PROPOSED FINAL REPORT

Upstream HVAC Initiative Process Evaluation

Massachusetts Program Administrators and Energy Efficiency Advisory Council

Date: October 2017
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1 EXECUTIVE SUMMARY

This Executive Summary provides a high-level review of the approach and results of the Upstream HVAC/Heat Pump Initiative Process Evaluation (Upstream HVAC Evaluation). The Massachusetts Program Administrators (PAs) and Energy Efficiency Advisory Council (EEAC) engaged the DNV GL team to conduct this evaluation of the Commercial & Industrial (C&I) Upstream HVAC/Heat Pump (HP) Initiative (Initiative), which compensates participating HVAC distributors for selling discounted qualifying equipment to C&I customers.¹

In this section, we present the study objectives, summarize the evaluation approach, and present key findings and recommendations.

1.1 Overview of objectives and approach

The primary goals of the Upstream HVAC Evaluation are to investigate:

- Why the Upstream HVAC Initiative is not experiencing greater activity (e.g., more units of incentivized equipment) among participating distributors
- The Upstream HVAC Initiative’s current impact on the market, and what opportunities may still exist
- What accounts for the difference in interest in participation among both participating and non-participating HVAC distributors
- What changes in design or delivery would lead to increased activity from a wider pool of both participating and non-participating HVAC distributors

The DNV GL team conducted our evaluation between February 2016 and March 2017. A high-level synopsis of the evaluation approach is as follows.

In-depth interviews with PA program managers and implementation contractors. Through six in-depth interviews (IDIs), some with multiple interviewees, the DNV GL team interviewed a total of nine Massachusetts PA program managers and implementation contractors. These interviews were designed to gain an understanding of these individuals’ knowledge of and perspectives on the Initiative, how it works, what program elements are currently effective, what challenges the program currently faces, and how the program could be improved.

Best practices literature review and in-depth interviews with non-Massachusetts program managers. We conducted secondary research to identify additional commercial upstream/midstream HVAC programs offered in markets other than Massachusetts. We compared key attributes of these non-Massachusetts programs with the Massachusetts program, such as the type of equipment they rebate and the size of the rebates they offer. We also looked for indicators of programs success such as participation levels, energy savings normalized by market size, higher benefit/cost ratios, and positive evaluation findings. We also conducted in-depth interviews with four program managers of non-Massachusetts commercial HVAC upstream/midstream programs, to learn about program design, marketing, outreach, education and training, participation barriers, and lessons learned in other states.

¹ Massachusetts 2013 to 2015 Three Year Plan
Market penetration/potential analysis. We conducted research to develop an understanding of the Upstream HVAC Initiative’s current impact on the market as well as its future potential. To these ends, we analyzed program activity and trends using tracking data, and performed data mining from the Market Share and Sales Trends Study recently completed in Massachusetts (MA C&I EM&V Project 61).

In-depth interviews of participating and non-participating market actors. We conducted three interviews with PA preferred manufacturers and 20 interviews with participating (n=12) and non-participating (n=8) HVAC manufacturers and distributors to investigate 1) why non-participants are not participating and 2) why HVAC manufacturers and distributors who are program participants are not leveraging the upstream incentives to promote the purchase of high-efficiency equipment more aggressively. Interview topics included motivation for joining the program, level of program activity, barriers to increased program activity, perspectives on rebate levels, and suggestions for improvement.

1.2 Key findings
This section summarizes the key findings of our research. The findings are organized by topic based on the results of the four evaluation tasks undertaken by the evaluation team including participation, Initiative design, equipment mix, marketing, interaction with distributors and market penetration/potential analysis.

Program participation
Non-participants vs. participants
Based on the information collected during the interviews with both participating and non-participating distributors, it is apparent that the key structural difference between participating and non-participating distributors is the perceived ability to cope with the administrative burden of participation in the program. It should be noted that in 2017, the program vendor changed and our discussions with PA program managers indicate that this was done, at least in part, to address administrative burdens such as lengthy rebate processing timelines. Further, we found that a portion of non-participating distributors had lower awareness levels indicating that lack of program awareness is likely a barrier to program participation.

Levels of program activity among participants
The distributor interviews revealed several barriers to greater program activity (e.g., more units of rebated equipment) among participating distributors including lack of demand for the rebated equipment from contractors and end-users, lack of contractor education, incentive levels which are perceived to be too low to adequately cover incremental costs, and perceptions of administrative burden. As mentioned below, the program managers and implementers also mentioned low rebate levels and administrative burdens as barriers to greater program activity.

Equipment mix
Several of the program managers and implementers mentioned that certain HVAC technologies currently in the Initiative that may not be a good fit for the purpose or model of the Initiative, while there are other HVAC technologies that would be a better fit. More specifically, nearly all market actors we spoke to mentioned the need to add Variable Refrigerant Volume (VRF) technology to the technologies incentivized by the Initiative. Interviewees also noted that it may not be cost-effective to carry out upstream programs for small incentive dollars, and for equipment that is not commonly sold, however had little to offer in terms of specific technologies that fit this description.
Program design

Our interviews with program managers, program implementers and market actors indicated that the biggest challenge to the program’s design is the slow turn-around of rebate payment to distributors and the associated administrative burden that goes along with that challenge. Program managers and implementers speculated that this was particularly true for those participating distributors or potential participating distributors who found it difficult to bear the carrying costs of providing the discounts on the energy-efficient equipment and then waiting a long time for the program to reimburse them.

Further, our interviews with program staff revealed marketing and participation barriers due to perceptions among many distributors that the program’s incentive payments were low when comparing the incremental cost between standard and high efficiency HVAC technology. Each PA program manager and implementer interviewed suggested increasing the value of the incentives offered, and a majority of the market actors interviewed suggested that the incentive should cover the full incremental cost.

Finally, we found that the Initiative allows the amount of incentive that is passed-through to the end-user to vary by distributor. Having a clear and consistent incentive structure that is communicated to all key stakeholders would likely benefit the program.

Program marketing

Our interviewees indicated that while successful when carried out, the marketing of the Initiative appears to occur infrequently and on an ad-hoc basis. Nearly all market actors noted that the Initiative would benefit from increased awareness and marketing to contractors and end-users. Further, our interviews with Non-Massachusetts program staff provided evidence of marketing success with strategic outreach through presence at conventions, trade shows and local meetings.

Stocking practices

Our interviews found that the stocking of eligible equipment has increased since the inception of the Initiative in the spring of 2013, the purchase of eligible equipment is encouraged during the sales process, and the incentive has a positive influence on their direct customers’ decisions.

Table 1-1: Change in stocking practices among participating distributors

<table>
<thead>
<tr>
<th>Stocking changes</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased stocking of eligible equipment</td>
<td>8</td>
</tr>
<tr>
<td>Not applicable</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>2</td>
</tr>
</tbody>
</table>

Best practices

Our best practices literature review and subsequent interviews with non-Massachusetts program managers found that deep collaboration and constant engagement with distributors is crucial for a successful upstream program. This same research also found that to be successful programs need to focus on the largest distributors as only a few large players usually control the majority of the market and are typically most motivated by incentives.
Finally, all of the non-Massachusetts programs that we researched, and all the non-Massachusetts program managers that we interviewed, communicated the need for patience with upstream programs. They indicated that constant engagement and collaboration over a prolonged period of time was key to a successful upstream program.

**Market Penetration/Potential Analysis**

One of the core research tasks of this study was to get a better sense of the future market potential for the Initiative by looking at the frequency of installed HVAC equipment types that either qualified for the Initiative or could be replaced by Initiative-qualifying equipment (e.g. room air conditioners) that were also ripe for replacement. The evaluators did this by researching the relative ages of installed HVAC equipment and comparing these ages to the Estimate Useful Lives (EULs) of these equipment types. The team was able to identify manufacture date for about two-thirds of the program-eligible HVAC equipment in the 2016 MA C&I Market Characterization Onsite Assessments and Market Share and Sales Trend Study (Project 41) sample through research on the manufacture nameplates. The following are some key findings from this research task.

**The average age of overall HVAC equipment**

Key findings concerning the overall age of the Massachusetts unitary HVAC equipment included:

- About a third of the program-eligible HVAC units in the Project 41 sample with identifiable manufacture dates were either past their Estimated Useful Life (EUL) or close to end of their EUL. Twenty-six percent of the program-eligible HVAC units with identifiable manufacture dates were past their EUL. Another 6% were within two years of the end of their EUL.

- The actual share of HVAC units past their EUL is likely larger than this. This is because we would expect that the pool of units whose manufacture date we were unable to identify (35% of the total sample) would have a higher proportion past their EUL than the pool of units whose manufacture date we could identify. Many of the factors that would make a manufacture date unattainable, such as long-term sun or salt damage to the nameplate or the unavailability of manufacturer model information, would correlate with old equipment age.

**Variations in age among different unitary HVAC equipment types**

Key findings concerning variations in average unit age among different HVAC unitary equipment types included:

- Water-sourced heat pumps, mini-split heat pumps, and mini-split ACs had the highest percentage of units in the field within two years of or past the EUL. Explanatory factors for this, as discussed in the body of the report, include the difficulty of replacing water-sourced heat pumps and the fact that over 90% of the mini split heat pumps in Project 41 were installed in buildings either in the lodging or healthcare business sectors. These are sectors where one would not expect much change in how the buildings are used, and accordingly, infrequent changes to HVAC system design. Further,  

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2 EULs are estimates of the median length of time an energy efficiency measure is installed before it is replaced or upgraded. In theory, for any given piece of equipment, about half of the units would be replaced before reaching their EULs and about half would be replaced after their EULs.

3 The MA C&I Market Characterization Onsite Assessments and Market Share and Sales Trend Study (Project 41) was a statewide study of existing buildings, including site visits of 800 commercial and industrial facilities. The study began in 2014 and was completed in 2016.

4 In response to suggestions by commenters on the draft report, we checked whether the differences in the percentage of units past their EULs were statistically significant between equipment types, PAs, and business types were statistically significant. To test these significances, we used a two-tailed t-test with an additional "design factor" which increases the variances of individual percentages to try to adjust for uncertainties in the Project 41 sample design.
because this equipment is not central equipment, many building operators may maintain a stock of replacement units and/or repair vs. replace broken equipment.

- **Window/wall ACs, PTACs, and package RTU heat pumps had the fewest units in the field past the EUL.** The body of the report provided some explanations for this including lower equipment costs and greater ease of replacement.

- **Geothermal heat pumps had the youngest average units in the field.** This was something we expected, since they are a relatively new technology.5

**Variations in equipment age among PA service territories**

There were some interesting differences among PAs as to the average of ages of the HVAC equipment. These included:

- **Across all program eligible AC units, there was a higher percentage of units past their EUL in the Eversource and Cape Light Compact service territories than in the National Grid and Unitil service territories.** Possible reasons for these differences appear in the discussions below focusing on particular types of AC equipment.

- **The split AC systems were much older in the former NSTAR service territory than in the National Grid service territory.** Nearly half (47%) of the split system AC units in the former NSTAR service territory were past their EUL, compared to only 6% of the split system AC units in the National Grid service territory. The body of the report cites the greater average age of Boston buildings as a likely explanatory factor for this. Further, system replacement may be correlated with tenant turnover in Class A office buildings.

- **Nearly all the PTACs found in the Cape Light Compact service territory were past their EUL.** The body of the report cites the cooler temperatures of the Cape and the greater seasonality of HVAC usage as factors which make HVAC equipment last longer on the Cape. The prevalence of small, independently-owned businesses (e.g., small hotels) on the Cape may be another explanatory factor since these smaller companies might replace their PTACs less frequently due to financial constraints or the lack of corporate policies concerning equipment replacements. Figure 1 illustrates these differences.

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5 Notably, the sample size for this technology was very small—just two sites.
**The results presented above are weighted using the respondent-level sample weight created for P41. All the percentages of units past their EUL are different from each other to a statistically-significant degree except that the percent of WMECO units past their EUL is not significantly different from the statewide proportion.**

**The weighted PTAC EUL distributions are based on the following “raw” observed unit quantities; Cape Light Compact (107), National Grid (2,438), Eversource (1,354), and Eversource (WMECO) (372)**

*Other findings concerning equipment age*

- The medium-sized businesses (500,000-4,500,000 kWh of annual consumption)\(^6\) had the highest percentage of older HVAC units for two of the three largest equipment types: package RTUs and split systems ACs.

- Finally, one additional finding – which is likely more interesting to program evaluators than to program designers -- is that the contacts at the Project 41 sites were reasonably accurate in estimating the age of their equipment, within a broad vintage range. The team compared what the Project 41 onsite contacts had reported as the relative age of their equipment and what the DNV GL team found to be the actual manufacture dates based on the nameplate information. Our analysis showed that in cases where the facility representative said that the HVAC units were installed recently, their self-reports were reasonably reliable.

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\(^6\) One topic of great interest in the evaluation of Massachusetts C&I energy efficiency programs has been whether these programs are adequately reaching mid-sized C&I customers (e.g., Project 19, Project 68). It should be noted that the mid-size category from the Project 41 data includes some customers in the 500,000-1,499,999 range. This is actually smaller than Project 68’s current definition of a mid-sized customer, which begins at 1,500,000 kWh.
1.3 Recommendations

Based on these key findings and the rest of the research conducted as part of this process evaluation of the PAs’ Upstream HVAC Initiative, we make the following recommendations to the PAs/EEAC. Section 7 of this report includes a full accounting of both the recommendations and considerations being made by the evaluation team.

- **Recommendation 1: Update the incentivized technologies to include VRF.** Every interviewee group we spoke with, including program managers and implementers, non-Massachusetts program managers and market actors, noted that VRF technology should be included among the technologies incentivized by the Initiative. It should be noted that VRF technology should only be included if cost-effective and appropriate for the market and the upstream delivery model.7

- **Recommendation 2: Address lengthy rebate processing times.** The current rebate processing times present a barrier to participation for distributors, especially those who find it difficult to bear the “carrying costs” of providing the discounts on the energy-efficient equipment and then waiting a long time for the program to reimburse them. As noted above, indications are that the new program vendor was brought on, at least in part, to address administrative burdens such as lengthy rebate processing timelines.

- **Recommendation 3: Develop a focused marketing campaign.** Our best practices review combined with our review of program marketing to date indicates that the Initiative will likely benefit from the creation of a marketing approach that both demonstrates the value of the incentives to distributors and end-users and can be leveraged to increase knowledge and awareness among targeted populations, including contractors and end-users. An intentional marketing plan which focuses on the more effective methods for interaction and long-term engagement with distributors will foster increased awareness and knowledge of the Initiative. Therefore, the PAs should review and consider adopting the marketing best practices employed by the non-MA programs contacted for this research effort.8

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7 During the finalization of this report, the evaluation team was informed by the PAs that the program will begin offering this measure in September 2017.

8 The PAs may find the work being done at Efficiency Vermont to be pertinent. A summary of this work is presented in the following, publicly available, ACEEE proceeding: http://aceee.org/files/proceedings/2016/data/papers/7_460.pdf
2 INTRODUCTION

The Commercial & Industrial (C&I) Upstream HVAC/Heat Pump (HP) Initiative (Upstream HVAC/HP Initiative) has been running since spring 2013. The program’s objective is to increase sales of energy-efficient HVAC equipment in the C&I sector with an upstream approach which involves compensating participating HVAC distributors for selling qualifying equipment models, and working with participating HVAC manufacturers to ensure the continued availability of the qualifying models. The program is implemented via independent implementation contractors and the Massachusetts Program Administrators (PAs) provide administrative oversight.

