of mind knowing we would not be scrambling to make a major repair/replacement out of necessity in potentially sub-zero temps was huge!**”*

*“My home inspector, Mass Save assessor, and my contractor all told me that **my boiler was at the end of its life and could fail at any time.**”*

Some participants noted that rebate levels could change or not be available in the future, and that this was also a motivating factor to replacing their equipment immediately through the program:

*“We would have done it in the next +/-5 years, but the rebate program was the reason that we didn’t wait. **We were afraid that the rebate wouldn’t be available if we waited.**”*

“Getting a rebate made a big difference in my replacing it when I did. I heard that the steam boiler rebates might not be available much longer. I listened to my contractor who chose the boiler according to the rebate requirements.”

2.5 Contractor Results

The evaluation team conducted surveys with 82 HVAC contractors who participated in the Early Retirement HVAC program in 2016 and 2017 to gather context on free ridership and understand contractor perspectives about the program.

2.5.1 Contractor Characteristics

Respondents were asked to verify, by equipment type, whether their company had completed a project that received an Early Retirement rebate. A majority (82%) of respondents said they had completed a boiler installation, 49% completed a furnace installation, 28% completed a central air conditioning installation, and 4% had completed a central heat pump installation.

Table 24 summarizes the types of heating equipment by fuel that the respondent’s company installs.

Table 24. Fuel Type of Equipment Installed (n=82)

Equipment Installs	% of Respondents
Boilers	82%
Boilers – Natural Gas	53%
Boilers – Propane	2%
Boilers – Oil	43%
Furnaces	49%
Furnaces – Natural Gas	39%
Furnaces – Propane	8%
Furnaces – Oil	13%
Central ACs	28%
Central Heat Pumps	4%

*Categories are not mutually exclusive; therefore, the sum of percentages is greater than 100%
Source: Contractor survey, questions S5 and F1*

Of the customers who received an Early Retirement rebate, respondents were asked to estimate the percent of customers who 1) received a Home Energy Assessment before contacting the contractor; and 2) first contacted their contractor and then completed the Home Energy Assessment. Overall, respondents were fairly split on which contact point happened first, with about half of respondents indicating that customers receive a Home Energy Assessment before contacting their contractor (average = 53%). This aligns with customer and energy specialist results as well.

2.5.2 Perspectives on Customer Decision-Making

To understand free ridership from a contractor perspective, the evaluation team asked contractors their opinions about the program’s influence on customer decision-making, and how many customers would have moved forward in the absence of the program. When asked how influential the Early Retirement HVAC program was on the customer’s decision to replace older HVAC equipment, contractors overwhelming said the program was highly influential. A majority (71%) of respondents said the program was “very influential” and 22% said it was “somewhat influential.”

However, when asked to quantify what percentage of customers would have likely still replaced their old equipment at the same time without the Early Retirement HVAC rebate, the average response was 49%, which is somewhat inconsistent with other responses and considerably higher than the participant results. Table 25 summarizes these responses by contractor participation level.

Table 25. Contractor-Reported Percent of Participants Who Would Have Installed Equipment Outside of the Program (n=82)

Participation Level	Mean	Number of Responses
High	33%	2
Medium	54%	16
Low	48%	64

Source: Contractor survey, question ER3

When asked to describe the influence of the Early Retirement HVAC rebate on customers’ decision to replace their functioning equipment early in an open-ended response, nearly all respondents confirmed the program was highly influential. Most respondents said that the financial savings on the new equipment and the savings on customers’ energy bills are the main influencing factors. Additionally, several respondents echoed responses from participants, saying that the risk of equipment failing at an inconvenient time is a highly motivating factor to participation in the program. Several contractors also mentioned the HEAT loan as a key influence. The following are a few highlighted responses:

*“Customers tend to contact us **before a catastrophic failure** happens when they know they can get thousands of dollars off a system now rather than waiting.”*

*“I guess they figure that it’s worth more to them **then taking the chance that their equipment will fail in the middle of a heating season.**”*

*“If equipment is still functioning with little problems, replacing equipment-based energy savings is often not economical. **The rebate makes it an economical choice.** Also, if it is still working, many people feel there is little incentive to replace.”*

*“It’s huge. The additional rebate helps lower the initial cost and allows homeowners to start saving on their utility bills sooner. I also think **the HEAT loan is a huge factor** as well.”*

A majority (64%) of contractors said that certain equipment types increase the likelihood that customers’ will replace their equipment at the same time, regardless of the rebate. When asked how early replacement varies by equipment, most contractors said that customers are more likely to replace heating

system early to avoid being without heat in the winter. Other reported influencing factors include payback and the cost of equipment, especially when it comes to boilers due to the rebate amount and age of the boiler.

“Delivery systems on boilers tend to be less efficient than warm air furnaces, so anyone motivated strongly by payback of their investment would look at the boiler as quicker payback.”

When asked how fuel type influences the likelihood of early equipment replacement, regardless of the Early Retirement rebate, a majority (56%) of respondents indicated that fuel type does not. For those who felt it did influence the likelihood, the fuel's cost of operation was a common response for how fuel type impacts the customer's likelihood for early replacement. However, there was little consensus on which fuel type has the lowest operation cost and is the most efficient.

“More people look at oil being high priced for the fuel costs as reason for going to a high efficiency unit, basically just fuel costs.”

“Not much fuel savings with oil. Lots of savings with new gas equipment.”

2.5.3 Installations Outside of the Program

The evaluation team did not calculate nonparticipant spillover for this program. Compared to the Standard HVAC program, the Early Retirement HVAC program has a narrow definition of what counts as a true “early retirement,” with strict requirements on age, remaining useful life, and condition that must be verified by a Home Energy Assessment or AC Check technician. This makes it unlikely that these installations are happening outside the program, and it is difficult to accurately gather these data from HVAC contractors. Additionally, program rebates are considerably higher than the Standard HVAC program rebates, making it less likely for customers to forgo participation. In consideration of this, the evaluation team, PAs, and EEAC felt that it was unlikely that considerable nonparticipant spillover is occurring.

From a process perspective, the evaluation team explored whether contractors report retiring equipment early outside of the program, to understand contractor perspectives on why this might be happening. When asked if they had completed projects that were eligible for the Early Retirement rebate but did not receive it, approximately half of respondents said that they had installed at least one perceived eligible project that did not receive an Early Retirement rebate. This does not represent an estimate of nonparticipant spillover, rather the proportion of contractors who said they had at least one project that did not receive a rebate.

Contractors were asked to clarify why they think these projects moved forward without participating in the Early Retirement HVAC program. Responses fell into three categories:

1. Customers did not want to wait for a Home Energy Assessment to qualify
2. Customers were unaware of the program
3. Customers had eligibility issues

It is unclear why contractors would not inform customers of the rebate, but these may be customers whose decision-making would not be influenced by the program, regardless. Several contractors also mentioned customers who were in emergency situations or who were deemed ineligible for the Early Retirement HVAC program; this indicates a lack of understanding from contractors about program

requirements, as emergency replacements would not be eligible for the program. Below are a few verbatim responses to the question of why some customers retired their equipment early and did not participate in the program:

“Emergency situation, unable to wait for an energy audit to pre-qualify.”

“Having an energy audit, and different opinion about the unit.”

“They were not eligible for different reasons.”

“They were not aware of the rebate program.”

For those who did not want to wait for a Home Energy Assessment, it is unclear if this means the equipment needed to be replaced faster, indicating it was likely ineligible, or if customers were simply impatient and did not want to wait to get an assessment scheduled. Below are some verbatim responses from contractors about why some customers did not want to wait for a Home Energy Assessment:

“Because we didn't have the time for someone to come out and qualify the equipment. The customer wanted the install ASAP.”

“Did not want to jump through the red tape of the program, or wanted to move more quickly than the program would allow.”

“The timeframe of the job needed to be completed before Mass Save could complete the audit.”

Contractors who said they had completed at least one early retirement project outside of the program were asked whether any of these customers had participated in the Standard HVAC program instead. The majority of contractors (54%) said yes, at least one of these projects went through the Standard HVAC program.

2.5.4 Fuel-Switching

Overall, a majority of contractors (85%) said that they will help customers switch from propane or oil to either natural gas or electric for their heating equipment. When asked about the number of fuel-switching projects their company assists with each year, the average response was 10. Table 26 summarizes these responses.

Table 26. Contractor-Reported Number of Fuel-Switching Projects per Year (n=82)

Fuel-Switching Projects	Percent
Few (<5)	33%
Some (5 - 15)	50%
Many (>15)	17%

Source: Contractor survey, question F3

2.6 Lead Vendor/Home Performance Contractor Energy Specialist Results

The team fielded a survey with LV and HPC energy specialists who completed Home Energy Assessments. This survey was intended to provide an understanding of program participant’s knowledge and awareness of heating and/or cooling replacement options. The survey also measured the energy specialists’ understanding of the program and its influence on participant actions. This survey provided context to NTG analysis, but was not used to directly calculate NTG. Table 27 provides an overview of the respondents by LV/other firms.

Table 27. Energy Specialist Respondents by Firm (n=36)

Company	Count
CLEAResult (LV)	19
RISE Engineering (LV)	7
Other Contractors	10
Total	36

Source: HEA Energy Specialist survey response rate

2.6.1 Home Energy Assessment Processes

The evaluation team asked energy specialists about the processes they took to assess eligibility and recommend participation in Mass Save programs. When asked what energy specialists consider when determining customer eligibility for the Early Retirement HVAC program, respondents stated that they primarily looked at the age of the equipment, followed by the equipment condition and equipment efficiency. In terms of when energy specialists tend to discuss the Early Retirement HVAC program with customers, respondents primarily said they either mentioned it at the end of the assessment with their recommendations or during the assessment when they inspect the heating and cooling equipment.

When asked about the percentage of homes that qualified for an Early Retirement HVAC rebate, the average response was 39% of homes were eligible for the Early Retirement HVAC rebate. Of the homes that qualified for the program, most respondents (53%) said that they recommended moving forward with replacing old equipment to “most” customers, and 33% reported that they recommended replacement to “all” customers. A smaller portion reported recommending the Early Retirement HVAC program to “some” customers (10%) and “few” customers (3%).