The implementation contractor maintains an online service which allows participating distributors to apply for incentive rebates by entering sales of qualifying units and other required information on their customers. The program is designed to pay the distributors within 60 days of their online application. At the time of evaluation, the program provided incentives for the following types of HVAC equipment:

- Commercial unitary and split air conditioning systems (air cooled, including all types of heating)
- Commercial unitary air conditioning systems (evaporatively cooled, including all types of heating)
- Commercial unitary air conditioning systems (water cooled, including all types of heating)
- Commercial unitary heat pump systems (air cooled)
- Commercial unitary heat pump systems (water source)
- Ground water – water source heat pump equipment (open loop)
- Ground loop - water source heat pump equipment (closed loop)
- Energy savings control and fan motor options

2.1 Evaluation objectives

The primary goals of this research were to investigate:

- Why the Upstream HVAC Initiative is not experiencing greater activity (e.g., more units of incentivized equipment) among participating distributors
- The Upstream HVAC Initiative’s current impact on the market, and what opportunities may still exist
- What accounts for the difference in interest in participation among both participating and non-participating HVAC distributors
- What changes in design or delivery would lead to increased activity from a wider pool of both participating and non-participating HVAC distributors
- Other important objectives of this evaluation included gaining insights into what HVAC distributors and end-use participants believe the Initiative is doing successfully, better understanding the Initiative’s current impact on the market, and identifying actions the PAs could take to further increase its reach into the market.
2.2 Overview of approach
The DNV GL team developed the research approach in collaboration with the Massachusetts PAs and EEAC. Figure 2-1 outlines the approach for this evaluation. A summary of the evaluation’s principal steps follows the diagram.

Figure 2-1. Overview of evaluation approach

Work plan and background research
The DNV GL team developed a detailed work plan to guide this evaluation effort. The work plan contained information on sampling approaches, research issues that would be addressed within the in-depth interviews, detail on how the team would measure market potential, and a detailed project budget and schedule.

As part of this scoping effort, and in order to establish a thorough understanding of the Initiative, the team conducted an initial review of publicly-available program documents, including the 2013-2015 and 2016-2018 Energy Efficiency Plans and the Mass Save website. We also reviewed current and recently-completed Massachusetts HVAC-related research. We conducted an initial examination of both the available program tracking data and the available on-site data from the Massachusetts C&I On-site Assessments.

In-depth interviews with PA program managers and implementation contractors
Through six in-depth interviews (IDIs), some with multiple interviewees, the DNV GL team interviewed a total of nine Massachusetts PA program managers and implementation contractors. These interviews were designed to gain an understanding of these individuals’ knowledge of and perspectives on the Initiative, how it works, what program elements are currently effective, what challenges the program currently faces, and how the program could be improved. Topics included roles in program design and delivery, the program’s
marketing and outreach efforts, barriers to participation, effective program elements, program challenges, and high-level lessons learned from trade ally research which the implementation contractors conducted in 2014.

Best practices literature review and in-depth interviews with non-Massachusetts program managers

We conducted secondary research to identify additional commercial upstream/midstream HVAC programs offered in markets other than Massachusetts. We compared key attributes of these non-Massachusetts programs with the Massachusetts program, such as the type of equipment they rebate and the size of the rebates they offer. We also looked for indicators of programs success such as participation levels, energy savings normalized by market size, higher benefit/cost ratios, and positive evaluation findings.

We also conducted in-depth interviews with four program managers of non-Massachusetts commercial HVAC upstream/midstream programs. Topics covered in these interviews included: program design (e.g., HVAC products rebated, rebate levels, market actor eligibility requirements); marketing, outreach, and education and training activities; paperwork requirements; barriers to participation; particularly effective program elements; and positive and negative lessons learned.

In-depth interviews of market actors

We conducted three interviews with PA-preferred HVAC manufacturers as well as 20 interviews with participating (n=12) and non-participating (n=8) HVAC distributors. The primary objectives of these market actor interviews were to investigate: 1) why non-participants are not participating and 2) why HVAC manufactures and distributors who are program participants are not promoting the upstream incentives more aggressively. Interview topics included motivation for joining the program, level of program activity, barriers to increased program activity, perspectives on rebate levels, and suggestions for improvement. The primary sources for sampling included the program tracking database (which contains the HVAC distributors participating in the 2014 Upstream HVAC Initiative), the HVAC market actor sample frame developed by the Characterization of Supply-Side Market Actors study team, a panel of HVAC equipment manufacturer/representatives developed by NMR Group for a Massachusetts cross cutting study and third-party data from InfoUSA.

Market penetration/potential analysis

Finally, the team wanted to look at two important aspects of the program-eligible HVAC market in Massachusetts. The first concerned market penetration -- how effective the Initiative had been at capturing a share of the recent purchases of program-eligible HVAC equipment in Massachusetts. The second concerned market potential -- how much old program-eligible equipment was out there which was ripe for replacement.

In the initial work plan for this study, the market penetration research had been part of the work scope. However, the EEAC and the PAs observed that this research overlapped significantly with research for Project 61: The Assessment of the Share of Incentivized High Efficiency Equipment. Therefore, they recommended that this market penetration research be removed from the study's work scope. However, the study still planned to feature the subset of Project 61 research which focused on program-eligible equipment in its final report.
The team did proceed with the second part of this market research which was to learn about the age mix of the current stock of HVAC equipment in Massachusetts and thereby learn about opportunities for future energy-efficient replacement.

2.3 Organization of report

The remainder of this report is organized as follows:

- **Discussion of individual evaluation tasks**: Each section presents a discussion of how the DNV GL team collected and analyzed data for the task and a description of findings from the evaluation activities noted above.
- **Recommendations and considerations**: This sections contains a summary of DNV GL’s recommendations and considerations resulting from this evaluation.
- **Interview guides**: We also include the in-depth interview guides used in the appendices of the report.
3 IN-DEPTH INTERVIEWS WITH PA PROGRAM MANAGERS AND IMPLEMENTATION CONTRACTORS

DNV GL conducted four in-depth interviews with PA program manager staff (PA program manager) and two interviews with implementation contractor staff (implementer) as part of this evaluation. Since some of the interviews feature multiple interviewees, we interviewed a total of nine people through these six interviews. We reviewed every interview in the context of the primary objectives of the Upstream HVAC evaluation.

The remainder of this section provides a detailed description of the research that DNV GL conducted. First, we present an overview of DNV GL’s interview objectives and approach. Following this, DNV GL reviews the interview results across the main question categories. Finally, we conclude with an overview of DNV GL’s findings regarding the Initiative design and implementation of the C&I Upstream HVAC/HP Initiative in the context of the PM and implementer interviews.

3.1 Overview and approach

We interviewed two groups as part of the process evaluation: PA program managers and implementation contractors (implementers).

The objectives of conducting interviews with PA program managers and implementers were two-fold: 1) to ensure that the DNV GL team has the most accurate and up to date information on past, current and future Initiative design; and 2) to identify key areas of interest for these parties.

The interview guide covered the following topics:

- Background
- Initiative changes
- Interaction with Initiative implementers
- Marketing and outreach
- Difference between participant and non-participant distributors
- Barriers
- Overall Initiative feedback

The implementer interviews were similar in purpose and scope as the PA program manager interviews. We completed interviews with representatives of both EFI and CLEAResult who are involved in the statewide implementation the Initiative. These included interviews with program implementation staff at EFI as well as field representatives at CLEAResult, whose responsibility it is to recruit HVAC distributors and manufacturers into the Initiative.

The topics DNV GL covered with implementers were similar to those described above for the PA program manager interview guide. The interviews with the implementers also focused on their outreach efforts, in particular:

- How they contact HVAC distributors and manufacturers,
- How frequently they interact with them,
- Sales pitches they use to promote the Initiative,
- Questions or concerns the distributors and manufacturers have about the Initiative,
- Barriers to participation, and
- What could be done to engage additional distributors through the Initiative.
3.2 Results and Findings

Below are the key findings from the PA program manager and implementer interviews. This section organizes these findings into subsections which mirror the key interview topics that we described above. Each subsection has paraphrased responses from interviewees that reflect DNV GL’s main takeaways. Table 3-1 shows which people and organizations DNV GL completed interviews with. The interviews with program managers were completed during the 2016 program year.

### Table 3-1: PA Program Manager and Implementer Interviewees

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nate Strong</td>
<td>Eversource</td>
</tr>
<tr>
<td>Rich Boehler</td>
<td>National Grid</td>
</tr>
<tr>
<td>Lindsay Henderson; Matt Dudley</td>
<td>Cape Light Compact</td>
</tr>
<tr>
<td>Brad Hunter</td>
<td>Unitil</td>
</tr>
<tr>
<td>Steven Jaslowich; Seanna Greene</td>
<td>EFI</td>
</tr>
<tr>
<td>David Parker; Kyle Chabot</td>
<td>CLEAResult</td>
</tr>
</tbody>
</table>

### Background

The interviews began by asking the respondent about their role in the design and delivery of the Initiative. The interviews included questions about program theory from the perspective of PA program manager and implementation staff, the goals of the Initiative, and perceptions of the pros and cons of the upstream model (versus downstream). Both PA program managers and Initiative implementers demonstrated a good understanding of the Initiative’s theory and goals. Table 3-2 provides some examples of their responses on this topic.
Table 3-2: Theory and Goals of the Initiative

<table>
<thead>
<tr>
<th>Noteworthy Program Manager Comments</th>
<th>Noteworthy Implementer Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>By channeling the incentive to distributor, the distributor can influence the contractor with lower upfront costs. This makes the translation for benefits related to high efficiency (HE) easier to the end customer, because no complications of paper work.</td>
<td>The theory of the Initiative is that the incentives will overcome the cost barrier. If the customer/contractor can install the HE equipment for the same cost as the standard efficiency equipment, then they will choose HE. This in turn would change the stocking practices of the distributors.</td>
</tr>
</tbody>
</table>

The main theories of the Initiative are for broader adoption and implementation of HE HVAC equipment. The expectation is that that market is moving towards HE, so let’s remove time barrier and economic barriers to move the market.

This Initiative is offering an upstream incentive as the carrot to open up the opportunity to work with distributors. The Initiative wants them to sell HE as part of their basic product offerings. As implementers, we need to understand the unique challenges and barriers to distributors, and integrate this knowledge into how we sell this Initiative so that the distributors understand the benefits.

Initiative Changes

The interviews had a section that focused on recent or planned changes in the Initiative beyond those detailed in the three-year planning documents. This included a discussion of any expected changes to the Initiative as a result of the expected changes to building energy code as well as federal standards.

No PA program manager mentioned any planned changes coming up for the Initiative beyond those detailed in the three-year planning documents. However, there were several comments made about potential program changes to the Initiative as a result of the expected updates to Federal building energy code and/or the Massachusetts amendments to the IECC 2015 code.

One implementer said that they are working on an analysis which compares the current Initiative efficiency tier guidelines to the expected federal code changes in 2017 (this includes changes in energy savings and cost-per-energy saved assumptions as well). The next step would be to layer in incremental cost data in order to calculate benefit-cost ratios. The implementer expects to see some product groups to be no longer cost effective due to the higher efficiency of the equipment baselines.

Interaction with PA Program Managers/Implementers

Another topic the interviews explored was the relationship between PA program managers and implementers. This section of the interview focused on the PA program managers’ experience interacting with implementers (EFI and CLEAResult), and these implementers experience interacting with the managers. While program managers see the implementers as a critical component to the program design process, some program managers do not feel implementers are taking responsibility for this area. It may be that implementers are not aware they have the latitude or ownership to provide these types of insights to program managers, but it is an area of need. Further, communication is not optimal for some program managers, who would like

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9 These changes include, but are not limited to, additional, appropriate equipment types.
10 The PAs switched vendors after our interviews with program managers and implementers were completed, however follow-up to ensure that the new vendor is stepping up to fill this void would be prudent.
more frequent discussions with implementers. Quarterly meetings may not be sufficient. Table 3-3 displays summarized comments from the interviews that describe their interaction with each other.

**Table 3-3: Interactions between PA Program Managers and Implementers**

<table>
<thead>
<tr>
<th>Noteworthy PA Program Manager Comments</th>
<th>Noteworthy Implementer Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>The relationship has been good, considering the scope of work provided. [The lead PA program manager] provided a pretty clear scope of work, so the expectations were initially clear. However, as the lighting initiative has evolved, there is a higher level of strategic insight coming from other implementers. This PA program manager type of proactive strategic insight is desired for the C&amp;I Upstream HVAC initiative from the implementer.</td>
<td>During the roll-out, there were a lot of meetings between the PA program managers and implementers, and a lot of discussion on how the Initiative should be implemented. These meetings were held twice a month at the beginning, but then the meetings became less frequent. One [PA program manager] acted as the liaison between the two groups, and implementers would have to talk to this manager in order to reach the other PA program managers. At the beginning, implementers and managers used to meet every two months to discuss the Initiative. Now they try to meet quarterly.</td>
</tr>
<tr>
<td>[Implementers] are managing the tasks they have been asked to manage, but there are systematic flaws in how the Initiative was created. There are communication barriers between the managers and the implementers when it comes to decision making. It is hard working everything through [PA program manager], as it is a struggle to communicate to the other PA program managers through this liaison.</td>
<td></td>
</tr>
<tr>
<td>The implementer should not just to be a program manager, but should lead the process change for the Initiative as well. Implementers in the field should come back with unbiased opinions on how to change the Initiative. This requires more “vision” from implementer on how the Initiative should be structured and run.</td>
<td></td>
</tr>
</tbody>
</table>

**Marketing and Outreach**

Another section of the interviews discussed the Initiative’s statewide and PA-specific marketing and outreach efforts to participating and non-participating distributors. Additionally, the interviews asked questions about the Initiative's statewide and PA-specific marketing and outreach efforts to other market actors and C&I customers.

The interview responses indicated that most outreach to distributors is conducted by the implementers. Some key PA program managers have roles in marketing to distributors, but most of the relationships are
created and maintained by implementers. Additionally, a lot of outreach occurs on an ongoing basis. Implementers may need to visit a distributor two to three times over several months to successfully communicate the benefits of the Initiative.

There is evidence of marketing success when the program is marketed through presence at conventions, trade shows and local meetings. Implementers noted that they have had success marketing this initiative at industry events, exhibitions and local HVAC and related industry meetings. In particular, they noted that ASHRAE events have been a successful marketing venue for implementation managers to develop connections with manufacturers. These manufacturer connections have helped them convince distributors that they should participate in the initiative.

Table 3-4 provides a summary of comments from PA program managers and Initiative implementers describing the impact of marketing and outreach on distributor participation. The topic of the question specifically highlights the percentage of distributors that are currently participating after having been contacted by marketing and outreach. Participation was defined as having submitted at least one rebate through the Initiative, which some distributors described as “active participants.”