To clarify why and how energy specialists prioritize recommendations around the Early Retirement HVAC program, the evaluation team asked energy specialists what prompts them to state that replacing old equipment is a high priority. Other than equipment age, some respondents noted that they recommend the Early Retirement HVAC program as “high priority” if there is a health or safety risk with the old system. Some respondents also said they will recommended it as a higher priority if other recommendations from the assessment will impact the HVAC equipment performance, or if the assessment resulted in few other recommendations.

“If their existing heating equipment fails combustion safety testing such as high levels of carbon monoxide, spillage, or draft issues, [or] if insulation recommendations will tighten up the house and could cause problems with their existing equipment back drafting.”

There were three primary situations where respondents said they recommended the Early Retirement HVAC rebates as a “lower priority:”

1. The customer has an eligible condensing furnace that is running well, since the efficiency level is high enough that replacement is not necessary and may not be cost-effective.
“Furnaces that are 12 years old and qualify are still high efficiency condensing models and are running fine. In this case I let the customer know it qualifies, but say the furnace is running fine at a high efficiency and doesn't need to be replaced.”
2. The house needs insulation improvements, which would result in greater savings for the customer than replacing the old equipment.
“If the house needs significant insulation improvements, which are more cost-effective and should be done first anyway so the new system can be sized accordingly.”
3. The customer makes it clear they are not interested in replacing their equipment.
“Sometimes customers have heard bad things about new heating equipment, so they are not interested in putting a high efficiency system in.”

Overall, most respondents indicated that neither equipment type (55%) or fuel type (59%) affected their recommendations to customers about Early Retirement HVAC program participation. A smaller portion said that equipment type (35%) and fuel type (35%) did affect their recommendations to customers. Respondents commented that whether a household has a furnace, or a boiler will have some influence on their recommendation to participate in the Early Retirement HVAC program. If the household has an eligible furnace that is working well, they are less likely to recommend replacement since the efficiency gains would be minimal. However, if the household has an eligible boiler some energy specialists stated they are more likely push for early replacement since the efficiency gains would be substantial. The equipment fuel type appeared to have less of an influence on their recommendations, especially since the rebate does not cover switching fuel types.

2.6.2 Perspectives on Customer Awareness of Program

Responses from energy specialists varied when asked how aware customers were on various topics relating to their HVAC system and the Mass Save rebates. The evaluation team asked energy specialists how many customers mention they want to either replace or repair their HVAC equipment prior to hearing the recommendations from the Home Energy Assessment. On average, energy specialists said about half of customers (49%) say they want to replace their equipment, and about 20% on average say they want to repair it.

When asked about customers' knowledge about their heating and cooling replacement options, most respondents said customers were only slightly knowledgeable (65%) or moderately knowledgeable (23%). A smaller portion of respondents (10%) said customers are not knowledgeable at all about their replacement options.

Respondents reported that “few” customers were aware of the Early Retirement HVAC rebates prior to the assessment. On average, respondents said 39% of customers were already aware of the Early Retirement HVAC rebates prior to their assessment. Table 28 summarizes these responses.

Table 28. Energy Specialist Perspective on Customer Awareness of Rebates (n=36)

Prior Knowledge of Rebates	Respondents
Few are already aware of rebates	48%
Some are already aware	38%
Many are already aware	14%

Source: HEA Energy Specialist survey, question B5

For customers that were already aware, respondents were asked where their customers heard about Early Retirement HVAC rebates. All of these respondents (100%) said their customers heard about the rebates from their HVAC contractor, 52% of respondents also indicated that customers hear about the program from their friends, coworkers, or family. Only a small portion of respondents (6%) said customers heard about the program from their utility or PA, and 17% said they heard it from other sources.

2.6.3 Perspectives on Customer Decision-Making

Respondents were asked to rank the most effective selling points for customers to participate in the Early Retirement HVAC program. A majority (59%) ranked the increased rebate for the early replacement of old equipment as number one, followed by energy bill savings with 45% ranking it as number two, and peace of mind with 48% ranking it as number three. Overall, most respondents ranked some combination of these three options as the top selling points for customers.

Table 29. Perceived Customer Priorities in Decision-Making

Rank	Selling Point	Respondents Most Frequently Selecting Rank
1	Increased rebate	59%
2	Energy bill savings	45%
3	Peace of mind	48%
4	Comfort	45%
5	Health and safety	41%

Source: Navigant analysis

When asked the approximate percentage of customers that would have replaced their old equipment early, regardless of the rebate, the average response was that 39% of customers would have replaced their equipment. Table 30 summarizes energy specialist perceptions of whether few, some, or many would have still replaced without the rebates.

Table 30. Energy Specialist Perception of Customers Who Would Replace without Rebates (n=36)

Replacement Regardless of Rebate	Respondents
Few would replace without rebate	30%
Some would replace without rebate	67%
Many would replace without rebate	3%

Source: HEA Energy Specialist survey, question C1

The team wanted to understand if this varied among customers who were aware of the Early Retirement HVAC rebate prior to the assessment, and respondents were fairly split in their answers. The following response summarizes the breadth of perspectives noted by respondents:

“Some people contact HVAC technicians to have a quote on a new heating system. Typically, they steer the homeowner toward the Mass Save program to look into any applicable rebates or financing. Most people are not aware of the rebates until informed by an energy specialist or the HVAC technician. Some people who have failing heating equipment that is still currently working try to be proactive with replacing it. Others have said they will wait till it dies, but the Early Replacement helps them be a little more proactive.”

To understand the effectiveness of the Early Replacement Program, respondents were asked to rate their perceived effectiveness of various elements of the program and the program overall on a scale of 0 to 10, where 0 means not at all effective and 10 means very effective. Overall, respondents thought the program was influential with a majority (86%) rating the effectiveness as a 7 or higher (mean = 7.5). When asked about the effectiveness of the rebate amount, 41% of respondents rated it as a 10 (mean = 8.2) meaning the rebate was very effective in motivating participation.

To understand what factors influence the customer’s decision to replace their equipment early, the evaluation team asked respondents to rate the influence of various elements on a scale of 0 to 10, where 0 means not at all influential and 10 means very influential. Respondents rated the influence of the recommendations from HVAC contractors highly, with 78% giving a rating of 7, 8, 9, or 10 (mean = 7.5). Recommendations provided from the assessment were rated as slightly less influential, with 62% giving a rating of 7, 8, 9, or 10 (mean = 7). Respondents rated plans for replacement or repair prior to the assessment as influential with 79% giving a rating of 7, 8, 9, or 10 (mean = 7.9).

When asked why customers decide to replace their equipment before it fails, respondents primarily said 1) peace of mind that it will not fail at an inopportune moment; 2) to save money on future utility bills; and 3) the rebate.

*“Either they are looking to upgrade to **higher efficiency equipment for savings**, or the heating/cooling system is on its way out and they know their time is limited. I encourage people to look into **rebates and financing** before a system fails because they **don’t want it to be a heating emergency** and risk pipes freezing or any other damage to the home.”*

When asked why customers decided not to replace their equipment before it fails, respondents primarily noted that even with the rebate, some customers cannot afford to replace the equipment, or have the “if it ain’t broke, don’t fix it” mentality. Other reasons customers decide not to replace equipment include plans on selling the home, and concerns that the newer equipment will be more expensive to maintain and/or might be less reliable. Respondents noted other aspects of the customer’s decision-making process include the payback period, recommendations from their HVAC contractor, and the age of customer—older customers are more reluctant to change their equipment.

Respondents were asked if they had any suggestions for improving the Early Retirement HVAC program. Common suggestions included:

- Incorporating fuel-switching into the rebate
- Differentiating between atmospheric and condensing furnaces so that there is a higher rebate for the atmospheric furnaces

- Reducing the age eligibility requirement for boilers to 20 years

APPENDIX A. DETAILED NET-TO-GROSS METHODOLOGY

Through the HES and Cooling & Heating Initiatives, residential customers are eligible to receive rebates for the early retirement of their heating and cooling equipment through the Early Retirement HVAC program. To qualify for the rebate, customers are required to receive a Home Energy Assessment or, for early replacement of central air conditioner or heat pumps, meet with an AC Check trained contractor.

The evaluation team is conducting the *RES36 Residential Early Retirement HVAC NTG Study* for the Massachusetts PAs' Residential Heating and Cooling initiative. As part of this effort, the evaluation team will conduct three data collection activities: participating customer surveys, surveys with assessors from the HES program, and surveys with HVAC contractors. This memo outlines the approach proposed for quantifying NTG for this program.

A.1 Net-to-Gross Measurement

The NTG ratio will be based on one input: estimates of free ridership (FR) among program participants. Given the nature of HVAC equipment replacement, participant spillover is not included in the calculation. Contractor-reported free ridership and nonparticipant spillover will be gathered but only assessed from a context perspective. The NTG ratio is calculated as:

$$NTG = (1 - FR)$$

As outlined in the RES36 Stage 3 Research plan, NTG will be estimated at the measure level. The evaluation team also expects to capture sufficient sample to analyze differences by contractor providing the assessment (LV/HPC/AC Check). Table A-1 lists the measures included in the NTG analysis.

Table A-1. Early Retirement Measures

Equipment Type
Furnace with ECM blower
Hot water boiler, owner-occupied
Hot water boiler, non-owner-occupied
Steam boiler
Central air conditioning
Central heat pump (SEER≥16, HSPF≥8.5)
Central heat pump (SEER≥18, HSPF≥9.6)

**The furnace and boiler stratifications will include all fuel types (natural gas, oil, and propane)
Source: Navigant analysis*

A.2 Participant Free Ridership

The free ridership score is a function of timing and efficiency. Quantity is also considered in cases where participants have installed more than one unit of the given measure through the program, although this is rare for this program (approximately 3% of the program population). In an Early Retirement HVAC program, the timing of replacement is the critical factor in determining free ridership because the primary goal of an Early Retirement HVAC program is to induce replacement of less efficient equipment before it fails. Table A-2 displays the key questions and inputs to estimating participant free ridership. Some questions included in this table are primarily used as warm-up questions or consistency checks, and not used directly in the free ridership calculation.