**Table 3-4: Percentage of Distributors Reached Who Are Now Participating in the Initiative**

<table>
<thead>
<tr>
<th>Noteworthy PA Program Manager Comments</th>
<th>Noteworthy Implementer Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>The current participation rate is quite high: for major, local distributors, probably 90% participation. But there is a gap in participation with the smaller distributors, or distributors that focus mainly on residential market, but do one or two commercial projects regularly.</td>
<td>The current distributor participation rate is over 90% after they have been contacted.</td>
</tr>
<tr>
<td>Almost all of the distributors signed up when the Initiative launched, but a smaller portion are participating: 60%-70% are active participants in the Initiative. The trend is if a manufacturer is taking part in the initiative, then distributors usually take part. When they don’t, then 0% of contractors/distributors participate.</td>
<td>There are a few distributors not involved in the Initiative. All of them have been contacted and have had the Initiative explained to them multiple times.</td>
</tr>
</tbody>
</table>

**Differences between Participant and Non-Participant Distributors**

One of the goals of the interviews was to gather information on the differences between participating and non-participating distributors. These differences were defined across a set of factors that would allow the PA program managers and implementers understand if there are any patterns between those distributors that participate, and those that do not. As defined above, participation means the distributor submitted at least one rebate through the Initiative. Table 3-5 provides a contrasting look at different characteristics between participating and non-participating distributors with summarized comments from the interviews.
Table 3-5: Differences between Participating and Non-participating Distributors

<table>
<thead>
<tr>
<th>Company size (annual sales)</th>
<th>Participating Distributor</th>
<th>Non-participating Distributor</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lot of big participating distributors have a brick-mortar location and showroom. They usually have staff to fill out forms and send data. Overall, bigger operations have the labor force to handle the paper work.</td>
<td>Small businesses have a tough time waiting for rebate to get processed. The distributors that are a “one guy in a truck” are not participating. The administrative resources required to request incentives can be too much on the smaller staff.</td>
<td></td>
</tr>
<tr>
<td>Distributors that sell only HVAC much more inclined to participate, in comparison to a distributor with a mix of products.</td>
<td>If they handle refrigeration, duct work, controls, lighting, etc., it is harder to narrow the focus down to just HVAC.</td>
<td></td>
</tr>
</tbody>
</table>
| Supply houses are knowledgeable about C&I Upstream HVAC offerings/incentives, they have high volume, and are engaged and interested in efficiency programs. | Non-supply houses are manufacturers or installation contractors who purchase equipment out of state or direct from Manufacturers. They normally do not participate in this Initiative. 
Also, if the distributor is mostly focused on residential sales, and commercial is a small percentage of their business, then they do not feel the need to participate in the Initiative. |

Barriers

The Barriers section of the interview focused on the PA program manager’s and implementer’s perceptions of the barriers to participation. Below are the recurring recruitment and implementation barriers that were identified during the interviews.

Recruitment Barriers:

- One PA program manager stated that when a distributor has multiple branches, there may be activity at the corporate hub, but not in the branches. There appears to be difficulty pushing the message out to the smaller branches.

- Both implementers found it difficult to get distributors to understand the economic value of the initiative. They mentioned that they need to show side-by-side comparisons as an example to the distributor to convey the benefits. Given that the distributor often only has a limited time to pitch an HVAC unit to a potential customer, distributors are concerned that they will lose a sale by pitching the high-efficiency unit because a competing distributor offered a lower-priced, standard efficiency unit. If a customer is just looking at cost, the implementers think the distributor is worried about the
customer getting steered toward the lower cost option without understanding the benefits of high efficiency units.

- Several PA program managers and implementers stated that the rebate is not enough money for distributors to be initially interested. One implementer mentioned they conducted a price analysis in 2014 and increased some incentives. They believe the pricing data is difficult to get, and it is hard for the initiative to react quickly to market changes.

- The PA program manager that acted as liaison between managers and implementers specifically mentioned that HVAC distributors are not willing to reveal information about customers. He said that HVAC distributors do not want the implementers to know who their customers are due to concerns about their customers being steered towards other distributors. He believed that this creates a trust barrier between the distributor and the implementer.

**Implementation Barriers:**

- Both implementers and managers mentioned that distributors can be cash out of hand for 30-60+ days, which causes a cash-flow strain. They described how PAs get monthly data from distributors via the implementation contractor and it typically takes 20 days to process data and the payment goes out 30 days after. This can put an economic strain on the distributor.

- One PA program manager described an issue with incentive transparency. He stated some implementation staff do not tell distributors they have to pass the incentives onto contractors or end-use customers. While with the lighting upstream program, the incentive is 99% passed down. But with the HVAC Initiative, the incentive is not-transparent, which can lead to contractors and end-users being confused about not receiving a rebate. He believed this confusion tarnishes the reputation of the Initiative for both distributors and end-users.

- Another barrier described by the same PA program manager as above is that distributors and manufacturers are protective of market data. He said he is able to get his hands on national level data, but what he cannot get is individual manufacturer or distributor sales data. Without this data, it is hard for him to evaluate the effectiveness of the Initiative design. He thinks the only real way to get Massachusetts market level data is to work for one of these distributors or manufacturers.

- One of the PA program managers for a large service territory stated that a big barrier is not a lot of competition in the HVAC market. This manager noted that for lighting, there is a large amount of competition, so the market moves quickly towards using the rebates to lower prices on high efficiency units. But since there are fewer manufactures and distributors in the HVAC market, he felt there is not as much competition to slash prices or sell the high efficiency units.

- Another major barrier mentioned by a PA program manager is for end-users that have a national presence. When these end-users need an HVAC system, they do not go through local distributors.. Instead, they may buy their HVAC in Nebraska, circumventing both participating and non-participating distributors in the area.

**Overall Initiative feedback**

The interview concluded with questions that focused on aspects of the Initiative that are perceived to be going well, and what (if anything) could be done to improve the Initiative. The points below summarize the comments and ideas that PA program managers and implementers provided during the interview.
**What is Working Well:**

- One PA program manager described the Initiative as reducing the cost per kWh from a cost-effectiveness standpoint. He stated that the Initiative had been experiencing more market activity compared to Cool Choice model. This was confirmed by an implementer who mentioned that the incentives paid, applications submitted, and measures processed for this Initiative have roughly doubled each year. The implementer has seen consistent growth across equipment categories, along with the number of enrolled distributors.

- On the implementation side, both implementers mentioned that the Initiative was working well for water source heat pumps. They reported that they had used the Initiative incentives to competitively bid projects for these, and was therefore seeing a lot of these moving through the Initiative.

- A positive aspect of the Initiative from one PA program manager’s perspective was that the upstream model seemed to be the right place for most of these types of HVAC systems. He said that if the goal of the Initiative is able to get every distributor and manufacturer to participate, and this increases the stocking and selling of high efficiency units, then they are closer now to that goal than three years ago.

- One implementer described the success of convincing a larger distributor to participate in the Initiative. Previously, the distributor was not participating because they did not understand the value proposition of the Initiative. The implementer worked with the distributor to explain the benefits, and got the distributor to sell these high efficiency units as part of their business model.

**What Could be Improved:**

- From a marketing and outreach perspective, one implementer described the need for more robust marketing material. He believed that the material needs to not only show how the initiative is good for the distributor, but also teach the distributor to communicate the benefits of high efficiency to the buyer.

- Several PA program managers mentioned the need for a new implementer/vendor to come into the Initiative with fresh ideas on how change and improve the Initiative, not just execute the Initiative. In January of 2017, a new vendor took over implementation of the Initiative, a necessary first step towards making this desired change.

- For improvements related to equipment, one implementer believed smaller equipment should be removed and pushed downstream. He stated the upstream model works well for units with high volume or those exceptionally large in size. His perspective is that the Initiative rebate is not driving buyer behavior by impacting incremental cost, but rather incentivizing a distributor to stock and sell the high efficiency unit.

- One implementer described the need for a reservation system for rebates. He mentioned there is a long sales life-cycle (sometimes 18 months or more) between when the equipment price is negotiated/sold, and when the equipment actually ships. He believes distributors are uneasy about extending discounts (sometimes $50K-$100K or more) for months with no concrete assurance that the Initiative will not change or go away in the interim.

Figure 3-1 shows the satisfaction rating PA program managers and implementers gave this initiative. PA program managers’ satisfaction ratings ranged from 2 to 3.5 (n=4), while the two implementers rated their
satisfaction a 4 and 4.5. While relatively low, several PA program managers mentioned that compared to three years ago, their satisfaction has increased during that time.

**Figure 3-1: Satisfaction Ratings**

![Satisfaction Ratings Chart](chart.png)

### 3.3 Conclusions

This section presents our conclusions based on the program manager and implementer interviews. The conclusions are grouped into three primary focus areas including participation barriers, technology mix and Initiative marketing.

**Barriers**

The interviews indicated that there are participation barriers based on the slow turn-around of rebate payment to distributors.

- Both PA program managers and implementers believe that the faster the payment, or upfront payments, the more positive feeling the participating distributors will have towards the payment process and the Initiative as whole.
- One implementer provided a useful analogy to describe how the upstream rebate Initiative is currently perceived by several distributors: He said that distributors think about customers in three categories, based on how long it takes them to pay:
  - "A" customers pay their invoice in 30 days, or less,
  - "B" customers in 30-60 days, and
  - "C" customers take 60+ days to pay their invoice.

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11 Only one implementer completed the full interview and was able to provide a satisfaction rating. The other implementer was going to follow-up with their score, but they did not send the information in time to be included in this report.
He indicated that the Initiative is like a “C” customer, and there are instances where 90 days go by and the rebate still has not been paid. He suggested that pre-funding for the Initiative would help the Initiative become an “A” customer, and give the distributors confidence that they will get paid quickly.

- Another idea discussed by those interviewed was for a third party to pay upfront, and the PA program managers pay the third party (with a small cost of cash).

The interviews also indicated marketing and participation barriers due to perceived low incentive payment when comparing the incremental cost between standard and high efficiency HVAC technology.

- Every PA program manager and implementer interviewed suggested increasing the price of incentive offered. One implementer suggested a graduating incentive scale for a third tier of high efficiency equipment, so that the highest efficiency units received substantial incentives.
- One implementer described the idea to offer a small side incentive for each application ($25-$50) that would cover the administrative costs and additional effort to get the end user information. They believed this would take away some of the implementation challenges, and this side incentive would help cover the distributors internal cost.
- The interviews revealed that there is a need for more marketing and outreach material that demonstrates the value of the Initiative, not only to the distributor, but also shows the distributor how to demonstrate the value of high efficiency to the buyer.

**Technology Mix**

Several interviewees mentioned there are HVAC technologies in the initiative that may not fit the purpose or model of this initiative, while there are other HVAC technologies that could be incorporated well. Below are several types of equipment some PA program managers and implementers recommended removing or changing, and a summary of their reasons:

- **Air-source heat pump:** Both a manager and implementer said that this equipment mimics cooling system in size categories, and the Initiative does not see a lot of activity here. They also mentioned that these units are designed for residential applications, and not often seen in the C&I customers. They believed that most people will not rely on heating aspects for a refrigerant system, and the Initiative does not see a lot of these systems come through above 5-10 tons.

- **Water source HP:** Although one PA program manager described this type of equipment as having seen a lot of activity, he had concerns about its fit in the Initiative. The challenge, in his opinion, is that in the high efficiency form, it usually is applied to new construction. So, the Initiative is in direct conflict with the new construction initiative. He believed there is not a good understanding of the relationship between the new construction initiative and what happens at the upstream point of sale. This manager’s recommendation is to take this technology out of standard upstream program, and just keep it in new construction. He felt this type of equipment does not really lend itself to a replacement situation, because these systems are about 1/3 larger than standard unit. So for retrofit, he believed a building would need to raise the ceiling to get the high-efficiency unit in. That is why he mentioned new construction to be more appropriate.

- **Ground source heat-pumps, open and closed loop systems:** One PA program manager wondered why these categories of equipment were in this Initiative. He believed the install cost for these systems to be very expensive. He had a discussion with manufacturers, and they said incentive does
help bring the cost of equipment down, but the bulk of the cost is in the install. So, one suggestion from this manager is to incentivize the installation cost for this equipment. Additionally, the manager noted that there are not a lot of these units installed locally. He thought it made sense to have an incentive for them, but perhaps it should live in a different program, one that is more customer direct, customized package.

- **Roof top units (RTU):** According to the implementers interviewed, very few C&I customers are invested in this piece of equipment (due to the split incentive issue between landlord and tenant). They felt that these HVAC units are usually replaced due to an emergency need, and replaced with exactly what was there before. Some PA program managers and implementers recommended adding the following technology to the Initiative:

- **VRF, VRV.** They believed the issue with adding this technology is that there is no standard VRF, so hard to create incremental compared to high efficiency. They suggested to look at what would have been in-use instead of VRF, and use that for the baseline calculation.

- **Air-cooled chillers:** Both implementers noted that air cooled chillers are regularly requested by distributors to be part of this Initiative.

- **Energy Management Systems (EMS):** According to one implementer, there are a number of different energy management controls that might fit the Initiative. He believes that some of these are custom applications, but there are some ‘out-of-box’ technologies that might fit the upstream model.
4 BEST PRACTICES LITERATURE REVIEW AND IN-DEPTH INTERVIEWS WITH NON-MASSACHUSETTS PROGRAM MANAGERS

This section is divided into two parts; the first half presents the findings of the literature review focused on upstream HVAC programs while the second half covers the findings from in-depth interviews with non-Massachusetts upstream programs. The literature review identified topics, questions, and upstream programs outside of Massachusetts to target for the in-depth interviews.

The remainder of this section presents an overview and results of the literature review, followed by a similar discussion of the in-depth interviews with non-Massachusetts upstream programs. Finally, we conclude with an overview of DNV GL’s findings regarding the design and implementation of the Initiative in the context of the literature review and non-Massachusetts program interviews.

4.1 Literature Review

Overview and approach

The primary objective of the literature review task is to learn about program designs, key evaluation findings, lessons learned, and best practices for commercial upstream HVAC programs from outside of Massachusetts. Information collected during the literature review will inform subsequent evaluation efforts, especially the in-depth interviews with program managers and implementers inside and outside of Massachusetts. DNV GL intends to use the in-depth interviews to expand on the preliminary findings identified by this literature review.

Prior to the start of the literature review, DNV GL identified six current (or recently offered) upstream/midstream programs to target for research: CenterPoint TX, Efficiency Vermont, NV Energy, PG&E, PNM and SCE/SCG. In addition, DNV GL hoped to uncover other relevant programs, evaluations, and best practice research during the literature review.

The literature review collected information on key program attributes such as program-eligible HVAC equipment and rebate amounts, program age, distributor and customer outreach and marketing strategies, program implementer, etc. In addition to benchmarking these program design features, DNV GL also researched program progress indicators such as number of qualified units installed, number of C&I customers (or facilities) served, number of participating distributors, participation trends over time, energy savings normalized by market size, and benefit/cost ratios. The most significant findings from the literature review came from documenting key market, impact, and process-related findings highlighted within publicly available program evaluation reports and best practice studies.
Programs and Sources Reviewed

DNV GL reviewed numerous utility and program implementer websites to identify as many upstream HVAC programs as possible for comparison with Massachusetts. After an extensive search, DNV GL identified the following currently offered programs for comparison with the Massachusetts Initiative:

- California Statewide Upstream HVAC Program (PG&E, SCE/SCG, SDG&E)
- The New York State Energy Research and Development Authority (NYSERDA) Upstream HVAC Program
- Efficiency Vermont Residential & Business Upstream Heat Pump Program
- PNM Distributor Discount Program
- National Grid Rhode Island Commercial Upstream HVAC/HP Initiative

In addition to reviewing program websites to document current offerings, DNV GL looked for evaluation reports and best practice studies focused on upstream programs. This effort proved to be especially valuable as the majority of the best practice findings and program design recommendations included in this report were identified from this body of program evaluations and best practice research. Table 4-1 below provides a brief description of the studies that were included in this literature review.

Table 4-1. Program evaluations and best practice studies reviewed

<table>
<thead>
<tr>
<th>Date</th>
<th>Author(s)</th>
<th>Title</th>
<th>Sponsor</th>
<th>Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr-16</td>
<td>DNV GL</td>
<td>Impact Evaluation of 2013-14 Upstream HVAC Programs</td>
<td>California Public Utilities Commission</td>
<td>The purpose of this evaluation is to verify gross and net savings claims for the measures associated with these upstream programs, and to provide information that will lead to more accurate savings estimates for future program cycles.</td>
</tr>
<tr>
<td>Jan-15</td>
<td>NMR Group, Inc.</td>
<td>Baseline Characterization Market Effects Study of Investor-Owned Utility Residential and Small Commercial HVAC Quality Installation and Quality Improvement Programs in California</td>
<td>California Public Utilities Commission</td>
<td>The report presents the findings of a baseline market characterization study focused on California IOU HVAC programs, including the Upstream HVAC program. One of the main objectives was to establish baseline market transformation indicators.</td>
</tr>
<tr>
<td>May-14</td>
<td>Maureen Quaid and Howard Geller</td>
<td>Upstream Utility Incentive Programs: Experience and Lessons Learned</td>
<td>Southwest Energy Efficiency Project (SWEEP)</td>
<td>Paper reviews the experience of investor-owned electric utilities with upstream incentive programs across the U.S. and provides some conclusions and program</td>
</tr>
</tbody>
</table>

12 Both the CenterPoint and NVE programs are no longer active and therefore no information on the programs is publicly available. DNV GL will pursue IDIs with these programs nonetheless.
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Mar-13</td>
<td>Constance Harvey, Energy Efficiency Center, University of California, Davis</td>
<td>Best Practices in Small Commercial HVAC Programs at California Utilities</td>
<td>Los Angeles Department of Water and Power (LADWP)</td>
<td>Paper reviews small commercial HVAC programs run by 3 utilities in California. The goal of the paper was to provide LADWP with up-to-date info on the programs, best practices and recommendations that could use to develop a similar program.</td>
</tr>
<tr>
<td>Nov-11</td>
<td>Research Into Action, Inc.</td>
<td>Energy $mart Products Upstream HVAC Program Process Evaluation</td>
<td>The New York State Energy Research and Development Authority</td>
<td>In-depth process evaluation report on the Upstream HVAC program, after 1 complete year in the field. Provides a unique early look at an Upstream Program including early goals, accomplishments, and lessons learned.</td>
</tr>
<tr>
<td>May-09</td>
<td>Itron, Inc. and KEMA, Inc.</td>
<td>2004/2005 Statewide Express Efficiency and Upstream HVAC Program Process Evaluation</td>
<td>California Public Utilities Commission and the California IOUs</td>
<td>In-depth process evaluation report on the 2004/2005 California Statewide Upstream HVAC Program including an assessment of the vendors and distributors. Despite being over five years old, this report provides valuable insight from HVAC distributors as well as recommendations aimed at improving upstream program design and delivery.</td>
</tr>
</tbody>
</table>

**Program comparison challenges**

DNV GL’s ability to meaningfully compare programs was limited by the publicly-available data discovered during the literature review. Overall, DNV GL found that all of the upstream programs outside of California are relatively new, with only a few years of delivery at most. As a result, the available program participation and performance information that would typically be found in evaluation reports was quite limited. Without this information, we expect there is limited value in comparing program offerings as we will not be able to identify which programs are performing well or identify potential factors for why they are successful.
Of the two programs where DNV GL was able to find program evaluation reports with data on program participation and performance, only one, NYSERDA, was directly comparable with the Initiative. The NYSERDA process evaluation was completed after the upstream program had been in operation for a full year. This provides a unique opportunity to compare the design and performance of two relatively new programs. Conversely, the California Statewide Upstream HVAC Program is quite mature as it has been in operation since 1998 and does not lend itself to a meaningful comparison with the Initiative which is only a few years old. Still, the California evaluations provide valuable findings, lessons learned, and recommendations that are relevant to Massachusetts.

Results and findings

As mentioned earlier, the most valuable information discovered during the literature review came from the program evaluations for NYSERDA and California as well as two separate studies that were focused on identifying best practices and lessons learned in upstream programs, generally. In this section we document the major findings from the literature review.

**First Year Findings from NYSERDA’s Upstream HVAC Program**

NYSERDA officially rolled out their upstream HVAC program in 2010 and it was evaluated in November 2011. This process evaluation was completed only 18 months or so after the launch of NYSERDA’s upstream program and provides an informative look into a similar program as the one currently being implemented in Massachusetts. By looking at evaluation results so close to the launch of the program, we can better understand the challenges associated with launching an upstream program as well as what can realistically be accomplished during the ramp up period.

NYSERDA’s upstream program is aimed at long term market transformation which contrasts with typical resource acquisition programs. In addition to offering “buy-down” funds to participating distributors, NYSERDA also provides co-op advertising funds, training, and resources for industry trade events. In the first year of the program, NYSERDA was able to form 33 discrete partnerships, exceeding their first year goal of 20. After 18 months, NYSERDA had 39 discrete program partnerships.

While NYSERDA was able to exceed their first year partnership goal, the level of activity amongst program partners varied greatly. About two-thirds of partners only enrolled in the program and did not participate in any additional program activities. Other important findings and recommendations from the process evaluation include:

- **The program goals were not clearly defined.** Similar to the Initiative, NYSERDA described their program as a market transformation effort with the goal of building the market for energy efficient HVAC equipment. However, there was no specificity or performance metrics around the market changes the program hoped to achieve. Without specific goals in place, NYSERDA had no way to determine if or when the HVAC market had been transformed. The evaluation recommended that NYSERDA develop a program logic model with activities, short and long-term objectives, and specific market transformation goals.

- **The program’s eligible products list is an evolving document.** The evaluation discovered that there was some confusion amongst program partners about how approved products were selected and how new products are added to the program. To alleviate this issue, it was recommended that

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NYSERDA clarify the program’s selection criteria to improve partner understanding and engagement.

- **The program should align its desired market changes with the marketing strategies used by program partners.** The evaluation found that many distributors were marketing HVAC equipment as “good, better, and best” to potential customers, with “best” equipment being both the most efficient for the end-user and most profitable for the distributor. The report also recommended that the program should consider the current sales practices utilized by partners when defining their market transformation goals. For example, it asked whether the program wants to grow the market only for “best” equipment or whether promoting “better and best” might also help the program achieve its goals.

- **Participants did not seem to be aware of all of the opportunities offered by the Upstream Program.** As previously mentioned, about two-thirds of program partners did not participate in any program-sponsored activity. The evaluation recommended that NYSERDA explore opportunities for improved partner outreach to raise awareness of the full suite of offerings. Additionally, the report found that the program might benefit from providing examples or case studies of successful promotions that other partners have done.

- **Be regionally consistent.** The evaluation noted that upstream actors (manufacturers and distributors) typically work across program administration territories. Therefore it would be beneficial for the NYSERDA program to minimize the differences between it and other regional programs to make it more likely that upstream market actors will engage with the program.

- **Upstream HVAC programs require time.** The evaluation recommended that such upstream programs be implemented for at least three years as participants need up to three years to fully understand the program and incorporate the program into their business operations.

**Evaluation Findings from California’s Statewide Program**

California has been running a Statewide Upstream HVAC Program since 1998 (aside from a two-year gap in the early 2000s where the state unsuccessfully tried to move downstream) and the process and impact evaluations of this program provide valuable findings and lessons learned from a very mature program. While a mature program like California’s is not directly comparable with a relatively new program like Massachusetts, the evaluation results can be used to improve program design and help avoid some of the issues that California has had to overcome. DNV GL has identified the following findings and recommendations from California as potentially relevant to Massachusetts:

- **IOU outreach to distributors is the most effective form of outreach.** The study found that More than half (57%) of distributors learned about the Upstream Program through a program representative.\(^{14}\)

- **Distributors are motivated by incentives.** The evaluation found that the ability to obtain a rebate for the stocking and sale of program-qualifying equipment was the main motivation for participation. Increasing sales of efficient equipment was the second-most-cited reason for participation.\(^{15}\)

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\(^{14}\) Itron, Inc., 2009.

\(^{15}\) Ibid.
High volume distributors are most influenced by incentives. The evaluation found that incentives influence equipment stocking and sales for the highest volume distributors but are less influential on lower volume distributors. Manufacturer-owned or franchised distributors that sell equipment directly from a specific manufacturer were not at all influenced by stocking or sales incentives.16

It is important to set incentive values appropriately to encourage the most efficient equipment. The evaluation recommended that the program consider increasing the rebate levels for higher efficiency equipment by 50-100% to encourage more sales in the highest efficiency tiers. The recommendation was based on distributor feedback that indicated the current incentive covers a greater percentage of the incremental cost for Tier 1 equipment compared to the higher efficiency tiers.17

• Large distributors struggled with data collection. The report noted that some large distributors felt that the process of obtaining customer information from contractors (which is a program requirement) was difficult. Specifically, they had issues with verifying the location where the equipment was installed. However, the evaluation concluded that even if distributors find the process difficult, this information is critical for an accurate evaluation of the program. Therefore the evaluation recommended that the program should consider supporting participants with the electronic application process as distributors may not have adequate resources or trained staff to fill out the necessary forms.18

• The market share of energy-efficient HVAC equipment is significant. In 2011 and 2012, almost half (46%) of all HVAC units sold were single-phase air-cooled and 40% of those units met the program’s Tier 1 or better efficiency standards. Air-cooled three-phase packaged and split equipment held the next largest market share (23%) and over half of the units sold (56%) met the program’s Tier 1 or better efficiency standard.19

• Upstream is more effective than downstream. In 2002, California attempted to move downstream while they evaluated the benefits of the previous upstream program cycle. From 2002-2003, the years of the downstream program, there were over 1,000 central air conditioning (AC) applications processed in California. From 2004-2005 the state processed 15,000 central AC applications through the Upstream Program.20

• Program savings were lower than expected. However, the effectiveness of upstream comes at a cost. The evaluation found that the primary driver of the low realization rates was that the actual efficiencies of the installed equipment were lower than assumed ex ante efficiency level estimates. The resulting low savings levels were most prevalent for air-cooled chillers and large unitary systems, which had gross savings realization rates of 11% and 15%, respectively. The evaluation provided many possible reasons for these low realization rates, including incorrect building types associated with savings claims, issues with using system performance maps that do not match the performance

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16 DNV GL, 2015.
17 Ibid.
18 Ibid.
19 NMR Group, Inc., 2015.
20 Ibid.
of installed equipment, and using a deemed savings approach for large water cooled chillers which can vary greatly depending on how they’re operated.  

- **Many unitary HVAC systems have non-functional economizers.** The evaluation found that within two years of installation, one-quarter of economizers were not working. As a result, the full energy savings potential of the program was not being realized. To alleviate this issue, the evaluation recommends that the program require evidence that the economizer is fully functional before dispersing the final incentive. 

- **Upstream programs don’t work in all markets.** Another report noted that Sacramento Municipal Utility District (SMUD) was offering the same Upstream HVAC Program as the three large IOUs in California until a few years ago. While the program had been very successful in the past, SMUD was forced to discontinue the program due to Sacramento’s struggling small commercial economy and falling participation rates. It is important to understand the market where the program is being implemented to make sure the program offerings and goals are appropriate given the current market conditions.

A net to gross evaluation of the California upstream program was completed in April 2017, after this literature review was conducted. Nevertheless, we mention it here as the study may yield additional insights for the PAs.

**Additional Upstream HVAC Program findings**

In addition to the upstream program evaluation findings, recommendations, and lessons learned documented above, DNV GL would also like to highlight the following points related to upstream initiatives identified during the literature review:

- **Upstream program validation.** Up to two-thirds of the HVAC market is for emergency replacement of broken equipment. These replacements must be done quickly and typically use whatever equipment the contractor has available, often overlooking energy efficiency in the purchase decision. Downstream programs are not effective at capturing a significant share of this emergency replacement market as evidenced by results in California when the state switched from upstream to downstream as it was perceived that the utilities were losing their “customer touch points.” The poor results of the downstream program lead the CPUC to reverse its prior decision and the subsequent upstream program saw a 900% increase in market impact in PG&E’s territory.

- **Rebate processing.** Having an online paperless rebate application is considered a success factor for upstream programs. The system should have an embedded database of utility customers and qualified equipment to quickly determine program eligibility. The benefits are fairly obvious and include automated application processing, fewer errors, faster incentive payments, and reporting for participants and program administrators. Massachusetts has already adopted this best practice.

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22 Ibid.
23 Harvey, 2013.
24 DNV GL, 2017
25 Quaid, 2014.
26 Ibid.
• **Incentive allocation.** Upstream programs have various approaches for incentive allocation with differing impacts on program cost-effectiveness. In California, PG&E provides flexibility to participating distributors with how much of the incentive must be passed through to customers and how much they can keep for themselves. This can cause issues with cost-effectiveness as incentive dollars passed through to customers are considered both a utility cost and a benefit to customers. However, incentive dollars that are not passed through to customers would be only considered a program cost. Conversely, some programs avoid this issue by requiring the full incentive to be passed through to customers. However, this requirement can penalize distributors and does not recognize their critical role in building a successful upstream program. There are also significant administrative and reporting requirements associated with upstream programs that are not present in typical downstream programs that should not be overlooked when deciding how to allocate program incentives. It is recommended to be flexible with the incentive allocation and allow the market to determine the best way to allocate resources. Another option to consider would be offering separate incentives or “spiffs” to further motivate sales staff and other non-incentive payments to help distributors offset their administrative and marketing costs.27

4.2 **Non-Massachusetts in-depth interviews**

**Overview and approach**

The literature review identified topics, questions, and upstream programs outside of Massachusetts to target for the in-depth interviews. DNV GL leveraged this research in order to develop an in-depth interview guide for use during our interviews with the upstream HVAC program managers and implementers identified during the literature review. Interviews were conducted during the 2016 program year.

The purpose of conducting in-depth interviews with program managers and implementers outside of Massachusetts is to expand on the findings from the literature review and learn about different program designs, key evaluation findings, lessons learned, and best practices for commercial upstream HVAC programs. DNV GL planned to complete 5-8 in-depth interviews with program managers and/or program implementers of non-Massachusetts commercial upstream HVAC programs. DNV GL identified the following commercial upstream HVAC programs for comparison with the Initiative:

- California Statewide Upstream HVAC Program (PG&E, SCE/SCG, SDG&E)
- The New York State Energy Research and Development Authority (NYSERDA) Upstream HVAC Program
- Efficiency Vermont Residential & Business Upstream Heat Pump Program
- PNM Distributor Discount Program
- National Grid Rhode Island Commercial Upstream HVAC/HP Initiative

The topics we covered in these non-Massachusetts program manager and implementer interviews included:

- Program theory
- Program goals
- Program incentives
- Stakeholder engagement
- Program impact
- Market penetration

27 Ibid.
The non-Massachusetts in-depth interview guide which was leverage for this interviews can be found in the appendices of this report.