Table A-2. Free Ridership Questions

Free Ridership Section	Survey Instrument Question wording
Intro/Warm-Up	{Questions gathering working condition of old [MEASURE]}
	If you had not replaced your [MEASURE] when you did through the program, how much longer do you think it would have kept working?
	Before you learned about the program, did you already have plans to replace your [IF QUANTITY >1 THEN SHOW QUANTITY] working [MEASURE]?
	Would you have replaced your [MEASURE]?
	Did the rebate or information you received change the timing of when you replaced your [MEASURE]?
Timing and Quantity	If the rebate had not been available, when would you have replaced your [MEASURE]?
	<p>On a scale of 0 to 10, where 0 is “not at all influential” and 10 is “very influential,” how influential was each of the following on your decision to install the high efficiency [MEASURE] at the time you did?</p> <ul style="list-style-type: none"> a. Program rebate b. Your contractor’s recommendations c. Information from your Home Energy Assessment/AC Check assessment d. The age or condition of your old [MEASURE] e. Information from your utility or Mass Save marketing materials or websites f. Previous experience with Mass Save programs g. [IF ALSO RECEIVED STANDARD REBATE FOR ANOTHER MEASURE] The rebate you received for another piece of equipment
Efficiency	Earlier you said you already had plans to replace your [MEASURE] before learning about the program. Were you already planning to install a [MEASURE] of the same efficiency as you did through the program?
	If you had not participated in the program, what level of efficiency do you think you would have installed? [Higher, the same, lower]

On a scale of 0 to 10, where 0 is “not at all influential” and 10 “is very influential,” how influential was each of the following on your decision to install the efficiency level you did?

- a. Program rebate
- b. Your contractor’s recommendations
- c. Information from your Home Energy Assessment/AC Check assessment
- d. The age or condition of your old [MEASURE]
- e. Information from your utility or Mass Save marketing materials or websites
- f. Previous experience with Mass Save programs
- g. [IF ALSO RECEIVED STANDARD REBATE FOR ANOTHER MEASURE] The rebate you received for another piece of equipment

Can you tell me, in your own words, how influential the program, including the rebate, your contractor, and any information you got during your Home Energy Assessment or AC Check was in your decision to install the [MEASURE] at the time you did?

Consistency Checks

The <PROGRAM> offers different levels of rebates for [MEASURE] that have already stopped working compared to those that are still working. Rebates for [MEASURE] that are still working are higher than for those [MEASURE] that have failed.

Before today, were you aware that you received an increased rebate for replacing your old working [MEASURE]?

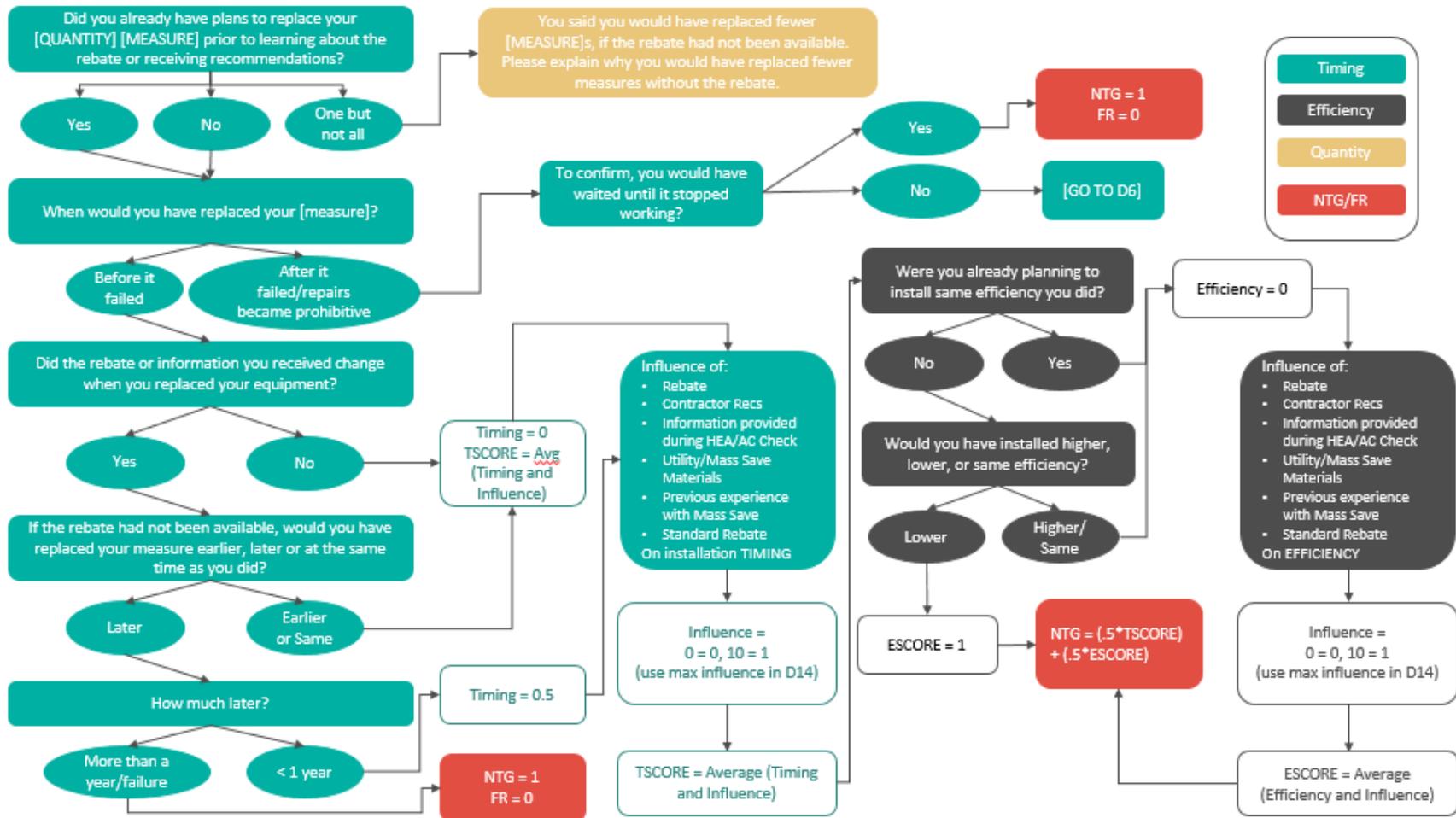
How much did this extra incentive influence your decision to replace your [MEASURE] before it stopped working?

Source: Navigant

As mentioned earlier, the timing of replacement is the primary determinant of free ridership for an Early Retirement HVAC program. If a participant would not have replaced their equipment until it failed in the absence of the program, the program should get full credit for their participation (0% free rider). Efficiency is only relevant when the program gets less than full credit for the timing of the replacement. In this case, the program should also get credit for increasing the efficiency of the installed equipment.

Within timing and efficiency, both the likelihood that a participant would have taken the same actions without the program and the influence the program had on the actions the participant did take will be assessed. When timing and efficiency likelihood scores are less than one, the influence of program aspects on the actions taken will be incorporated as well. Figure A-1 illustrates this approach to calculating participant free ridership.

Figure A-1. Participant Free Ridership Algorithm



Source: Net-to-gross analysis development

The following questions will also be included as additional context:

- When you called your contractor, were you planning to...replace, repair, or something else?
- Who or what was the most influential in your decision to replace your [heating/cooling] equipment while it was still functioning?
- Who or what was most influential in identifying and recommending the efficiency level of the equipment that you installed?
- If you had waited until your [MEASURE] failed to replace it, and received a lower rebate, what is the likelihood that you would still have installed the SAME efficiency [MEASURE]? Please use a scale of 0 to 10 where 0 is “not at all likely” and 10 is “very likely.”

In addition, other open-ended questions will be used when responses to the free ridership questions conflict. For example, when a respondent indicates that the availability of the rebate was the most influential factor in their decision to install their equipment when they did, but then rates the influence of the rebate low (0 to 3 on an 11-point scale). Some of these questions are:

- Why did you decide to install the [MEASURE]?
- Can you tell me, in your own words, how influential the program, including the rebate, your contractor, and any information you got during your Home Energy Assessment or AC Check was in your decision to install the [MEASURE] at the time you did? [MEASURE].
- [If aware they received an additional incentive for replacing before failure] How much did this extra incentive influence your decision to replace your [MEASURE] before it stopped working?

The evaluation team will compare responses from participants indicating particularly low (e.g., 0% to 10%) or high (e.g., 90% to 100%) free ridership rates. If there are irreconcilable inconsistencies, the evaluation team will drop these cases from the analysis.

A.3 Market Actor Free Ridership

The evaluation team will survey two market actor groups: 1) heating and cooling contractors, and 2) LV/HPCs, to provide consistency checks and context for the participant free ridership. Contractor free ridership results will be calculated separately from participant results, as a means of understanding how this important group of market actors views the influence of the program. The evaluation team will not use these results to override participant responses. Participant results will be used to calculate the ultimate NTG results for this program to place more reliance on the customer’s self-report of their decision-making process.

A.3.1 Heating and Cooling Contractors

Heating and cooling contractors will be asked a series of questions to understand their business practices and activities to understand the program influence. The survey will include the following questions to determine their perspective of free ridership:

- Thinking about all of the HVAC equipment your company has installed that received Early Retirement rebates, how influential was the program, including the rebates and information provided, in your customers’ decisions to replace their older HVAC equipment before it stopped functioning?

- Think about ALL of the customers you worked with who received an Early Replacement rebate for any equipment type. If the Early Replacement program had not existed, what percent of those customers would have likely still replaced their old equipment at the same time without the rebate? Include any customer who would have waited to replace their existing equipment by repairing or waiting for it to fail.
- You said that [X] percent of customers would have waited to replace their equipment until it failed or was unrepairable. Does this vary by the type of equipment they are looking to replace? In other words, are customers more likely to replace certain types of equipment early?
- How and why does this vary by equipment?
- Does this vary based on whether the equipment uses gas, oil, propane, or another fuel type? In other words, are customers more or less likely to replace HVAC systems that use gas, oil, or propane?
- How and why does this vary by fuel?
- Can you describe the influence of the Early Replacement rebate on your customers' decisions to replace their old functioning HVAC equipment?

HVAC contractors who participate in the Early Retirement HVAC program also participate in the Standard HVAC program. Given these overlaps in sample and the lines of questioning, the evaluation team has been coordinating with the TXC34 Standard HVAC NTG evaluation team and will be combining their contractor surveys into one with modules for Standard and Early Retirement.