**Challenges**

DNV GL attempted to contact the implementation manager for all upstream HVAC programs identified during the literature review; however we experienced some challenges scheduling the in-depth interviews as noted in the table below. Our primary targets for the interviews were the implementation managers as they were best suited to answer our questions due to their day-to-day involvement with the programs. Table 4-2 presents the interview disposition for each upstream program:

Table 4-2. Non-Massachusetts in-depth interview disposition by program

<table>
<thead>
<tr>
<th>Program</th>
<th>Disposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Statewide Upstream HVAC Program (PG&amp;E, SCE/SCG, SDG&amp;E)</td>
<td>Complete</td>
</tr>
<tr>
<td>The New York State Energy Research and Development Authority (NYSERDA) Upstream HVAC Program</td>
<td>Complete - NYSERDA's HVAC distributor program has been discontinued but we were able to complete an interview with the PM of an upstream HVAC program targeted at contractors.</td>
</tr>
<tr>
<td>Efficiency Vermont Residential &amp; Business Upstream Heat Pump Program</td>
<td>Complete</td>
</tr>
<tr>
<td>PNM Distributor Discount Program</td>
<td>Complete</td>
</tr>
<tr>
<td>National Grid Rhode Island Commercial Upstream HVAC/HP Initiative</td>
<td>Dropped - DNV GL consulted with the PAs before decided to drop this interview due to significant overlap with the Massachusetts Initiative</td>
</tr>
</tbody>
</table>

During the outreach effort, DNV GL learned that the NYSERDA Upstream HVAC program was discontinued due to poor performance. While we could not interview the Upstream HVAC implementation manager, we were able to secure an interview with the implementation manager of another NYSERDA upstream program focused on the upstream HVAC contractor channel. DNV GL also identified that the Rhode Island program is more or less identical to the Massachusetts program and is being implemented by the same team that implements the Massachusetts program. We consulted with the MA PAs and decided to exclude Rhode Island from our non-Massachusetts in-depth interviews due to fact that we already interviewed that implementation team under another evaluation task.

**Results and findings**

This section presents the key findings from the in-depth interviews, organized by key research topics. The majority of findings presented in this section come from the three upstream HVAC distributor program interviews (California, Efficiency Vermont and PNM). Findings from the NYSERDA program focused on HVAC

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28 Some of the distributor interview questions were not applicable as this program was focused on HVAC contractors, however, the interview did yield valuable high level findings and lessons learned about implementing upstream programs.
contractors (not distributors) are incorporated when relevant. Findings have been completely anonymized to protect the identity of respondents and program sponsors. The non-Massachusetts in-depth interviews yielded the following key findings:

**Program theory and goals**

- **Program design.** At a high level, all three upstream HVAC distributor programs were designed to increase access to efficient HVAC equipment in the market which is often purchased during an equipment failure event. The programs also sought to reduce the financial hurdles associated with purchasing more efficient equipment through financial incentives.

- **Market transformation vs. resource acquisition.** All of the upstream HVAC distributor programs that we interviewed were initially constructed with the intention to transform the HVAC market in their service territory. However, one of those programs quickly abandoned the long-term market transformation goal due to its perceived difficulty and narrowed its focus to achieving annual savings targets. This program had limited resources for distributor engagement and no mechanism in place for tracking sales or market share of efficient HVAC equipment.

- **Program goals.** One of the programs that we interviewed indicated that their quantifiable goals were fairly arbitrary and were established without any sense of market size or resource potential. This program did not collaborate with distributors to establish goals and largely based their annual savings goals on the program budget relative to the overall portfolio budget. On the other side of the spectrum, one program indicated that they spent over a year assessing the market and meeting and collaborating with key stakeholders before setting program goals and launching the program. This program had a solid understanding of the market and the energy savings potential which are factored into both short and long term goals. Lastly, the third program’s annual goals are established by regulators and are based on past performance and budget allocation.

**Program measures and incentives**

- **Equipment.** The three distributor programs that we interviewed offer incentives on a variety of HVAC equipment covering multiple levels of efficiency. No program indicated that they had plans to remove or add equipment to their eligible product lists.

- **Incentives.** Incentive levels for the programs varied by equipment type and efficiency levels. One program set the incentives based on the deemed energy savings and used a fixed cost per estimated kWh savings to establish incentive levels. One program that we interviewed collaborated with distributors to gain a solid understanding of the incremental costs and profit margin of the efficient equipment targeted by the program before setting their incentives. The third program’s incentive levels are both based on and constrained by the estimated incremental measure cost established by regulators. This program cannot pay an incentive that exceeds the incremental measure cost deemed by regulators.

- **Incentive timing.** All of the distributor programs that we interviewed indicated that incentive payments are typically made within 30 days and can take as little as two weeks. Neither program reported issues with unhappy distributors due to delayed incentive pay-outs.

- **Incentive allocation.** Incentive allocation between customers and distributors is handled very differently between the three distributor programs that we interviewed. One program requires 100%
of the equipment incentive to be passed through to the customer because there are separate incentives allocated to distributors for stocking program equipment and off-setting administrative costs associated with participating in the program. The other two programs do not require the full incentive to be passed through to the customer and allow the distributor freedom to allocate the incentive between the customer and themselves as they see fit.

Stakeholder engagement

- **Varying levels of engagement.** After the initial recruitment of distributors into the upstream program, one upstream program implementer indicated that they were not currently engaged at all with distributors. They indicated that a lack of resources (i.e. staffing issues) was impacting their ability to regularly engage with participating retailers. The other two distributor program indicated that they have had a deep level of engagement with distributors from the very beginning. One of those programs indicated that they hold lengthy salesperson trainings to help the people delivering the program better understand and communicate the benefits of purchasing more efficient HVAC equipment. The same program also holds regular strategy meetings with key manufacturer and distributor stakeholders to discuss incentives, marketing, data collection requirements, and any issues that they have with the program.

- **Engagement impacts activity.** The program that is not currently very engaged with participating distributors also noted a significant drop off in distributor activity over the last 3 months. Conversely, the other two programs repeatedly stressed the importance of engagement and one program has a full-time account manager whose main responsibilities are checking in with distributors, coordinating marketing promotions and program changes, and resolving issues as soon as they occur.

Program impact

- **No evaluations yet.** Two of the programs that we interviewed have only been around for a couple of years and have not gone through an impact evaluation yet.

- **Mature program.** The upstream program in California is more mature and has undergone multiple impact evaluations. The results of the most recent evaluation are referenced in the literature review section.

Market penetration

- **Distributors.** Two of the programs that we interviewed indicated that they had 100% of relevant HVAC distributors enrolled in the program. One of these programs also estimated that three large distributors accounted for around 95% of their addressable market. The third program was less sure about their market penetration but estimated that around 50% of eligible HVAC distributors were participating in the programs.

- **Sales.** Two of the programs do not attempt to collect sales data and therefore have no ability to estimate the market share of efficient equipment. The other program that we interviewed has access to sales data from participating distributors but has not yet attempted to quantify market share or changes in market share. However, they indicated that would be interested in pursuing that type of analysis soon.

Barriers
• **IT systems.** For one program, the biggest barrier to success was the fact that the existing IT infrastructure of most HVAC distributors was inadequate to meet the data collection and reporting requirements of the program. There was a misalignment between how customers were invoiced prior to the program compared to the data requested by program implementers. To overcome this barrier, the program worked with key stakeholders to optimize how data is collected and provided training and incentives to promote the new data collection process. On the implementer side, the same program also mentioned the initial challenge of updating internal IT systems to detect and avoid double dipping between upstream and downstream HVAC programs.

• **Distributor recruitment.** One program said that their most significant barrier was recruiting distributors into the program. They had issues convincing distributors that the program was real and said, “at least half of the distributors initially slammed the door in our face.” Even once they convinced distributors to participate, many of them were not receptive to the program and it took a lot of work to demonstrate the value proposition and increase engagement.

• **Staffing.** As previously mentioned, one program reported that they had a low level of engagement with participating distributors due to staffing issues which have become a significant barrier to success. This program underestimated the level of distributor engagement that was required to implement a successful upstream program and has not been able to increase staffing because of budget constraints.

• **Consistent funding.** One program mentioned lack of availability and inconsistent program funding as the number one barrier to running a successful upstream program. A discontinuation of (or drop in) funding, even if temporary, can have a significant negative effect on the market’s perception of the program. Inconsistent program funding from year to year can disrupt momentum with distributors and it’s very difficult to reengage a distributor who has been turned off by the program.

**Conclusions**

The conclusions and lessons learned from these program manager interviews included:

• **Deep engagement and collaboration with distributors can lead to program success.** One of the key findings from the program manager interviews was that deep collaboration and constant engagement with distributors is crucial for a successful upstream program. One program implementer stressed that the program must work for the distributors, with incentives calibrated around real-world costs to create a value proposition that distributors will buy in to. Collaboration with key stakeholders on every aspect of the program, from incentive levels to data collection requirements to long term strategy, will help secure the necessary buy-in for a successful program. Conversely, another program implementer explained how their lack of engagement with distributors was having a direct negative impact on program performance.

• **Focus on large distributors.** Two programs emphasized the need to focus on the largest distributors as only a few large players usually control the majority of the market.

• **Patience.** All of the programs that we interviewed communicated the need for patience with upstream programs. One program took a full year to assess the market, meet and collaborate with stakeholders, and design their upstream program before rolling it out. Another program reiterated the theme of patience and said that it takes time to change embedded practices and business models. This program said that the first two years of the program were a struggle and it took a lot of
effort to engage the market but by the third year the distributors were fully on board with the value proposition of the program and activity took off. Constant engagement and collaboration over a prolonged period of time might be the key to a successful upstream program.
5 IN-DEPTH INTERVIEWS OF PARTICIPATING AND NON-PARTICIPATING MARKET ACTORS

This section presents the results of our qualitative IDIs with manufacturers and distributors of HVAC/HP equipment in Massachusetts. These interviews leveraged the research conducted under the program manager and implementer interviews, the best practices literature review and the interviews with non-Massachusetts program managers to identify key areas of exploration with the market actors targeted by the program.

5.1 Overview and approach

These in-depth interviews have two key objectives:

- To investigate why some HVAC distributors and manufacturers are not participating in the program.
- To explore why some HVAC distributors and manufacturers who are officially program participants are not more actively promoting the upstream incentives.

The DNV GL team conducted three sets of in-depth interviews, targeting three distinct market actor groups associated with the Initiative:

- Manufacturers participating in the Initiative29 (5 targeted; 6 completed)
- Distributors participating in the Initiative,30 including both relatively active and relatively inactive distributors, based on their sales listed in the program tracking data (10 targeted; 12 completed)
- Distributors that are not currently participating in the Initiative, but which distribute HVAC/HP equipment in Massachusetts that is eligible for incentives (10 targeted; 8 completed)

The interview guides for participating and non-participating distributors covered the following topics:

- Program Design
- Participation Process (Participants)
- Program Activity (Participants)
- Program Awareness (Non-Participants)
- Barriers to Participation (Non-Participants)
- Market Conditions
- Firmographics

The interview guide for manufacturers covered a similar set of questions related to program experience, but also delved deeper into market conditions. Topics covered in the manufacturer interview guide included:

- Program Experience
- Production & Demand
- Perception of the Market
- Market Share
- Firmographics

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30 Participation is defined as having submitted at least one rebate through the Initiative.
In total, the DNV GL team conducted 26 in-depth interviews with manufacturers and distributors of HVAC/HP equipment who sell or distribute their products in Massachusetts. Table 5-1 shows the final number of completed interviews.

### Table 5-1: In-depth interviews conducted

<table>
<thead>
<tr>
<th>Market actors</th>
<th>Target completes</th>
<th>Final completes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participating Manufacturers</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Participating Distributors</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Non-Participating Distributors</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>26</td>
</tr>
</tbody>
</table>

Sampling approaches for each market actor group and IDI results are presented below. The primary sources of sampling data were:

- Program tracking data from the Initiative
- A panel of HVAC equipment manufacturer/representatives developed by NMR Group for a Massachusetts cross-cutting study
- The sample frame from Massachusetts EM&V Project 36 - *Characterization of Supply Side Populations*
- Third-party data from InfoUSA.

### Sampling Approach

For the manufacturer interviews, the DNV GL team selected a sample of manufacturers from a panel of HVAC manufacturers/representatives which the NMR Group had determined to be operating in Massachusetts. When NMR interviewed 30 of these manufacturer’s representatives in Q2 2016, 14 of these interviewees also agreed to speak with DNV GL staff. DNV GL eliminated four of the 14 from its manufacturer sample because they are considered distributors for the purposes of this study. The remaining 10 manufacturers formed part of our initial manufacturer sample frame. In order to avoid any response bias, the DNV GL team then cross-referenced the manufacturers identified by NMR but not recruited into the panel with the PAs’ list of preferred manufacturers to add additional manufacturers to our sample frame.

DNV GL completed interviews with 12 distributors participating in the Upstream HVAC/HP Initiative. We developed a sample frame of participating distributors from three information sources including: program tracking data from the HVAC/HP initiative (which included the HVAC distributors participating in the 2014 and 2015 upstream HVAC initiative), an HVAC market actor sample frame which the EM&V Project 36 team had developed, and distributors from the NMR panel discussed above.

Our sample was primarily random with one exception. Because the Cape Light Compact believed that the distributors who serve the Cape are often different than those who serve the rest of the state, the DNV GL team reserved one sample point for a distributor who operated on Cape Cod.

Finally, we completed interviews with a random sample of eight distributors who we confirmed as not participating in the Upstream HVAC/HP Initiative. These respondents represented a wide range of firm types, including single-site independent businesses, franchises, and multi-state corporations. We developed the
sample frame for these non-participating distributors from two sources: the HVAC market actor sample frame which the Massachusetts EM&V Project 36 team had developed, and InfoUSA, a database of company information often used for Massachusetts C&I evaluations. Once again, the DNV GL team reserved a sample point for a non-participating distributor who operated on Cape Cod.

We sampled both the participating and non-participating distributors at the individual office level to tease out any differences in the participation decision-making process and equipment stocking practices within the same distribution company. We also cross-referenced our participating and non-participating distributor samples with the PAs’ participating distributor list to reduce misclassification.

## 5.2 Results and findings

Below we present the key findings from the market actor interviews. The results are organized into subsections based on the interview topics described above. Each subsection includes paraphrased responses from interviewees that reflect DNV GL’s primary takeaways.

### Company information

First, we asked all three sets of respondents (manufacturers, participating distributors, and non-participating distributors) several questions to help characterize the market each firm served, including annual sales, the portion of sales made in Massachusetts, the portion of sales made in the C&I market, and the portion of HVAC equipment sales for both heat pump and non-heat pump technology. Table 5-2 shows these findings.

### Table 5-2. Sales summary

<table>
<thead>
<tr>
<th>Respondent Type</th>
<th>Annual Sales</th>
<th>% Sales to MA</th>
<th>C&amp;I as % Sales</th>
<th>Non-HP Heating Equip Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>NA</td>
<td>DK</td>
<td>65%</td>
<td>0%</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>NA</td>
<td>75% regional</td>
<td>70%</td>
<td>0%</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>NA</td>
<td>Measurable part of heating market</td>
<td>NA</td>
<td>Little</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>NA</td>
<td>Significant, 2-5%</td>
<td>100%</td>
<td>20%</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>NA</td>
<td>NA</td>
<td>50%</td>
<td>10%</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>NA</td>
<td>Less than 0.2%</td>
<td>10%</td>
<td>90%</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>$10M</td>
<td>95%</td>
<td>10%</td>
<td>99%</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>Refused</td>
<td>40%</td>
<td>5%</td>
<td>98%</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>$2.5M</td>
<td>90%</td>
<td>25%</td>
<td>60%</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>$40M</td>
<td>Quite a bit</td>
<td>70%</td>
<td>0%</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>Refused</td>
<td>45%</td>
<td>33%</td>
<td>90%</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>Refused</td>
<td>10%</td>
<td>60%</td>
<td>75%</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>&gt;$1B</td>
<td>40%</td>
<td>35%</td>
<td>100%</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>&gt;$3M</td>
<td>80%</td>
<td>20%</td>
<td>70%</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>Refused</td>
<td>80%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>$20-25M</td>
<td>15-20%</td>
<td>50%</td>
<td>85%</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>&gt;$30M</td>
<td>70%</td>
<td>15%</td>
<td>70%</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>Refused</td>
<td>Not sure</td>
<td>“Good amount”</td>
<td>DK</td>
</tr>
</tbody>
</table>
DNV GL then asked several questions to help characterize each distribution firm including number of staff, total number of locations, total number of locations in MA and the locus of the participation decision. Participating and non-participating distributors represented a wide range of firm types, from single site franchises to multi-state corporations. Table 5-3 below shows the staff size for the entire corporation, the total number of corporate outlets, the number of outlets in Massachusetts, and the locus of decision-making regarding program participation.