A.3.2 Lead Vendors and Home Performance Contractors

Surveys with LVs and HPCs will provide context to free ridership rates and will not be used to directly calculate NTG. A Home Energy Assessment or AC Check is required for Early Retirement rebates, and in many cases the LV/HPC assessment may be the impetus of participants' decisions to replace inefficient equipment. The LV/HPC surveys will investigate the LV/HPC's understanding of participants' knowledge of the program and heating and cooling options and the LV/HPC's perception of program influence over customer decisions. Survey questions will include:

- On a scale of 0 to 10, where 0 is "not at all knowledgeable" and 10 is "very knowledgeable," how knowledgeable are most customers about their heating and/or cooling replacement options prior to the Home Energy Assessment?
- Before you provide your recommendations during a Home Energy Assessment, what percentage of customers to whom you recommend an early replacement ...
 - Are already aware of rebates for purchasing high efficiency equipment?
 - Are already aware of the increased rebate for replacing their older, inefficient equipment before it fails?
 - State that they would like to replace heating and/or cooling equipment before the Home Energy Assessment?
 - State that they would like to replace heating and /or cooling equipment based on recommendations provided in the Home Energy Assessment?
 - Are aware that their equipment is near the end of its useful life prior to the Home Energy Assessment?

- On a scale of 0 to 10, where 0 is “not at all influential” and 10 is “very influential,” how influential do you think each of the following is in a customer’s decision to replace their equipment before it fails?
 - The amount of the rebate
 - Recommendations provided during the Home Energy Assessment
 - Plans for replacement/repair they had in mind prior to the Home Energy Assessment
- Approximately what percentage of customers are already aware of the program via their HVAC contractor prior to their Home Energy Assessment?
- When prioritizing recommendations for a home, are early replacements typically a high, middle, or low priority recommendation?
 - Why do you prioritize them that way?
- Of all the homes you visited in the past 12 months, what percentage would qualify for an Early Replacement rebate?
 - In what percentage of those homes did you recommend an early replacement?
- Overall, why do you think customers decide to replace their heating and cooling equipment before it fails?
- What are the main reasons customers decided not to replace their rebate-eligible heating and cooling equipment?

A.4 Exploration of Nonparticipant Spillover

Questions gathering indicators of nonparticipant spillover will be collected via the contractor survey. However, the evaluation team expects to use this information only as context, and for process findings for the program. For the Early Retirement HVAC program, the evaluation team expects minimal nonparticipant spillover due to the design and requirements of the program and the increased rebate. In addition, the fact that the program requires verification by a Home Energy Assessment technician or AC Check contractor would make any savings estimates less reliable as they would rely on contractor guesses at eligibility.

However, the evaluation team does believe there is value in asking higher-level questions relating to early retirements outside of the program to assess if 1) contractors believe there is eligible equipment being installed outside of the program, and, if so, 2) why that might be occurring. An example may be exploring if waiting to get a Home Energy Assessment is a barrier to participating in the program. Although the evaluation team will not be quantifying savings from contractor responses, these findings will be useful from a program design and delivery perspective.

The following are questions the team plans to use to explore nonparticipant spillover:

- We’d like to understand if there is any program-eligible equipment being installed without program rebates. Since you began participating in the program, have you ever replaced any old, functioning equipment that you feel was eligible for the Early Retirement rebate, but did not receive one? Please only think about any equipment that met the Early Replacement program requirements for age and condition.
- Did any of these customers receive a Standard Program rebate instead?

- What percent of customers would you say received a Standard rebate instead of an Early Retirement rebate?
- About how many Early Replacement program-eligible projects did your company install that did not receive an Early Replacement rebate? Include all installations, whether they received a Standard rebate or not. Your best guess is fine.
 - a. Furnaces
 - b. Boilers
 - c. Central air conditioners
 - d. Central heat pumps
- Why do you think these customers were eligible to receive an Early Replacement rebate, but did not get one?

A.5 Participant Spillover

It is rare that residential participants install multiple pieces of HVAC equipment and participant perceptions of “energy efficient” may not align with PA definitions, so participant spillover will not be included in the NTG calculation for the Early Retirement HVAC program.

APPENDIX B. PARTICIPANT SURVEY

B.1 Introduction

Hello, my name is (YOUR NAME) with Bellomy Research. I am calling on behalf of [PA], one of the sponsors of the Mass Save® energy efficiency program. May I please speak with [FIRST.NAME LAST.NAME] or the person who made the decision to install equipment through the Mass Save Early Heating and Cooling Equipment Replacement program? (IF RESPONDENT NOT AVAILABLE, SAY:) May I please speak to one of the adults in your household who is responsible for your [PA] bill? (IF NOT AVAILABLE, ARRANGE A CALL BACK.) (IF ANOTHER PERSON COMES TO THE PHONE, REPEAT INTRO TO HIM/HER.)

Intro1. This is not a sales call. We are conducting a study with Massachusetts residents that recently received a rebate for installing energy efficient equipment through the Mass Save Early Heating and Cooling Equipment Replacement program. 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.

(INTERVIEWER NOTE: If customer asks about how their information is kept secure, please use the following response, “We maintain safeguards to protect survey responses. These include, for example, physical security of our facilities, technical safeguards to protect electronic data, and manager supervision.”)

(INTERVIEWER NOTE: If respondents question legitimacy, say: “If you have any questions or would like to verify the legitimacy of this research, please contact [PA CONTACT] with [PA].”)

B.2 Verification

[ASK IF SBOILER = 1]

A1. According to our records, you recently installed a high efficiency steam boiler that received a rebate through the Early Heating and Cooling Equipment Replacement program. Is that correct?

1. Yes
2. No
98. [Not Sure]
99. [Refused]

[ASK IF HWBOILER = 1]

A2. According to our records, you recently installed a high efficiency hot water boiler that received a rebate through the Early Heating and Cooling Equipment Replacement program. Is that correct?

1. Yes
2. No
98. [Not Sure]
99. [Refused]

[ASK IF A2 = 1 AND QUOTAMEASURE = HOT WATER BOILER – NON OWNER-OCCUPIED]

INTRO_DUPE. Our records indicate you installed a hot water boiler at [HSTREET_NAME]. Are you the person who made the decision to install that equipment?

- 1. Yes *[CONTINUE]*
- 2. No *[terminate]*
- 98. [Not Sure] *[terminate]*
- 99. [Refused] *[terminate]*

[IF HWB_DUPE = 1, ASK]

INTRO_DUPE2. Our records show you installed hot water boilers at multiple locations. For this discussion, please just think only about the location at [HSTREET_NAME]. We'll ask about other locations at the end of the call.

- 1. *[CONTINUE]*

[ASK IF FURNACE = 1]

A3. According to our records, you recently installed a high efficiency furnace that received a rebate through the Early Heating and Cooling Equipment Replacement program. Is that correct?

- 1. Yes
- 2. No
- 98. [Not Sure]
- 99. [Refused]

[ASK IF CAC = 1]

A4. According to our records, you recently installed a high efficiency central air conditioner that received a rebate through the Early Heating and Cooling Equipment Replacement program. Is that correct?

- 1. Yes
- 2. No
- 98. [Not Sure]
- 99. [Refused]

[ASK IF HP = 1]

A5. According to our records, you recently installed a high efficiency central heat pump that received a rebate through the Early Heating and Cooling Equipment Replacement program. Is that correct?

- 1. Yes
- 2. No
- 98. [Not Sure]
- 99. [Refused]

[TERMINATE IF NO MEASURE VERIFIED (A1-A5 <> 1)]

[DISPLAY IF MULTIPLE TYPES OF MEASURES]

A6_Intro. For the rest of the survey, please think only about the *[Measure]* you installed.

[ASK IF QUANTITY > 1]

A6. Our records show that you installed *[Quantity]* *[Measure]*s through the program. Is this correct?

- 1. Yes
- 2. No
- 98. [Not Sure]
- 99. [Refused]

[ASK IF A6 = 2]

A7. How many *[Measure]*s did you install through the program?

[Numeric Open End]

[FOR PROGRAMMING: IF A7 NE SAMPLE_QUANTITY, RECODE NEW_QUANTITY AND USE NEW_QUANTITY FOR D1 AND D4 INSERTS]

A8. Is the *[MEASURE]* still in use *[IF MEASURE = AC: during the cooling season]*?

- 1. Yes
- 2. No
- 98. [Not Sure]

[ASK IF A8 = 2] (MEASURE IS NOT IN USE)

A9. Why aren't you using the *[MEASURE]*? *(DO NOT READ LIST. RECORD ALL MENTIONS.)*

- 1. Under repair
- 2. Being replaced
- 3. Still waiting to receive
- 4. Have not yet installed
- 97. [Other][Specify] Other (Please specify)
- 98. [Not Sure]
- 99. [Refused]

[TERMINATE IF NO MEASURE IN USE (if a8 = 2, terminate)]

B.3 Program Awareness

[ASK B1 IF ASSESSMENT <> NONE] / [IF ASSESSMENT = NONE, SKIP TO B1A]

B1. Our records indicate that you also received an *[ASSESSMENT]* prior to your participation in the Early Heating and Cooling Equipment Replacement program.

[IF ASSESSMENT = HEA: This is when an energy specialist from Mass Save visited your home, and provided information and recommendations on how you could improve the efficiency of your home.]

[IF ASSESSMENT = AC CHECK: This is when your contractor visited your home to test that your central AC was working properly.]

Is that correct?

- 1. Yes
- 2. No
- 98. [Not Sure]
- 99. [Refused]

[ASK IF ASSESSMENT = NONE]

- B1A. Prior to installing your [MEASURE], do you recall receiving...? (READ STATEMENT.)
- A. a Home Energy Assessment from a Mass Save Energy Specialist, who would have provided information and recommendations on how you could improve the efficiency of your home
 - B. [ASK IF MEASURE = AC OR HEAT PUMP] Or, a visit from an AC Check contractor, to test that your cooling equipment was working properly?
 - 1. Yes
 - 2. No
 - 98. [Not Sure]
 - 99. [Refused]

[FOR PROGRAMMING: IF B1 = 2, 98, 99, RECODE NEW_ASSESSMENT = NONE. IF B1A_A = YES, RECODE NEW_ASSESSMENT = HEA. IF B1A_B = YES, RECODE NEW_ASSESSMENT = AC CHECK.]

[RECODED FIELD IS LABELLED "NEW_ASSESSMENT" IN DATA.]