**Table 5-3: Firmographics**

<table>
<thead>
<tr>
<th>Respondent Type</th>
<th>Staff #</th>
<th>Total Outlets</th>
<th>MA Outlets</th>
<th>Locus of Participation Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participating Distributor</td>
<td>12</td>
<td>1</td>
<td>1</td>
<td>Local</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>180</td>
<td>16</td>
<td>7</td>
<td>Corporate</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>400</td>
<td>20</td>
<td>12</td>
<td>Local</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>100</td>
<td>8</td>
<td>5</td>
<td>Local</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>160</td>
<td>7</td>
<td>1</td>
<td>Local</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>3200</td>
<td>83</td>
<td>28</td>
<td>Corporate</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>&gt;2000</td>
<td>80</td>
<td>26</td>
<td>Corporate</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>Local</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>50</td>
<td>9</td>
<td>7</td>
<td>Corporate</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>30</td>
<td>2</td>
<td>0</td>
<td>Local</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>100</td>
<td>7</td>
<td>5</td>
<td>Corporate</td>
</tr>
<tr>
<td>Participating Distributor</td>
<td>DK</td>
<td>9</td>
<td>6</td>
<td>Corporate</td>
</tr>
<tr>
<td>Non-Participating Distributor</td>
<td>&lt;10</td>
<td>1</td>
<td>1</td>
<td>NA</td>
</tr>
<tr>
<td>Non-Participating Distributor</td>
<td>Don’t know</td>
<td>8</td>
<td>8</td>
<td>NA</td>
</tr>
<tr>
<td>Non-Participating Distributor</td>
<td>11 to 49</td>
<td>3</td>
<td>3</td>
<td>NA</td>
</tr>
<tr>
<td>Non-Participating Distributor</td>
<td>&lt;10*</td>
<td>406</td>
<td>6</td>
<td>NA</td>
</tr>
<tr>
<td>Non-Participating Distributor</td>
<td>&gt;1,000</td>
<td>407</td>
<td>7</td>
<td>NA</td>
</tr>
<tr>
<td>Non-Participating Distributor</td>
<td>100 to 249</td>
<td>10</td>
<td>10</td>
<td>NA</td>
</tr>
<tr>
<td>Non-Participating Distributor</td>
<td>&gt;1,000</td>
<td>285</td>
<td>2</td>
<td>NA</td>
</tr>
<tr>
<td>Non-Participating Distributor</td>
<td>100 to 249</td>
<td>18</td>
<td>12</td>
<td>NA</td>
</tr>
</tbody>
</table>

* - Employee count for franchise only, multiple franchisees participate.
We also asked manufacturers about the type of HVAC/HP equipment they manufacture. Their responses are presented in Table 5-4. Each of the manufacturers we spoke to produced equipment which is eligible for incentives under the Initiative.

### Table 5-4: Types of equipment manufactured

<table>
<thead>
<tr>
<th>Equipment types</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M1</strong></td>
</tr>
<tr>
<td>PTAC, VRF, HP, everything HP based, Mini-split</td>
</tr>
<tr>
<td><strong>M2</strong></td>
</tr>
<tr>
<td>VRF only</td>
</tr>
<tr>
<td><strong>M3</strong></td>
</tr>
<tr>
<td>Package, central, DH, single package, gas fired and HP, VRF.</td>
</tr>
<tr>
<td><strong>M4</strong></td>
</tr>
<tr>
<td>NA</td>
</tr>
<tr>
<td><strong>M5</strong></td>
</tr>
<tr>
<td>No combustion</td>
</tr>
<tr>
<td><strong>M6</strong></td>
</tr>
<tr>
<td>Ductless MS, all stuff is DX, residential 1-5 ton, commercial splits up to 10, package up to 15 ton. No VRF</td>
</tr>
</tbody>
</table>

Finally, we asked both non-participating distributor and manufacturing respondents whether high efficiency HVAC equipment and heat pumps were a particular focus of their company’s offerings, and why or why not. All six manufacturers interview noted that it was a focus of the company. Seven of eight non-participating distributors reported that high efficiency equipment is a business focus, with the one negative response attributed to “lack of customer interest in energy efficiency.” They further noted that from their perspective, the program is focused on natural gas measures and that “a lot of New England doesn’t even have gas.” However, they reported that high efficiency equipment makes up about 30% of their sales. Across the entire non-participant sample, high efficiency equipment made up 62% of sales (See Figure 5-1 below).

**Figure 5-1. Portion of sales that are energy efficient equipment (Non-Participants)**
One non-participating distributor’s response highlights a potential gap in Initiative implementation. A national distributor with two outlets in Massachusetts, responded as follows:

- “Before you brought it up I wasn’t aware we weren’t participating. We do business in 39 plus states. Usually from the local sales person is the first I hear about [programs]. From there I take the paperwork and send to corporate. There haven’t been too many programs we haven’t been involved in.”

This suggests that the Initiative may not have contacted the appropriate representative(s) at their outlets, or that the Initiative may benefit from reaching out to corporate officers in the case of chains or franchises.

Program awareness

Each interview guide included a section which focused on program awareness and engagement. We asked manufacturers if they were “aware of an initiative called the commercial and industrial Upstream HVAC/Heat Pump Initiative, sponsored by the Massachusetts Energy Efficiency Program Administrators.” If they said no, interviewers explained that they might know it as “the Mass Save Upstream HVAC/HP Initiative,” implemented by EFI on behalf of the Massachusetts PAs. Recall of the program was moderate with only two of the manufacturers stating that they were familiar with the Initiative even after the second prompt. One additional manufacturer said that his company was aware of Mass Save but not the details of the program and another noted that they would expect their distributors to track and be aware of the available incentive programs.

Program awareness levels among non-participating distributors was similar to that of manufacturers. Five out of eight respondents reported they were unaware of the Initiative prior to the interview, and cited this as the reason they were not participating. Two of eight reported that they had been contacted by the Initiative. One of these two reported that they did not sell enough qualifying equipment to justify engagement, and the other reported that they found “the commitment agreement unattractive.”
DNV GL also asked non-participating distributors several questions about the method of contact, preferences, and the impact of more information and contact. Table 5-5 shows that of the non-participants interviewed, only three said that increased contact/information would have made a difference in their decision to participate.

Table 5-5: Impact of increased outreach (Non-Participants)

<table>
<thead>
<tr>
<th>Initiative awareness</th>
<th>Would increased contact/information make a difference?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Non-Participating</td>
<td></td>
</tr>
<tr>
<td>Distributors (n=8)</td>
<td>3</td>
</tr>
</tbody>
</table>

Finally, DNV GL provided some basic information about the Initiative to non-participating distributors, and then asked them what they thought the benefits of the program might be. One did not respond; six speculated about positive benefits; and one noted the avoidance of negative impacts. Representative quotes follow in Table 5-6.

Table 5-6: Perceived Program Benefits (Non-Participants)

<table>
<thead>
<tr>
<th>Noteworthy Non-Participating Distributor Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketing help would increase sales, save energy, and educate my staff so we're more compelled to sell energy efficiency.</td>
</tr>
<tr>
<td>We're just getting into mini-splits. If someone is willing to help me, I'm willing to try to sell it.</td>
</tr>
<tr>
<td>It could help us sell higher SEER equipment that's more profitable than the lower SEER. The more you could advertise and the more you can make it simple, that's the key to making it happen.</td>
</tr>
<tr>
<td>Usually it goes the other direction, if we're not involved it becomes a negative, contractors expect us to be involved, usually a backwards incentive. Usually biggest determining factor is simplicity of administration, if it's likely we're going to miss something and not get reimbursed that's likely to keep us from getting involved.</td>
</tr>
</tbody>
</table>

When speaking with participating distributors, DNV GL asked a series of questions about their initial awareness of and engagement with the Initiative. As shown in Figure 5-2 below, initial awareness came from three primary sources: Initiative staff, prior engagement with PA-sponsored programs, and co-workers.
Figure 5-2. Source of awareness of the Initiative (Participants)

Eight of the twelve participating distributors reported being involved from the beginning of the Initiative, with three reported enrolling in 2014 or later; and the remaining one did not know.

Program design

Our interviewers asked several questions related to program design to better understand respondents’ opinions about the mix of current rebate-eligible measures and about incentive levels. First we presented respondents with a list of all the HVAC/HP measures qualifying for rebates through the Initiative, and then asked them whether they thought this was the right mix of energy efficiency measures and why. We also asked whether there were any types of equipment they thought should be added to the Initiative, and whether there were any types of equipment that should be eliminated from it.

A majority of all interviewees mentioned adding VRF technology to the current mix of measures supported by the program. Five out of twelve participating distributors recommended adding VRF systems to the Initiative, suggesting the market and savings would be significant. Half of manufacturers also suggested adding ERV or HRV technology. Other specific technologies mentioned included VFD technology, high-efficiency boilers and Building EMS. Further, ten out of twelve participating distributors were satisfied with the equipment mix offered by the Initiative, and two said that they would like it expanded to cover specialized equipment they sell. Representative quotes appear in Table 5-7.
Table 5-7: Equipment Mix

Noteworthy Comments

Some VRF technology is now coming out single phase at 5-ton capability. A bit on residential side, early on the curve, way behind the curve on commercial side.

VRF & Ductless are all we sell.

VRF is the way larger stuff is going. We are seeing it in Bid & Spec documents all the time.

The lack of VRF is a gaping hole in the commercial program and represents a huge missed opportunity.

In terms of which technologies to remove from the program, none of the interviewees had much to offer with only two manufacturers providing responses. The limited responses included AC and ductless heat pumps.

DNV GL’s interviewers also asked respondents whether the then current incentive levels (ranging from $30 to $125 per ton through this Initiative) were sufficient to encourage distributors to sell these higher efficiency units and encourage customers to buy higher efficiency HVAC products, why or why not, and if not, which high efficiency HVAC products needed different incentive levels. We then asked respondents to suggest alternative incentive levels.

Among the three interviewee groups, including manufacturers, non-participating distributors, and participating distributors, only one of the participating distributors noted that the incentive levels were not sufficient. Despite the overall agreement that the then current incentive levels were sufficient, several respondents did provide additional suggestions specific to incentive levels including adding/increasing the incentives for VRF and mini-splits and adding an incentive to cover the processing fees for distributors.

Participation process and sales practices

DNV GL’s interviews with participating distributors explored a number of issues related to the participation process, including level of program activity, stocking and sales practices, motivation for participation, initial concerns, what is working well with the program participation process and what could be improved.

Program activity

DNV GL sought to gauge the level of participation on multiple indices, including the number of incentives received, the types of equipment incented, and the portion of eligible equipment incented. At the local level, the reported number of incentives applied for in a year is on the order of “a dozen” or “a couple dozen” per distributor location. At the corporate level, things varied more widely with one respondent reporting 300 – 400 per year and another estimated 40-50 for their company. Among those respondents involved with incentive processing, all of them reported that all the Initiative-eligible units they sold were submitted for incentives. Further, they mentioned that incentives were primarily requested for two types of equipment, commercial unitary systems (roof top unit or ”RTU”) and heat pumps. The majority of heat pump units which they mentioned were ductless mini-split units.

Several questions addressed respondents’ preferences on the frequency and method of interaction with program staff. There was no evidence to support making any changes to the current systems, which appeared to be ad hoc, but working.
Motivation for participating

Only three respondents reported incentives as a motivation for enrolling. One stated they enrolled based on their relationship with the program representative, responding simply “David” to the question “What motivated your company to get involved in this initiative?” The majority reported a range of motivations related to increasing or preserving sales and/or profit. Three specifically mentioned the need to be competitive. Several respondents noted that the profit margin on high efficiency equipment is better than for standard efficiency equipment, saying, for example, “We can sell higher SEER equipment, bigger dollars, more profit.”

Initial concerns about participating

The large majority of respondents (83%) reported that initially they had concerns about participating in the Initiative. The most frequent concern was that the Initiative would increase the administrative burden. Three out of seven noted this as a shifting the burden from end-users or contractors to their organizations. For most respondents, these concerns have been resolved. However, it is worth noting that the resolution for many respondents involved more work on their part, in some cases staff dedicated in whole or in part to managing incentives. The distribution of responses on these issues is shown in Table 5-8 below.

Table 5-8: Initial Concerns

<table>
<thead>
<tr>
<th>Initial concern</th>
<th>Fully resolved</th>
<th>Partially resolved</th>
<th>Not resolved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased administrative burden</td>
<td>7</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Cash flow concerns</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Inventory management</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>2</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

Stocking and sales practices

The interviewers also asked questions related to the changes in the availability and promotion and purchase of qualifying equipment with majority of respondents reporting that since engaging with the Initiative, the stocking of eligible equipment has increased, the purchase of eligible equipment is encouraged during the sales process, and the incentive has a positive influence on their direct customers’ decisions (see Table 5-9). Most reported that they are stocking more eligible equipment. Two respondents reported that the majority of their sales are ordered directly from the manufacturer, and stocking is thus not applicable.

Table 5-9: Change in stock

<table>
<thead>
<tr>
<th>Stocking changes</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased stocking of eligible equipment</td>
<td>8</td>
</tr>
<tr>
<td>Not applicable</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>2</td>
</tr>
</tbody>
</table>

As to equipment availability, most reported that availability is unchanged since the Initiative began, and related to manufacturing and shipping time frames more than demand. As to sales practices, three-quarters of respondents reported that eligible equipment was frequently or always offered during the sales process.
The other three had no response or did not know what was done “at the counter.” Relevant quotations are included in Table 5-10.

**Table 5-10: Equipment Availability and Sales Practices**

<table>
<thead>
<tr>
<th>Noteworthy Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>We give them standard and high efficient option as well. 90% of quotes go from inside sales, and we give both options.</td>
</tr>
</tbody>
</table>

*It is offered every time unless efficiency is already specified as high efficiency. If they ask for high efficiency, we try to encourage them to meet program requirements.*

<table>
<thead>
<tr>
<th>Noteworthy Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>We push program-eligible 75% of the time, unless they specifically asked for inexpensive as possible. Quite often price both ways.</td>
</tr>
</tbody>
</table>

*Eligible equipment is not encouraged primarily in cases where the equipment is pre-specified (e.g., on drawings) or needs to replace an existing foot-print (RTUs).*

**Barriers to participation**

The interview guides explored potential barriers to participation with both participating and non-participating distributors. A majority of both groups cited administrative burden as a disadvantage or barrier to the upstream program. Specifically, two-thirds of respondents (8 of 12) noted that the additional administrative burden is a disadvantage, while half of non-participating distributors noted administrative burden as a barrier to high efficiency equipment sales. Table 5-11 presents some relevant responses.

**Table 5-11: Barriers to Program Participation**

<table>
<thead>
<tr>
<th>Noteworthy Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>They say paperwork is easy, it’s really not, not as cut and dry as they say. Model changes and slight modifications in products have to keep going back to check against third party lists. The third-party delay can slow things down, especially in a year with a lot of model changes and slight modifications in the model numbers, for example last number being a 6 instead of a 7 to show a change in the logo.</td>
</tr>
</tbody>
</table>

*Only thing negative is the person dedicated to doing claiming and keeping track of where we ship.*

*Stuff rolls down hill and I’m at the bottom. Had some problems, lots of follow up necessary, only one went through smoothly.*

*A larger company might be able to hire someone to administer, I’m swamped as it is. Only a small store, it’s too much for the incentive.*

Other barriers noted by interviewees included the incremental cost, equipment availability, interest in the market, and the frequency of program changes.

Only four respondents offered suggestions to overcome these barriers. Two of these suggested returning to the downstream program design, one suggested providing payment to the sales person (e.g., SPIF), and one suggested increasing the incentive to cover the administrative cost of program participation.
Market conditions

Our interviews with manufacturers and participating distributors explored a number of issues related to market conditions including marketing, passing through of incentives, contractor awareness, and the Initiative’s influence on the contractor and on the sales mix. We also asked manufacturers about production and sales, stocking practices and any market-level barriers to manufacture of high-efficiency equipment.

Marketing and pass-through of incentive

We asked participating distributors whether or not they marketed the Initiative to their customers. Eight out of the 11 respondents stated that they did market the Initiative to their customers. All the participating distributors also said that they pass through at least some portion of the incentive, as shown in Table 5-12 below. The primary reason cited for not passing through all of the incentive to contractors was to cover the administrative costs incurred by the distributor.

Table 5-12: Marketing

<table>
<thead>
<tr>
<th>Market to contractors</th>
<th>Count (n=11)</th>
<th>Pass through incentive</th>
<th>Count (n=12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>6</td>
<td>Most</td>
<td>9</td>
</tr>
<tr>
<td>Partially</td>
<td>2</td>
<td>All</td>
<td>3</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DK</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Contractor awareness

We asked participating distributors about contractor awareness of the Initiative. Ten out of the 12 respondents provided estimates of contractor awareness levels (Figure 5-3). Responses were varied, with four of the ten reporting low contractor awareness and the same number claiming high contractor awareness. One respondent put it best when they noted “[Awareness is a] mixed bag, 60% know about it rebates, other 40% need to be educated.”

Figure 5-3 - Contractor awareness (n=10)
Influence of incentive

When asked about the Incentive’s influence on contractors, 11 participating distributors responded, with eight saying that the incentive was influential, two saying they did not know, and one saying it was not influential.

We also asked participating distributors about the Initiative’s impact on their sales mix. Our instrument contained a series of questions designed to precisely identify stocking and sales of qualifying equipment relative to non-qualifying equipment and to identify the portion incented. Without exception, the respondents noted that they did not have sufficient information to fully complete this sequence. However, we were able to determine from the responses offered that it is highly likely that application for incentives was made for all eligible equipment sold and that sales of eligible equipment have increased due to the Initiative. However, the extent to which the Initiative has increased sales cannot be quantified based on information we gathered.

Production and sales

We asked manufacturers whether demand for high efficiency HVAC/HP equipment has changed in Massachusetts since the Initiative’s launch, and if so, in what way. Four of the six manufacturers said that demand has changed and that it has gone up. While this is a positive finding for the Initiative, given that awareness of the program is low among manufacturers, their estimates of program influence are not likely to be reliable. Table 5-13 presents relevant responses.

Table 5-13: Initiative’s effect on production and sales

<table>
<thead>
<tr>
<th>Noteworthy Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>There’s awareness and a willingness to at least offer the high efficiency option to market. There has been an uptick, recall projects over last 12-24 months where it was a factor; they wanted to take advantage of that program.</td>
</tr>
<tr>
<td>Market awareness, competitive pricing, and rebates are helping.</td>
</tr>
</tbody>
</table>

We also asked whether manufacturers’ stocking practices for high efficiency HVAC/HP equipment in Massachusetts had changed since the Initiative’s launch, and if so, in what way. In this instance, three of the 6 manufacturers we spoke to noted that is has changed, while the remaining three note that there has been little change. In the case of those reporting a change in stocking practice, all noted that the direction was to stock more high efficiency equipment. Examples of responses are shown in Table 5-14.

Table 5-14: Change in stocking practices

<table>
<thead>
<tr>
<th>Noteworthy Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>We’ve always done the same thing - stock at regional distribution and increased stock level with demand. We’ve seen a 15-20% increase.</td>
</tr>
<tr>
<td>About the same, production-wise I don’t see a difference.</td>
</tr>
</tbody>
</table>
Finally, we asked how manufacturers how they expected their manufacturing and stocking practices for high efficiency HVAC/HP equipment to change in Massachusetts over the next year, 2 years, and 5 years. Then we asked, “To what extent will the MA PA upstream HVAC/HP Initiative have a role in these changes?” Again, responses were mixed with four of the six respondents predicting that high-efficiency stock would go up over time while the remaining two predicted no change. Further, only two predicted that the program would have any influence over their manufacturing and stocking practices.

Barriers to producing and selling high efficiency equipment

We asked manufacturers about any factors that might be preventing their companies from producing or selling more high efficiency HVAC/HP equipment. Half of respondents noted that customer demand represented the primary barrier to producing and selling high-efficiency equipment – put simply “[t]here are more Malibus sold than Mercedes.” Two of the remaining three respondents noted that the incremental cost of the higher efficiency unit can be difficult which can lead to architects and engineers not recommending the efficient equipment. Examples of manufacturers responses are presented in Table 5-15.

<table>
<thead>
<tr>
<th>Table 5-15: Barriers to producing/selling high efficiency equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Noteworthy Comments</strong></td>
</tr>
<tr>
<td>Basically, the initial cost compared to typical RTU: the VRF initial cost is higher, which is the biggest hurdle right now. That and industry is still new, such that lots of engineers and contractors are not exposed. Reluctance is based on familiarity; 50% of engineers shy away.</td>
</tr>
<tr>
<td>Getting the architects and engineers to specify it, because it is a more expensive solution to install, but generally has a lower lifetime cost.</td>
</tr>
<tr>
<td>There are more Malibus sold than Mercedes. There are no barriers to producing; barriers to selling are customer demand, customer promotion, cost.</td>
</tr>
</tbody>
</table>

Overall Initiative feedback

DNV GL asked participating distributors to rate their satisfaction with aspects of the Initiative on a five-point satisfaction scale, where 1 is “very dissatisfied” and 5 is “very satisfied.” Figure 5-4 depicts these responses.
What is working well:

- Paperwork – Overall ratings on the paperwork, despite complaints about the administrative burden noted in response to other questions, were quite high. Respondents had positive comments to offer on the online tools and noted that the main problem was acquisition of the detailed information on installation site.

- Support – Ten of twelve respondents rated Initiative support as better at satisfactory or better. One did not know since their contact with the Initiative is through their corporate territory manager. In response to open-ended questions on the support received from the Initiative, respondents were positive. Four out of 12 named the same EFI representative without being prompted, and were extremely positive towards him.

- Program benefits - All but one of the respondents reported benefits from participation in two categories related to their bottom line, increased sales and increased profit. Several of the distributors felt the end user received the greatest benefit from the Initiative: long-term savings from higher quality equipment.

What could be improved:

- Incentive processing time – Respondents found this the least satisfactory aspect of the Initiative. They also noted that information on processing sometimes not forthcoming and responsiveness at the processing level may be lacking. One respondent specifically noted: "[e]very time we submit for rebates the administrators have to match up every invoice, [it would be] better if a pool of resources was available that the administrator could pay quickly. Aim for 30 -45 days, rather than 90 to 120..."
days. If there were a 30-day turnaround everyone would be apt to participate. Expand application timeframe from 90 days to 180 in busy season.”

- Marketing materials – Based on the responses to questions related to marketing materials it is not clear to distributors that they even exist. In particular, distributors are looking for marketing materials that can be leveraged with the end user.

- Distributor participation - Respondents also offered suggestions for encouraging participation by other distributors. These included presenting at Air Conditioning Contractors of America meetings, doing in-person outreach to non-participating distributors, adding equipment, increasing downstream marketing, and increasing incentives.

- Manufacturers and non-participating distributors were also given the opportunity to offer any overall observations regarding the Initiative at the close of the interview. Interviewees focused on reiterating points raised earlier in the interview and focused on the type of equipment incented and the target audience for the Initiative. Comments of interest are presented in Table 5-16.

Table 5-16: Closing Comments – Non-Participating Distributors & Manufacturers

<table>
<thead>
<tr>
<th>Noteworthy Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>I’ve never been asked for a high efficiency RTU. In most cases they are looking for easy, quick replacement. Information is not ending up at end users, so at the end of day go for the cheapest unit. I’m already selling 18 SEER DHP even on commercial stuff. There’s an opportunity to get folks into VFR in coming years as standards increase. We’re seeing it more and more from design build contractors.</td>
</tr>
<tr>
<td>I don’t know why every AC on RTU isn’t a HP, and that frustrates me. Most contractors aren’t taught the basic of what they do. Better education in the industry and for general contractors is needed.</td>
</tr>
<tr>
<td>Target the manufacturers, go further upstream. Your dollar go further the further up the food chain you go. Have heard of upstream programs on West Coast. Not sure how that would work, sure you’d want to have some sort of verification that we’re shipping more into market.</td>
</tr>
<tr>
<td>VRF incentive level, key to getting people to use technology is to get specifiers to put in it. Will take a big incentive to get it noticed. Whatever they number is will have to catch their attention, So Cal had $700-900/ton for VRF since 2010, stopped now. I think it was moving the market, I think the goal of any incentive program is someday you don’t need it. It would be better for upstream program to tell distributors can keep some rebate, because of difference, can’t advertise it. Just said what’s in it for you, then can advertise rebate across the board, what they do in VT and CT. Advertise to end user, very helpful.</td>
</tr>
</tbody>
</table>

5.3 Conclusions

In this section, we synthesize and interpret the results of the above IDIs.
Participation

A key research question for this effort was to determine what is driving the varying participation levels between distributors, both in terms of why some participated and others did not and why some participating distributors did not move more Incented technologies.

Non-participants vs. participants

Based on the interviews conducted, both participating and non-participating distributors range across all size categories. Further, all distributors reported that the manufacture and sale of energy efficiency equipment is a focus of their business. However, based on the information collected during the market actor interviews, it is apparent that one key structural difference between participating and non-participating distributors is the relative ability to cope with the administrative burden of participation in the program and the lengthy timeline associated with rebate processing, which often can be correlated with size. Further, we found that most nonparticipating distributors interviewed were unaware of the Initiative prior to the interview, highlighting an opportunity for increased program activity.

Participants

There are several drivers for why the Initiative is not experiencing greater activity (e.g., more units of rebated equipment) from participating distributors including:

- Market demand/Contractor education – It is the distributors’ perception that in many cases the end-use customer is not interested in the high efficiency equipment, either because their contractor has not specified high-efficiency or there is an urgent replacement problem, and the contractor is just focused on getting in and out quickly.
- Incentive levels - For some equipment types, distributors generally do not make enough sales to justify the time and energy spent to figure out the participation process.
- Participation fatigue/Administrative burden – in some cases, distributors can burn out after experiences with rebate delays or other administrative burdens

Program design

Through our interviews, a number of themes related to program design arose, including incentive design, equipment mix and program marketing.
**Incentive design**

The administrative burden associated with the current design of the rebate process is significant enough to come up several times throughout our interviews with market actors. Additionally, the turnaround time to receive incentives is generally perceived as too slow. Reducing the time associated with the processing of rebates would have a positive impact on participant experience, particularly those participants for whom covering the incremental cost of the high-efficiency equipment may be difficult.

How the incentive is applied to a project varies by distributor. Some distributors pass 100% of the rebate through to the contractor/end-user while others retain a percentage of the incentive to cover their own increased administrative costs. Having a clear incentive structure that is communicated to all key stakeholders would likely benefit the program.

**Equipment mix**

Nearly half of the market actors we spoke to mentioned the need to add VRF technology to the technologies incentivized by the Initiative. Further, several interviewees noted that it may not be cost-effective to carry out upstream programs for small incentive dollars, and for equipment that is not commonly sold.

**Initiative marketing**

Marketing of the Initiative appears to occur infrequently and on an ad-hoc basis. Nearly all market actors interviewed noted that the Initiative would benefit from increased awareness and marketing to contractors and end-users.
6  MARKET PENETRATION/POTENTIAL ANALYSIS

6.1  Overview and approach

The goal of the market penetration and potential analysis was to learn about two important aspects of the program-eligible HVAC market in Massachusetts. The first concerned market penetration: we wanted to determine how effective the Initiative had been at capturing a share of the recent purchases of program-eligible HVAC equipment in Massachusetts. The second concerned market potential: we wanted to determine how much old, replacement-ripe program-eligible equipment remained across the state.

The market penetration research was initially included in the scope of the work plan for this evaluation. However, the PAs and EEAC Consultants observed that this research overlapped significantly with research being conducted for another DNV GL team project, the Assessment of the Share of Incentivized High Efficiency Equipment (Project 61), and thus recommended that the market penetration research be removed from the scope of the Upstream HVAC Evaluation. However, the final report for the Upstream HVAC Evaluation includes the subset of the Project 61 research that focused on program-eligible equipment for which the sample sizes were large enough to produce meaningful results.

The DNV GL team proceeded with the market potential research phase of this evaluation, to learn about the age mix of the current stock of HVAC equipment in Massachusetts and accordingly, identify opportunities for future energy-efficient replacement. These nameplate lookups focused on types of HVAC equipment that were eligible for the Initiative, including:

- Commercial unitary and split air conditioning systems (air cooled, including all types of heating)
- Commercial unitary air conditioning systems (evaporatively cooled, including all types of heating)
- Commercial unitary air conditioning systems (water cooled, including all types of heating)
- Commercial unitary heat pump systems (air cooled)
- Commercial unitary heat pump systems (water source)
- Ground water – water source heat pump equipment (open loop)
- Ground loop – water source heat pump equipment (closed loop)
- Energy savings control and fan motor options

The research also looked at the age of unitary HVAC equipment types that were not program-eligible, but that could potentially be replaced by program-eligible equipment. These include mini-split ACs and wall ACs.

We drew the HVAC equipment nameplate information from the DNV GL team project Industrial Market Characterization On-site Assessment and Market Share and Sales Trends Study (Project 41), mostly from photographs taken in the field. The DNV GL team determined manufacture dates using model numbers, serial numbers and other information on the nameplates and matching them with public databases of HVAC equipment serial numbers and our own compilations of such data from similar studies in California and elsewhere. In cases where we could not match the nameplate data with existing information on manufacture dates, we reached out to HVAC equipment manufacturers for additional information. More details about our data collection methodology appear later in this section.

To determine whether the HVAC equipment might be ready for replacement, the DNV GL team used Massachusetts’ definition of Estimated Useful Life (EUL) of 15 years for these equipment types. In addition to identifying equipment which was at or past its EUL, we identified equipment which was within two years of reaching its EUL.
Collecting the nameplate information

As noted, the HVAC equipment nameplate information came from Project 41, mostly from photographs taken in the field. HVAC equipment nameplates contain an assortment of information regarding the unit they are attached to. While some of the information is required, most of it is included at the discretion of the manufacturer. Model number, serial number, and some definition of energy load appear on almost every HVAC nameplate. While the manufacture date is sometimes listed, often it is not.

An alternative way of determining the manufacture date is to decode manufacturer’s serial number nomenclature. For tracking purposes, HVAC manufacturers almost always encode the date and month or date and week of manufacture in the serial number. 31 Figure 6-1 shows a package RTU nameplate that shows manufacture date just below the model number. Figure 6-2 below shows a typical nameplate of a Carrier package/RTU that does not list the manufacture date.