- B2. How did you first learn about the availability of the rebate for replacing your old heating or cooling equipment with a [Measure]? (DO NOT READ LIST. RECORD ONE ANSWER ONLY.) (INTERVIEWER NOTE: IF RESPONDENT MENTIONS "THE PERSON WHO DID THE AUDIT", SELECT "HOME ENERGY ASSESSMENT/ENERGY SPECIALIST" FOR THE ANSWER.)
- 1. Contractor
 - 2. Home Energy Assessment/Energy Specialist
 - 3. Utility website
 - 4. Retailer/dealer
 - 5. Friend/relative/neighbor/word of mouth
 - 6. Internet
 - 7. Bill insert/mailing
 - 97. [Other][Specify] Other (Please specify)
 - 98. [Not Sure]
 - 99. [Refused]

[ASK IF B2 = 1 and ASSESSMENT = HEA]

- B3. To clarify, did your contractor inform you about the rebate for replacing your old working [MEASURE] **before** you had a Home Energy Assessment from Mass Save?
- 1. Yes
 - 2. No
 - 98. [Not Sure]
 - 99. [Refused]

[ASK IF B2 <> 2 and ASSESSMENT = HEA]

B4. Did the Energy Specialist who visited your home as part of the Home Energy Assessment mention the rebates available for replacing your old but working *[MEASURE]*?

- 1. Yes
- 2. No
- 98. [Not Sure]
- 99. [Refused]

B5. Did you receive any marketing materials from *[PA]* or Mass Save about the benefits of replacing inefficient older but functioning heating and cooling equipment with new high efficiency equipment?

- 1. Yes
- 2. No
- 98. [Not Sure]
- 99. [Refused]

B6. Did you visit *[PA]*'s or Mass Save's website to learn more about the benefits of replacing your older, inefficient equipment with high efficiency heating, cooling, or water heating equipment?

- 1. Yes
- 2. No
- 98. [Not Sure]
- 99. [Refused]

B7. Did you receive a tax credit or rebate from the local, state, or federal government for the *[MEASURE]* that you installed?

- 1. Yes
- 2. No
- 98. [Not Sure]
- 99. [Refused]

B.4 Equipment Characteristics and Condition

C1. At the time of replacement, approximately how old was your existing system? (IF NEEDED: Your best guess is fine.)

___ YEARS *[Numeric Open End]*

[PROGRAMMER PLEASE PROVIDE NOT SURE CHECKBOX FOR OUTBOUND AND ONLINE VERSIONS]

C2. What was the condition of your old *[Measure]*? (READ LIST. RECORD ONE ANSWER ONLY.)

- 3. Working well with no problems
- 4. A few minor issues
- 5. In need of some repairs
- 6. In need of major repairs
- 7. Not working at all
- 98. [Not Sure] (DO NOT READ)
- 99. [Refused] (DO NOT READ)

C3. Prior to replacing your system, had it undergone any repairs not including regular maintenance or tune-ups?

- 8. Yes
- 9. No
- 98. [Not Sure]
- 99. [Refused]

[ASK IF C3 = 1]

C4. Approximately how many times did you have to repair the old system during the year prior to replacement, not including regular maintenance or tune-ups? (IF NEEDED: Your best guess is fine.)

___ times *[Numeric Open End]*

[PROGRAMMER PLEASE PROVIDE NOT SURE CHECKBOX FOR OUTBOUND AND ONLINE VERSIONS]

C5. If you had not replaced your *[Measure]* when you did through the Early Heating and Cooling Equipment Replacement program, how much longer do you think it would have kept working? Would you say...(READ LIST)?

- 10. 1 year or less
- 11. 2 years
- 12. 3 years
- 13. 4 years
- 14. Or 5 or more years
- 98. [Not Sure] (DO NOT READ)
- 99. [Refused] (DO NOT READ)

C6. There are a variety of reasons why people replace their *[MEASURE]*. When thinking about your decision to replace your old *[MEASURE]*, how important was the fact that your system might be reaching the end of life and might fail in the near future? Would you say...(READ LIST)?

- 5. Very important
- 4. Somewhat important
- 3. Neither important nor unimportant
- 2. Somewhat unimportant
- 2. Not at all important
- 98. [Not Sure] (DO NOT READ)
- 99. [Refused] (DO NOT READ)

C7. Prior to learning about the Early Heating and Cooling Equipment Replacement program, had you already been in contact with your contractor to discuss...(READ LIST)? (RECORD ALL MENTIONS.)

- 1. Replacing your *[Measure]*,
- 2. Repairing your *[Measure]*
- 97. (DO NOT READ) Or neither
- 98. [Not Sure] (DO NOT READ)
- 99. [Refused] (DO NOT READ)

C8. Why did you decide to install the *[MEASURE]*? (DO NOT READ LIST. RECORD ALL MENTIONS.)

1. Old equipment could not be repaired
2. Old equipment was too old and not worth fixing
3. Repairs required to fix the old equipment were too expensive
4. To increase efficiency level
5. I thought the rebate might not be there when my unit failed in the future
6. Because the rebate was higher if I replaced it before it failed
7. Contractor indicated the unit would fail soon
97. *[Other][Specify]* Other (Please specify)
98. *[Not Sure]*
99. *[Refused]*

B.5 Free Ridership

D1_Intro. Now I would like to ask you some questions about what motivated you to install the *[Measure]* through the Early Heating and Cooling Equipment Replacement program when you did. When answering the following questions, please think about your decision to install an efficient *[Measure]* before your old one stopped working.

D1. The Early Heating and Cooling Equipment Replacement program helps customers replace old but working heating and cooling equipment by providing information and recommendations as well as increased rebates for this equipment.

[IF NEW_QUANTITY = 1, display:] Before you learned about the program, did you already have plans to replace your working *[Measure]*?

[IF NEW_QUANTITY > 1, display:] Before you learned about the program, did you already have plans to replace your *[IF NEW_QUANTITY > 1 THEN SHOW NEW_QUANTITY]* working *[Measure]*s?

1. Yes, I had plans to replace my *[MEASURE]*
2. No, I did not have plans to replace my *[MEASURE]*
3. *[IF NEW_QUANTITY > 1 SHOW:]* I planned to replace some, but not all of my *[MEASURE]*s *[Skip to D4]*
98. *[Not Sure]*
99. *[Refused]*

D2. If you had not participated in the program, when would you have replaced your *[Measure]*? *Would it have been... (READ LIST)?*

1. While it was still working reasonably well
2. When it began to have more major issues, or repairs were too costly or extensive, or
3. After it stopped working completely and became unrepairable
98. *[Not Sure]* (DO NOT READ)
99. *[Refused]* (DO NOT READ)

[Ask if D2 = 2 OR 3]

D3. Just to confirm, you would have waited until after your *[Measure]*

[IF D2 = 2, SHOW: needed costly or extensive repairs to replace it?]

[IF D2 = 3, SHOW: stopped working completely to replace it?]

- 1. Yes
- 2. No
- 98. [Not Sure]
- 99. [Refused]

[if d3 = 1, skip to d9]

[if d3 = 2, 98, 99, continue]

[Ask if D1 = 3]

D4. You said you would have replaced some, but not all *[NEW_QUANTITY]* of your *[Measure]*s. Please explain why you would have replaced fewer *[MEASURE]*s without the rebate. (RECORD VERBATIM.) (INTERVIEWER: *PROBE FOR TIMING AND INFLUENCE OF PROGRAM ON INSTALLATION FOR THE MULTIPLE PIECES OF EQUIPMENT.*)

_____ *[Open End]*

D5. *For the next questions, I'd like you to think about the [MEASURE] you would have still replaced if the program had not existed.*

Did the rebate or information received from the contractor or energy assessor change the timing of when you replaced your *[Measure]*?

- 1. Yes, it changed when I replaced my *[Measure]*
- 2. No, it did not change when I replaced my *[Measure]*
- 98. [Not Sure]
- 99. [Refused]

D6. *If the rebate had not been available, when would you have replaced your [Measure]? Would it have been...(READ LIST)?*

- 1. *Earlier than you did through the program*
- 2. *At the same time as you did through the program*
- 3. *Later than you did through the program*
- 4. *I would not have installed the [Measure]*
- 98. [Not Sure] (DO NOT READ)
- 99. [Refused] (DO NOT READ)

[Ask if D6 = 4]

D7. *Just to confirm, if the rebate had not been available, you would not have installed the [MEASURE] at all, is that correct?*

- 1. Yes
- 2. No
- 98. [Not Sure]
- 99. [Refused]

[Ask if D6 = 3]

D8. *If you had not received the rebate, or recommendation from your contractor or energy assessor, when would you have installed the [MEASURE]? Would it have been...(READ LIST)?*

1. *Within 6 months*
2. *Between 6 months and a year later*
3. *More than a year later*
4. *When it failed*
5. *When repairs became too costly or extensive for you to repair*
98. [Not Sure] (DO NOT READ)
99. [Refused] (DO NOT READ)

D9. Who or what was the most influential in your decision to replace your [MEASURE] equipment while it was still functioning? (DO NOT READ LIST. RECORD ONE ANSWER ONLY.) (INTERVIEWER NOTE: IF RESPONDENT MENTIONS "THE PERSON WHO DID THE AUDIT", SELECT "HOME ENERGY ASSESSMENT/ENERGY SPECIALIST" FOR THE ANSWER.)

1. Me/myself
2. Contractor
3. Home Energy Assessment/Energy Specialist
4. Availability of rebate
5. Friend/family/neighbor/word of mouth
97. [Other][Specify] Other (Please specify)
98. [Not Sure]
99. [Refused]

D10_Intro. Now I would like to ask you a couple of questions about what motivated you to install a high efficiency [Measure] through the Early Heating and Cooling Equipment Replacement program. When answering the following questions, please think about your decision to install a high efficiency [Measure] rather than a less efficient one.

[Ask if D1 = 1]

D10. Earlier you said you already had plans to replace your [Measure] before learning about the program. Were you already planning to install a [Measure] of the same efficiency as you did through the program?

1. Yes
2. No
98. [Not Sure]
99. [Refused]

D11. *If you had not participated in the program, what level of efficiency do you think you would have installed when you replaced your [Measure]? Would it have been...(READ LIST)?*

1. *Higher efficiency*
2. *The same efficiency*
3. *A lower efficiency*
98. [Not Sure] (DO NOT READ)
99. [Refused] (DO NOT READ)

D12. Who or what was the most influential in identifying and recommending the **efficiency level** of the equipment that you installed? (DO NOT READ LIST. RECORD ONE ANSWER ONLY.) (INTERVIEWER NOTE: IF RESPONDENT MENTIONS “THE PERSON WHO DID THE AUDIT”, SELECT “HOME ENERGY ASSESSMENT/ENERGY SPECIALIST” FOR THE ANSWER.)

- 1. Me/myself
- 2. Contractor
- 3. Home Energy Assessment/Energy Specialist
- 4. Availability of rebate
- 5. Friend/family/neighbor/word of mouth
- 97. [Other][Specify] Other (Please specify)
- 98. [Not Sure]
- 99. [Refused]

D13. If you had waited until your *[Measure]* failed to replace it, and received a lower rebate, what is the likelihood that you would still have installed the SAME efficiency *[Measure]*? Please use a scale of 0 to 10 where 0 is “not at all likely” and 10 is “very likely.”

[SHOW GRID]

D14. Next, I am going to ask you to think about the influence of the program on two components of your decision to install your *[Measure]*: the timing of when you installed it, and the efficiency level of the equipment.

Please answer the following questions on a scale of 0 to 10 where 0 is “not at all influential” and 10 is “very influential.”

(READ STATEMENT, THEN READ BOTH COMPONENTS OF THE SCALE.) (RECORD ANSWER FOR EACH.)

(REPEAT FOR ALL STATEMENTS.) (REPEAT SCALE AS NECESSARY.)

	1. on the timing of when you installed your <i>[MEASURE]</i>	2. on the efficiency level of your <i>[MEASURE]</i>
a.	How influential was the program rebate	
b.	How influential was your contractor’s recommendations	
c.	[IF ASSESSMENT = HEA or AC Check] How influential was information from your <i>[ASSESSMENT]</i> (if <i>NEEDED</i> : the HEA was your Home Energy Assessment, when the energy specialist from Mass Save visited your home, and provided information and recommendations on how you could improve the efficiency of your home.)	

- d. How influential was the age or condition of your old *[Measure]*

- e. How influential was information from your utility or Mass Save marketing material or websites

- f. How influential was previous experience with Mass Save programs

- g. [IF STANDARD = 1] How influential was the rebate you received for another piece of equipment

PROGRAMMING NOTE: CALCULATE INCONSISTENCY CHECK.

COMPUTE MAX_INF = MAX OF D14_1A, D14_1B, D14_1C, D14_1E, D14_1F, D14_1G, D14_2A, D14_2B, D14_2C, D14_2E, D14_2F, and D14_2G.

[ASK IF: MAX INF < 4 AND (D2 = 2 OR D2 = 3)]

D15. Earlier you said that you would have been unlikely to install the [MEASURE] at the time you did if the rebate wasn't available, but at the same time you say that the program was not influential in your decision to install it. Would you say...(READ LIST)?

1. Yes, the program was influential in my decision, or
2. No, the program was not influential on my decision

[ASK IF: MAX INF > 7 AND (D2 = 1)]

D16. Earlier you said that you would have been likely to install the [MEASURE] at the time you did if the rebate wasn't available, but at the same time you say that the program was influential in your decision to install it. Would you say...(READ LIST)?

1. Yes, the program was influential in my decision, or
2. No, the program was not influential in my decision

D17. Can you tell me, in your own words, how influential the program, including the rebate, your contractor, and any information you received *[IF ASSESSMENT = HEA OR AC Check DISPLAY: "during your HEA or AC Check,"]* was in your decision to install the [MEASURE] at the time you did? (RECORD VERBATIM.)

_____ *[Open End]*

D18. Mass Save offers different levels of rebates for [MEASURE]s that have already stopped working compared to those that are still functioning. Rebates for [MEASURE]s that are still working, like yours, are higher than for those [MEASURE]s that have failed.

Before today, were you aware that you received an increased rebate for replacing your [MEASURE] that was still working?

1. Yes
2. No
98. [Not Sure]
99. [Refused]

[ask if D18 = 1]

D19. How much did this extra incentive influence your decision to replace your [MEASURE] before it stopped working? (RECORD VERBATIM.)

_____ *[Open End]*

[ASK IF STANDARD = 1]

D20. Our records show you also recently received rebates from Mass Save for other heating, cooling, or water heating equipment for your home. Can you describe how, if at all, your installation of this other rebated equipment impacted your decision to install [MEASURE] at the time that you did? (RECORD VERBATIM.)

_____ *[Open End]*

[ASK IF HWB_DUPE = 1]

END_DUPE. We have on record that you also installed energy efficient hot water boilers through the program at other locations. Was your decision-making process to install hot water boilers the same or different for these other locations?

- 1. Same
- 2. Different
- 98. [Not Sure]
- 99. [Refused]

[ASK IF END_DUPE = 2]

END_DUPE_FOLLOW. How was it different? (RECORD VERBATIM.)

_____ *[Open End]*

B.6 Demographics

E1. We are almost finished. What type of residence do you live in? (READ LIST IF NEEDED.)

- 1. Single-family
- 2. Duplex or two-family
- 3. Apartment or condo in a 2-4 unit building
- 4. Apartment or condo in a building with more than 4 units
- 5. Townhouse or row house
- 6. Mobile home or house trailer
- 97. [Other][Specify] Other (Please specify)
- 98. [Not Sure]
- 99. [Refused]

E2. Approximately when was this home built? (READ LIST IF NEEDED.)

- 1. Before 1950
- 2. Between 1950 and 1959
- 3. Between 1960 and 1969
- 4. Between 1970 and 1978
- 5. Between 1979 and 1988
- 6. Between 1989 and 2001
- 7. Between 2002 and 2007
- 8. 2008 or later
- 98. [Not Sure] (DO NOT READ)
- 99. [Refused] (DO NOT READ)

E3. What is your home's primary heating fuel? (READ LIST IF NEEDED. RECORD ONE ANSWER ONLY.)

1. Natural gas
2. Propane
3. Fuel oil
4. Kerosene
5. Coal
6. Wood
7. Pellet wood
8. Electricity
97. [Other][Specify] Other (Please specify)
98. [Not Sure] (DO NOT READ)
99. [Refused] (DO NOT READ)

E4. What is the highest level of education you completed? (READ LIST IF NEEDED.)

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. Bachelor's degree
6. Graduate or professional degree
98. [Not Sure] (DO NOT READ)
99. [Refused] (DO NOT READ)

E5. Which of the following best describes your age? (READ LIST.)

1. 18 to 24
2. 25 to 34
3. 35 to 44
4. 45 to 54
5. 55 to 64
6. 65 or over
98. [Not Sure] (DO NOT READ)
99. [Refused] (DO NOT READ)

E6. What best describes your total household income in 2017, before taxes? (READ LIST.)

1. Less than \$35,000
2. \$35,000 to less than \$50,000
3. \$50,000 to less than \$75,000
4. \$75,000 to less than \$100,000
5. \$100,000 to less than \$150,000
6. \$150,000 to less than \$200,000
7. \$200,000 or more
98. [Not Sure] (DO NOT READ)
99. [Refused] (DO NOT READ)

Those are all the questions I have. 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.

APPENDIX C. EARLY RETIREMENT CONTRACTOR SURVEY

C.1 Introduction

Thank you for agreeing to take part in this survey!

As mentioned in the email you received, we are conducting this survey on behalf of the utilities and energy efficiency service providers that sponsor [Mass Save®](#). We would like to learn about your experiences with the Mass Save rebate program for high-efficiency heating, water heating, and cooling equipment. Your feedback will help make sure that the Sponsors of Mass Save continue to benefit customers and contractors such as yourself. If you are eligible for the survey and complete it, we will send you a \$50 Amazon gift card or check or donate \$50 to one of these charities: Hurricane Relief Fund, Big Brothers Big Sisters of Massachusetts Bay, or the Berkshire Humane Society. Our questions should take less than 25 minutes of your time and your answers will be kept confidential.

[IF PHONE, SHOW "IF NEEDED:"] Questions about the legitimacy of this research? Contact Chris Chan, Eversource, at (781) 441-8544 or christopher.chan@eversource.com or study manager Nicole Rosenberg at (617) 284-6230 x9.

[IF WEB, LINK A POP UP TO FIRST MENTION OF MASS SAVE: "Mass Save® is a collaborative of Massachusetts' natural gas and electric utilities and energy efficiency service providers including Berkshire Gas, Blackstone Gas, Cape Light Compact JPE, Columbia Gas of Massachusetts, Eversource, Liberty Utilities, National Grid, and Unitil. They empower residents, businesses, and communities to make energy efficient upgrades by offering a wide range of services, rebates, incentives, trainings, and information."]

[IF PHONE] IF SAYS JUST RESPONDED TO ANOTHER SURVEY: The sponsors of Mass Save are conducting two surveys. *This* survey is about how the Mass Save rebates affect the decisions that you and your customers make. The *other* survey is about the costs to purchase and install certain types of residential water heating and cooling equipment. We really appreciate your answering both surveys, and we hope you can take a little time today to answer these questions too.

C.2 Screening

- S1. Let's first make sure that you are eligible to complete the survey. Does your company install residential heating, water heating, and cooling equipment in single-family homes in Massachusetts? [IF RESPONSE CATEGORIES ARE IN PARENTHESES, EXCLUDE FROM WEB SURVEY; DON'T KNOW/REFUSED SHOULD NEVER BE READ ALOUD ON PHONE]
1. Yes
 2. No
 98. Don't know
 99. (Refused)

[IF S1 < > 1] Unfortunately, you are not eligible to complete this survey. Thank you for your time. [TERMINATE]

S1a. Are you familiar with your company’s installation of high-efficiency heating, water heating, and cooling equipment for which customers received rebates from the Sponsors of Mass Save?

- 1. Yes
- 2. No
- 98. Don’t know
- 99. (Refused)

[IF S1a < > 1, READ] Would you be able to refer us to a colleague who is familiar with your participation in these programs and can respond to this survey? [WILL WORK WITH SURVEY PROGRAMMERS ON BEST FOLLOW-UP APPROACH FOR EACH MODE TO OBTAIN CONTACT INFORMATION]

S1b. [WEB ONLY; SKIP AFTER REACHING P77 QUOTA (n=20)] Does your company install either of the following types of equipment in commercial or industrial buildings in Massachusetts?

- a. Small commercial water heaters, including tankless or tank-style residential-style units
- b. Large commercial water heaters, such as dedicated domestic hot water boilers and combined heating/DHW boilers

[FOR EACH]

- 1. Yes
- 2. No
- 98. Don’t know
- 99. (Refused)

S1bb. [ASK IF S1b_a OR S1b_b = 1] Would you be willing to answer additional questions about your company’s installations of commercial water heaters at the end of this survey, for an additional \$30 gift card?

- 1. Yes
- 2. No
- 99. (Refused)

[COMPUTE P77 = 0; IF S1bb = 1, THEN P77 = 1]

S2_TEXT. The Sponsors of Mass Save offer two levels of rebates to encourage residential customers to replace less efficient heating and cooling equipment with high-efficiency equipment: **Early-Replacement** and **Standard**. Early Replacement rebates are offered for functioning furnaces, central air conditioning systems, and central heat pumps that are 12 or more years old, or functioning boilers that are 30 or more years old; and are expected to function and operate for the foreseeable future. Early Replacement rebates are about two and a half times as much as Standard rebates.

S2INTRO. [\[ASK IF STANDARD = 1 AND ER = 1\]](#) Our records indicate in 2016 your company installed equipment for which both Standard and Early Replacement rebates were claimed. To your knowledge, is that correct?

1. Yes, both Standard and Early Replacement rebates
2. No, just Standard rebates
3. No, just Early Replacement rebates
98. Don't know
99. (Refused)

S2INTROa. [\[ASK IF STANDARD = 1 AND ER = 0\]](#) Our records indicate in 2016 your company installed equipment for **Standard** rebates were claimed, but not for Early Replacement rebates. To your knowledge, is that correct?

1. Yes, just Standard rebates
2. No, just Early Replacement rebates
3. No, both Standard and Early Replacement rebates
98. Don't know
99. (Refused)

S2INTROb. [\[ASK IF STANDARD = 0 AND ER = 1\]](#) Our records indicate in 2016 your company installed equipment for which Early Replacement rebates were claimed, but not for Standard rebates. To your knowledge, is that correct?

1. Yes, just Early Replacement rebates
2. No, just Standard rebates
3. No, both Standard and Early Replacement rebates
98. Don't know
99. (Refused)

[\[IF S2INTRO, S2INTROa, OR S2INTROb = 98 OR 99, READ\]](#) Is there a colleague of yours who is familiar with your company's installation of rebated equipment who can respond to this survey?
[\[WILL WORK WITH SURVEY PROGRAMMERS ON BEST FOLLOW-UP APPROACH FOR EACH MODE TO OBTAIN CONTACT INFORMATION\]](#)

[IF V_ER < > 1 AND ALL VSQTY_XX = 0, SKIP TO TERM4]

S5. [IF V_ER = 1, INCLUDE “Next, we’ll ask you to think about the types of residential equipment you installed that received **Early Replacement** rebates through the Mass Save program.”]

Our records show that in 2016 your company installed the following types of residential equipment for which you or your customers received **Early Replacement** rebates from Mass Save. Is that correct? If your company is a large retailer, only think of the installations that your store or location’s installers perform. [SINGLE SCREEN]

- a. [ASK IF ER_CAC = 1] Central air conditioning systems
- b. [ASK IF ER_FURN = 1] Furnaces
- c. [ASK IF ER_BOIL = 1] Boilers
- d. [ASK IF ER_CHP = 1] Central heat pumps

[FOR EACH]

- 1. Yes
- 2. No
- 98. Don’t know
- 99. (Refused)

[COMPUTE VERIFIED MEASURE VARIABLES, “VER_XX” SERIES]

COMPUTE	EQUALS
VER_CAC	0
VER_FURN	0
VER_BOIL	0
VER_CHP	0

IF	THEN
S5a = 1	VER_CAC = 1
S5b = 1	VER_FURN = 1
S5c = 1	VER_BOIL = 1
S5d = 1	VER_CHP = 1

[IF ALL S5 < > 1 AND V_STANDARD = 0] Unfortunately, you are not eligible to complete this survey. Thank you for your time. [TERMINATE]

C.3 Early Replacement Net-to-Gross Context (RES36)

[IF V_ER < > 1, SKIP MODULE]

Let’s discuss your experiences with the Early Replacement rebates in 2016.

- ER1. [ASK IF VER_FURN, VER_BOIL, OR VER_CHP = 1] Customers who receive an Early Replacement rebate for furnaces, boilers, or heat pumps must get a Mass Save Home Energy Assessment to verify eligibility. What percentage of customers who receive an Early Replacement rebate...
- a. **First** receives a Home Energy Assessment, **then** contacts you to install their HVAC equipment?
 - b. Works with you **first**, and then you refer them to the Home Energy Assessment to verify eligibility?
 [ALLOW 0 TO 100; WHOLE NUMBERS]
 998. Don't know
 999. (Refused)
- ER2. Thinking about all of the HVAC equipment your company has installed that received Early Replacement rebates, how influential was the program, including the rebates and information provided, in your customers' decisions to replace their older HVAC equipment before it stopped functioning? Would you say the program was....
1. Very influential
 2. Somewhat influential
 3. Not very influential
 4. Not at all influential
98. Don't know
 99. (Refused)
- ER3. Think about ALL of the customers you worked with who received an Early Replacement rebate for any equipment type. If the Early Replacement program had not existed, what percent of those customers would have likely still replaced their old functioning equipment at the same time without the rebate?
 [FOR EACH ALLOW 0 TO 100; WHOLE NUMBERS]
 998. Don't know
 999. (Refused)
- ER4. [SKIP IF ER3 > 100] You said that [ER3] percent of customers would have still replaced their old functioning equipment at the same time without the Early Retirement rebate. Does this vary by the type of equipment they are looking to replace? In other words, are there certain types of heating and cooling equipment that customers are more or less likely to replace before they fail?
1. Yes
 2. No
98. Don't know
 99. (Refused)
- ER4a. [ASK IF ER4 = 1] How and why does this vary by equipment?
 [OPEN END]
 98. Don't know
 99. (Refused)

- ER4b. [ASK IF VER_FURN OR VER_BOIL = 1] Does this vary based on whether the equipment uses gas, oil, propane, or another fuel type? In other words, are customers more or less likely to replace HVAC systems that use gas, oil, or propane before they fail?
1. Yes
 2. No
 98. Don't know
 99. (Refused)
- ER4c. [ASK IF ER4b = 1] How and why does this vary by fuel?
[OPEN END]
98. Don't know
 99. (Refused)
- ER5. In your own words, can you please describe the influence of the Early Replacement rebate on your customers' decisions to replace their old functioning HVAC equipment?
[OPEN END]
98. Don't know
 99. (Refused)
- ER6. We'd like to understand if there is any program-eligible equipment being installed without program rebates.
Since you began participating in the program, have you ever replaced any old, functioning equipment that you feel was eligible for the Early Replacement rebate, but did not receive one?
1. Yes
 2. No
 98. Don't know
 99. (Refused)
- ER7. [ASK IF ER6 = 1] Did any of these customers receive a Standard Program rebate instead?
1. Yes
 2. No
 98. Don't know
 99. (Refused)
- ER7A. [ASK IF ER7 = 1] What percent of customers would you say received a Standard rebate instead of an Early Replacement rebate even though they were eligible for an Early Replacement rebate?
[ALLOW 0 TO 100; WHOLE NUMBERS]
998. Don't know
 999. (Refused)
- ER8. [ASK IF ER6 = 1] About how many Early Replacement program-eligible projects did your company install that did not receive an Early Replacement rebate for each of the following equipment types? Include all installations, whether they received a Standard rebate or not. Your best guess is fine.
- a. Furnaces
 - b. Boilers
 - c. Central air conditioners
 - d. Central heat pumps

[FOR EACH]
[OPEN-END NUMERIC]

- 998. Don't know
- 999. (Refused)

ER8. [ASK IF ER6 = 1] Why do you think these customers were eligible to receive an Early Replacement rebate, but did not get one?

- [OPEN END]
- 998. Don't know
 - 999. (Refused)

C.4 Fuel Types

F1. [SKIP IF V_ER <> 1] Our records indicate that your company installs equipment with the following fuel types. Does your company in fact install these? [SINGLE SCREEN]

- a. [IF GAS_B = 1 AND VER_BOIL = 1] **Natural gas** hot water or steam boilers
- b. [IF PROPANE_B = 1 AND VER_BOIL = 1] **Propane hot water or steam** boilers
- c. [IF OIL_B = 1 AND VER_BOIL = 1] **Oil hot water or steam** boilers
- d. [IF GAS_F = 1 AND VER_FURN = 1; SKIP IF VS_FURN = 1] **Natural gas** furnaces
- e. [IF PROPANE_F = 1 AND VER_FURN = 1] **Propane** furnaces
- f. [IF OIL_F = 1 AND VER_FURN = 1] **Oil** furnaces

[FOR EACH]

- 1. Yes
- 2. No
- 98. Don't know
- 99. (Refused)

F2. Are there instances when your company helps a customer switch from either propane or oil to natural gas or electricity for their heating equipment?

- 1. Yes
- 2. No
- 98. Don't know
- 99. (Refused)

F3. [IF F2 = 1] About how many fuel-switching projects does your company assist with per year?

[OPEN-END NUMERIC]

- 9998. Don't know
- 9999. (Refused)

C.5 Final Closing

On behalf of the Sponsors of Mass Save, thank you very much for your time today.

APPENDIX D. HOME ENERGY ASSESSMENT ENERGY SPECIALIST SURVEY

D.1 Email Introduction

On behalf of the utilities and energy efficiency service providers that sponsor [Mass Save®](#), we are conducting a study of the Mass Save Early Heating and Cooling Replacement Program. According to our records, you have performed Home Energy Assessments in homes that have received rebates for replacing their older, inefficient equipment before it fails. We are interested in your opinion about how knowledgeable your customers are about their heating and cooling equipment replacement options and what ultimately motivates them to replace their equipment. The survey will take about 10 minutes and the information that we gather will be used to improve energy efficiency programs in Massachusetts. All of your responses are confidential. We will only report aggregated findings across all survey respondents.

D.2 Verification

A1. According to our records, you provided Home Energy Assessments for the Home Energy Services (HES) initiative in Massachusetts in the past year. Is that correct?

98. Yes

99. No [[Terminate](#)]

98. [Not Sure]

A2. Mass Save offers different levels of rebates for heating and cooling equipment. The Early Replacement rebates (for HVAC equipment that is older but still working) are higher than the standard rebates (for equipment that has failed).

Have you recommended that someone replace their heating or cooling equipment through the Early Replacement Program in the past year?

100. Yes

101. No [[Terminate](#)]

98. [Not Sure]

[[If A2 = 1](#)]

A3. Can you describe your understanding of the requirements for customers to participate in the Early Replacement program? [[OPEN END](#)]

D.3 Program Awareness and Knowledge

We are interested in your opinion about how knowledgeable customers are about their heating and cooling equipment replacement options and the Early Replacement Rebates.

B1. When considering if a customer is eligible to participate in the Early Replacement program, what do you typically look for in a home? [[OPEN END](#)]

- B2. Overall, how knowledgeable are most customers about their heating and/or cooling replacement options prior to the Home Energy Assessment (HEA)?
- 102. Not knowledgeable at all
 - 103. Slightly knowledgeable
 - 104. Moderately knowledgeable
 - 105. Very knowledgeable
 - 106. Extremely knowledgeable
 - 98. [Not Sure]
 - 99. [Refused]
- B3. Thinking only about the customers for whom you ultimately recommend early equipment replacement, what percentage of customers... [NUMERIC OPEN END, DOES NOT NEED TO ADD TO 100%]
- 1. Are already aware of rebates, in general, for purchasing high-efficiency equipment (prior to hearing your recommendations)?
 - 2. State that they would like to *repair* their heating and/or cooling equipment (prior to hearing your recommendations)?
 - 3. State that they would like to *replace* their heating and/or cooling equipment (prior to hearing your recommendations)?
 - 4. Are aware that their equipment is near the end of its useful life prior to the HEA?
- B4. At what point in the HEA do you typically mention the availability of the Early Replacement rebates? [OPEN END]
- B5. Approximately what percentage of customers are already aware specifically of the Early Replacement rebates prior to their HEA?
- [ASK IF B5 > 0]
- B6. From what sources do customers say they have heard of the Early Replacement rebates? (SHOW OPTIONS, SELECT ALL THAT APPLY)
- 1. Their HVAC contractor
 - 2. Their utility or program administrator (program website, marketing materials, etc.)
 - 3. Friends, coworkers, or family
 - 4. Somewhere else (SPECIFY)
 - 98. [Not Sure]
 - 99. [Refused]
- B7. How effective do you think Mass Save program materials are in communicating the benefits of the Early Replacement program?
- B8. When presenting the value of the Early Replacement program, which of the following do you find to be most effective selling points for customers? Please rank them from most effective – 1, to least effective - 5. [RANDOMIZE 1-5]
- 1. The increased rebate for early replacement of old equipment

- 2. The energy bill savings from new efficient equipment
- 3. Peace of mind/avoiding uncertainty about when equipment will fail
- 4. Health and safety
- 5. Comfort
- 98. [Not Sure]
- 99. [Refused]

- 99. [Refused]

B9. In what situations do you recommend the Early Replacement rebates as high priority? [OPEN END]

[If B9_3 >0]

B10. In what situations do you recommend the Early Replacement rebates as lower priority? [OPEN END]

B11. Does the type of eligible equipment (such as central air, furnace, boiler, heat pump, etc.) affect what recommendations you make to customers when it comes to participating in the Early Replacement program?

- 1. Yes
- 2. No
- 98. [Not Sure]
- 99. [Refused]

[If B12=1]

B12. How does equipment type affect your recommendations? [OPEN END]

B13. Does the fuel type of eligible equipment affect what recommendations you make to customers when it comes to participating in the Early Replacement program?

- 1. Yes
- 2. No
- 98. [Not Sure]
- 99. [Refused]

[If B14=1]

B14. How does fuel type affect your recommendations? [OPEN END]

B15. Of all the homes you visited in the past 12 months, what percentage would qualify for an early replacement rebate? [NUMERIC OPEN END]

[If B16>0]

B16. In what percentage of those homes did you recommend an early replacement? [Numeric OPEN END]

D.4 Customer Decision Making

C1. Of the customers you speak with that are interested in the Early Replacement rebates, what percentage do you think would replace their old equipment early regardless of the rebate?

[NUMERIC OPEN END]

[ASK IF C1 <> 0]

C2. Does this vary by whether the customer was already aware of the rebate before their assessment? If so, how? [OPEN END]

[ASK IF C1 <> 0]

C3. Does this vary by equipment or fuel type? If so, how? [OPEN END]

C4. Overall, why do you think customers decide to replace their heating and cooling equipment before it fails? [OPEN END]

C5. On a scale of 0-10, where 0 is “not at all effective” and 10 is “very effective,” how effective do you think the Early Replacement program is at influencing customers to replace their old heating and cooling equipment before it fails?

[NUMERIC OPEN END]

C6. On a scale of 0 to 10, where 0 is “not at all influential” and 10 is “extremely influential,” how influential do you think each of the following elements is in a customer’s decision to replace their equipment before it fails?

1. The amount of the Early Replacement rebate
2. Recommendations provided during the HEA
3. Plans for replacement or repair they had in mind prior to the HEA
4. [ASK IF B6 = 1] Recommendations from their HVAC contractor prior to the HEA

C7. What are the main reasons customers decide not to replace their Early Replacement rebate-eligible heating and cooling equipment? [OPEN END]

C8. Can you tell me anything else about customers’ decision-making processes related to replacing their heating and cooling equipment? [OPEN END]

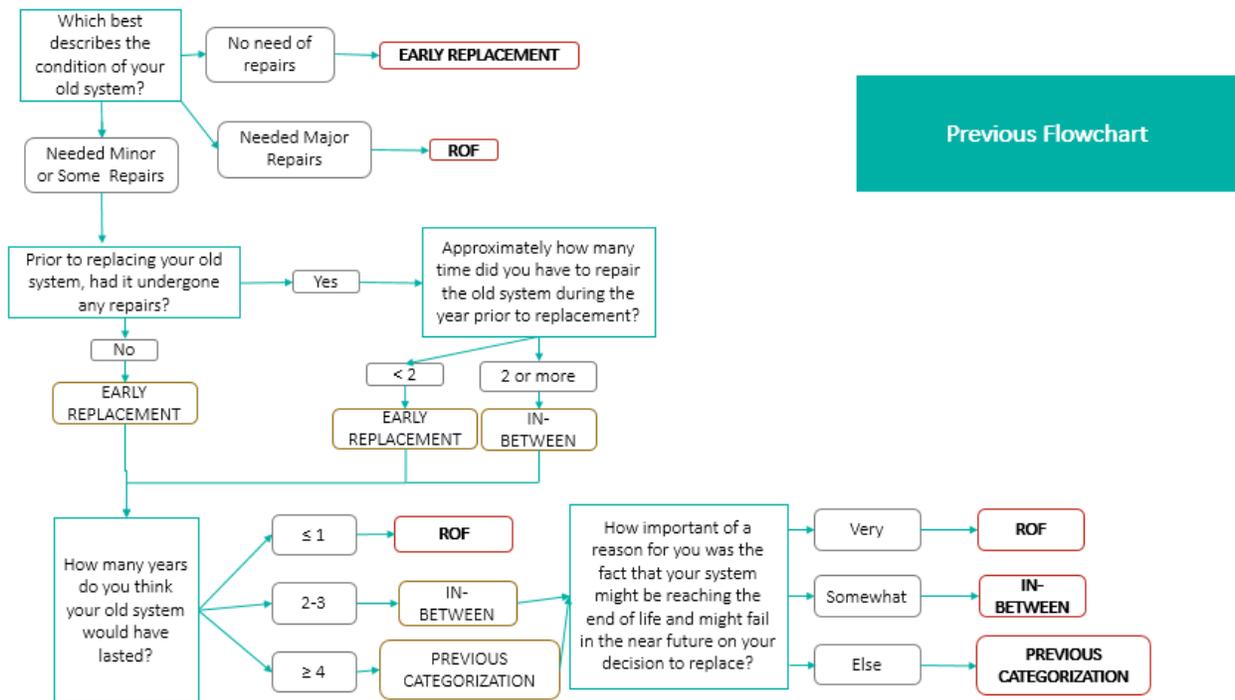
D.5 Opportunities for Improvement

D1. Do you have any suggestions for improving the Early Heating and Cooling Replacement Rebate program? [OPEN END]

Those are all the questions I have. Your responses are very important to the Massachusetts Program Administrators and will help as they design future energy efficiency programs. We appreciate your participation and thank you for your time.

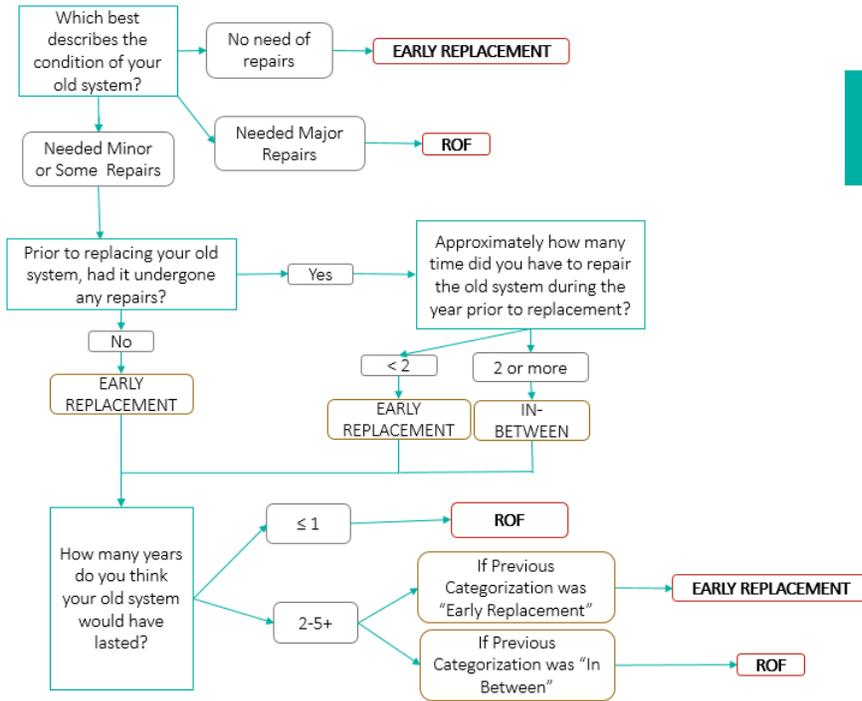
APPENDIX E. REPLACEMENT TYPE CATEGORIZATION APPROACH

Figure 2. Adapted 2012 HVAC Evaluation Replacement Type Approach



Previous Flowchart

Figure 3. 2018 Replacement Type Approach



2018 Edits to Flowchart