Figure 6-1. AC nameplate listing the manufacture date

31 Why they choose to do this instead of posting the manufacture date directly on the nameplate is not easily answered, but it has long been the practice.
Over the past two decades, some amount of information on HVAC manufacturers’ serial number nomenclature has become available online. Sources of this information range from HVAC contractor forums to non-profit building energy websites dedicated to cataloging it. The DNV GL team has also compiled numerous documents and web links containing useful information for decoding serial numbers. This information allows us to obtain manufacture dates for HVAC equipment without manufacturer dates on the nameplates, such as the example shown in Figure 6-2.

The DNV GL team did not categorize a unit’s age unless a clear serial number style was available for that unit. If a serial number fell into a group of multiple serial number styles where multiple manufacture dates could be interpreted for the unit, they listed the date as “unknown-more information needed.” The first pass of serial number vintage lookups was limited to categorizing the serial numbers with a clearly identifiable serial number style showing the year of manufacture. After this first pass, we were able to confidently identify manufacture dates for approximately two thirds of program-eligible units with legible serial numbers.

For some HVAC manufacturers, there was limited reliable information available on serial number nomenclature. For these manufacturers, the DNV GL team contacted the manufacturer’s customer service
department directly. For all but one manufacturer, a representative was eventually able to provide additional information on serial number nomenclature. We completed this second pass of manufacture date research for over a dozen different manufacturers, which helped us categorize an additional 20% of program-eligible units with legible serial numbers.

Sample frame

The starting point for our sample frame of HVAC manufacturer nameplate lookups was the HVAC data collected for Project 41, which appeared in one of the following two distinct sets of data tables:

- **Large Built-Up HVAC**: This set of data tables includes larger built-up central HVAC systems consisting of multiple dedicated components.
- **Stand-Alone Unitary HVAC**: This set of data tables includes HVAC equipment that was smaller or was entirely contained in one unitary package like Rooftop Units (RTUs), portable Air Conditioners, or split system residential style AC units.

Since one of the objectives of these nameplate lookups was to better understand the potential market for the Initiative, we chose to limit the lookups to those types of HVAC equipment that were either eligible for the Initiative or which could potentially be replaced by program-eligible equipment. Table 6-1 shows which types of HVAC equipment from the Project 41 study we targeted for the nameplate lookups and, which types we excluded.

**Table 6-1. HVAC equipment from Project 41 data that was targeted for lookups**

<table>
<thead>
<tr>
<th>Stand-alone unitary HVAC</th>
<th>Large built-up HVAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program-eligible HVAC units included in nameplate lookups</td>
<td>Non-program eligible units excluded from the HVAC lookups</td>
</tr>
<tr>
<td>01 - Split system AC</td>
<td>01 - Split forced air furnace</td>
</tr>
<tr>
<td>02 - Split system heat pump</td>
<td>02 - Baseboard heater</td>
</tr>
<tr>
<td>03 - Package/RTU AC</td>
<td>03 - Window/wall heating unit</td>
</tr>
<tr>
<td>04 - Package/RTU heat pump</td>
<td>04 - Unit heater</td>
</tr>
<tr>
<td>05 - Window/wall AC unit</td>
<td>05 - Space heater</td>
</tr>
<tr>
<td>06 - Mini split AC only</td>
<td></td>
</tr>
<tr>
<td>07 - PTAC</td>
<td></td>
</tr>
<tr>
<td>08 - Water source heat pump</td>
<td></td>
</tr>
<tr>
<td>09 - Geothermal heat pump</td>
<td></td>
</tr>
<tr>
<td>10 - Mini split heat pump</td>
<td></td>
</tr>
</tbody>
</table>

The on-site instrument used by the Project 41 field staff contained about 50 different data points/questions about all stand-alone or unitary type HVAC units present. Due to the time burden associated with recording serial numbers for every unit, the unit serial number was not one of data points on the Project 41 on-site instrument. However, the field staff did take photos of the unit nameplate and the unit itself.

If the date of manufacture was not listed on the unit nameplate, the Project 41 site instrument prompted the field staff to estimate whether the unit was manufactured in the last 5 years, which at the study’s outset
was 2009 or newer. The site instrument also prompted the field staff to ask onsite contacts to report the year of installation for each HVAC unit present.\(^{32}\)

Initially, the DNV GL planned to give priority to nameplate lookups of program-eligible HVAC equipment that had been reported as installed or manufactured prior to 2009. The main reason for this was that since both the Market Share and Sales Trends Study (Project 50) and the Assessment of the Share of Incentivized High Efficiency Equipment (Project 61) were looking at more recent HVAC units, there was seemingly a greater need to collect information on the older HVAC units. Our team planned to only do nameplate lookups on the newer models if schedule and budget permitted.

However, once we started doing the lookups, we realized that the iterative process of researching the manufacture date for a subset of "older" units and then going back to research "newer" units would be much more time-consuming than running the process just once, for all units. Therefore, we decided to do nameplate lookups on all the program-eligible equipment regardless of equipment age.

The program-eligible units captured in the Project 41 study included 2,814 unique HVAC records representing a total of 13,012 total units. In most cases, Project 41 field staff would inventory a single unit and capture the nameplate data for just that unit. However, in some situations, particularly with lodging or educational business types, they would observe numerous identical HVAC unit models at a single site. If these identical units all appeared to have been installed at one time and the field staff could confirm that assumption with the site contact, they would capture the nameplate data for one unit and then increase the quantity for that record every time they observed an identical unit. At some hotels or schools, they counted dozens or even hundreds of identical HVAC units.

Of the 2,814 program-eligible-HVAC records in the Project 41 database, 1,272 records (representing 4,643 units) had a manufacture date clearly listed on the nameplate. Of the remaining 1,542 HVAC records without a manufacture date listed on the nameplate, the Project 41 field staff had taken a photo for 1,364 records. Of those 1,364 HVAC records with at least one photo, the DNV GL team was able to read and transpose a serial number for 922 records. Of the 922 records with a legible serial number, we were able to confidently identify a manufacture date for 821 records (representing 4,159 units). Figure 6-3 below shows the un-weighted manufacture date outcome distribution of program-eligible units collected for the Project 41 study.

\(^{32}\) If the onsite contacts did not know the data of installation, the Project 41 engineers would probe to try to code the response as either "don't know before 2009" or "don't know after Jan 1 2009." It also should be noted that for a few very large sites, the Project 41 engineers did not ask about the age of every individual unit, but might instead ask whether all the units had been installed around the same time and then try to deduce the age of this group of units by other information such as nameplate data.
Figure 6-3. Disposition of program-eligible HVAC equipment by availability of manufacture date

Upon completion of the nameplate lookups, we combined these updated manufacture dates with the other HVAC data already collected in the Project 41 study. We applied the adjusted respondent-level site weights to each HVAC unit to use for analysis. The Project 41 sample design requires that the respondent-level site weights be used for all Project 41 equipment types that vary in quantity from site to site.

6.2 Results and findings

The distribution of program-eligible HVAC unit manufacture dates is shown in Table 6-2 and Table 6-3. Table 6-2 shows the distribution of all AC program eligible units, while Table 6-3 shows all program-eligible heat pump units. The distribution of manufacture dates across different unit types is fairly even over the past 15 years, with some vintages stretching back to the 1980s. However, for each unit there does appear to be a spike in unit presence for one or two years. Part of this spike is attributable to site-level respondent weighting. If a site with a high respondent weight had a large quantity of identical units installed at the same time, possibly because it has a newer building or major renovation, the combination of high weighting and high quantity causes a distribution spike. For some of the unit types with fewer overall units observed, single year vintage spikes are more pronounced.

*The values listed above are based on un-weighted quantities observed in the field (13,012 total HVAC Units)
Table 6-2. Distribution of program-eligible AC manufacture dates

<table>
<thead>
<tr>
<th>Manufacture date</th>
<th>Package RTU AC</th>
<th>PTAC</th>
<th>Split system AC condensing unit</th>
<th>Window/wall AC only</th>
<th>Mini split ACs</th>
<th>Statewide totals for ACs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to 1995</td>
<td>3%</td>
<td>9%</td>
<td>2%</td>
<td>3%</td>
<td>2%</td>
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<tr>
<td>1996</td>
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<td>0%</td>
<td>6%</td>
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<tr>
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<td>0%</td>
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</table>

*The results presented above are weighted using the respondent-level sample weight created for P41.

**The observed unit quantities for each unit type are; Package RTU AC (2,157), PTAC (4,271), split system AC (1,707), window/wall AC (1,478), mini-split AC (704)
Table 6-3. Distribution of program-eligible heat pump manufacture dates

<table>
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<tr>
<th></th>
<th></th>
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<td>28%</td>
<td>0%</td>
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</table>

*The results presented above are weighted using the respondent-level sample weight created for P41.

**The observed unit quantities for each unit type are: geothermal heat pump (68), mini-split heat pump (726), package RTU heat pump (248), split-system heat pump (398), water source heat pump (1,255)

For all equipment, a 15-year EUL age was applied based on current AC and heat pump measure life ratings found in the 2016-17 Massachusetts Technical Reference Manual (TRM).

In comparing the percentages of unknown manufacture dates across different unit types, it is apparent that unit access for field staff was an issue with some equipment types more than others. Window/wall air conditioners showed the highest portion of unknown manufacture dates. While window/wall AC units are typically physically accessible to field staff, the nameplate is located either in an area covered by the window shroud or outside of the window. This makes it difficult, if not impossible, for field staff to access the nameplate without completely removing the unit from its installed position.

Additionally, there were sites with hundreds of window/wall AC units. Unless a site contact informed the field staff that all the units were purchased at the same time and were the same model number, the field engineers could not associate a manufacture date to that unit without direct observation of the nameplate.

Of the 800 Project 41 sites visited, there were only 8 sites with known water-sourced heat pumps present. Despite that, a total of 1,255 water-sourced heat pump units were observed at the 8 sites. Three large lodging sites accounted for over 900 observed water sourced heat pumps. The case of geothermal heat pumps, there were only 2 sites with these units installed. In both cases the unit manufacture and install dates were known and occurred in the past 5 years.
On average, 17 percent of all equipment is shown to be past the rated EUL with an additional 4% showing a manufacture date within 2 years of the 15-year EUL. If one removes the units with unknown manufacture date from the denominator, then the share of older units increases to 26%.

For most equipment types, the percent of units manufactured prior to the 15-year EUL was in the 15%-25% range (Figure 6-4). Water-sourced heat pumps showed the highest percentage of units past the 15-year EUL, at 54% of the weighted population. Figure 6-5 shows the share of units past their EUL when the denominator is only those with identifiable manufacture dates.

Figure 6-4. Statewide EUL vintage distribution for all program-eligible units

*The results presented above are weighted using the respondent-level sample weight created for Project 41. **The observed unit quantities for each unit type are: geothermal heat pump (68), mini-split AC (704), mini-split heat pump (726), package RTU AC (2,157), package system heat pump (248), PTAC (4,271), split-system AC (1,707), split-system heat pump (398), water source heat pump (1,255), window/wall AC (1,478) for a statewide total of 13,012 observed units.
Table 6-4 shows which of the shares of units past their EULs in Figure 6-4 were statistically different from one another.

**Table 6-4: Statistically-Significant Differences in %s of Units Past EULs**

<table>
<thead>
<tr>
<th>HVAC Equipment Type</th>
<th>Which Equipment Types It’s Share of Units Past EUL Are Statistically Different From</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geothermal heat pumps</td>
<td>Mini-split heat pumps, water-source heat pumps</td>
</tr>
<tr>
<td>Mini-split ACs</td>
<td>Mini-split heat pumps, water-source heat pumps, window wall ACs</td>
</tr>
<tr>
<td>Mini-split heat pumps</td>
<td>Geothermal heat pumps, mini-split ACs, window wall ACs</td>
</tr>
<tr>
<td>Package RTUs</td>
<td>Water-source heat pumps, window wall ACs</td>
</tr>
<tr>
<td>Package system heat pumps</td>
<td>All equipment types except geothermal heat pumps</td>
</tr>
<tr>
<td>PTACs</td>
<td>All equipment types except mini-split ACs, split system heat pumps, and geothermal heat pumps</td>
</tr>
<tr>
<td>Split system ACs</td>
<td>PTACs, water source heat pumps, window wall ACs</td>
</tr>
<tr>
<td>Split system heat pumps</td>
<td>Geothermal heat pumps, mini-split ACs, window wall ACs</td>
</tr>
<tr>
<td>Water-source heat pumps</td>
<td>All equipment types</td>
</tr>
<tr>
<td>Window wall ACs</td>
<td>All equipment types except geothermal heat pumps</td>
</tr>
</tbody>
</table>
Figure 6-5. Statewide EUL vintage distribution for all program-eligible units with identifiable nameplates

When looking at the distribution of program-eligible equipment which are past the EUL by electric PA, some interesting trends appear. Of the 15 sites visited in the Unitil service territory, less than 1% of the weighted units were manufactured prior to 2002. That being said, of the 44 program-eligible units we observed at the 15 sites, only 2 were manufactured prior to 2002. Additionally, while only 19 of the 44 units had unknown manufacture dates, their site weighting caused those 19 units to represent 63% of the program-eligible unit population for Unitil.

A much larger sample size contributed to the EUL findings in the other PA territories, minimizing the variance between observed quantities and weighted distributions. It should be noted that of all program-eligible units, only 9% of weighted units in the National Grid electric service territory had a known manufacture date prior to 2002. That number goes up to 14% when looking at unweighted unit totals, but this frequency is still considerably less than the EUL distribution rate seen at the other three PA service territories with healthy sample sizes. The overall weighted program-eligible unit EUL distribution by electric PA is shown in Figure 6-6.
Figure 6-6. EUL distribution for all program-eligible HVAC units by electric PA

* The results presented above are weighted using the respondent-level sample weight created for Project 41. All the percentages of units past their EULs are different from each other to a statistically-significant degree except: 1) Cape Light Compact’s percentage of units past their EULs is not statistically different from those of Eversource NSTAR or Eversource WMECO 2) The percentages of units past their EULs are not statistically different between Eversource NSTAR and Eversource WMECO 3) Unitil’s percentage of units past their EULS is not statistically different from any of the other results. ** The observed unit quantities found within Electric PA territories; Cape Light Compact (556), National Grid (5,755), Eversource NSTAR (5,680), Unitil (44), Eversource WMECO (977), and the Statewide weighted totals (13,012).

Figure 6-7 shows the percentage of units past their EUL when the units without identifiable nameplates are removed from the denominator. It shows that the a little more than a third of the units with identifiable ages in the Eversource and Cape Light Compact service territories are past their EUL.
To show a contrast to the weighted EUL distribution results in Figure 6-6, the unweighted unit EUL distribution results appear in Figure 6-8. The distributions were based on the total observed units at sites across the different Electric PA territories, with no weighting applied. The biggest variations occur within the PAs with fewer sites visited, and the overall statewide distributions are very close to the weighted distributions found in Figure 6-6.
Figure 6-8. EUL distribution for all program-eligible units by electric PA un-weighted

*The results presented above are unweighted. All the percentages of units past their EULs are different from each other to a statistically-significant degree except for Unitil whose percentages of units past their EULs are only statistically-different from Cape Light Compact’s.

**The observed unit quantities found within Electric PA territories: Cape Light Compact (556), National Grid (5,755), Eversource (5,680), Unitil (44), Eversource (WMECO) (977), and the Statewide weighted totals (13,012)

Project 41 classified the sites by size based on annual electrical usage categories. The EUL distribution of program-eligible units by business size appears in Figure 6-9. It shows that the 500,000-4,500,000-kWh usage category had the highest percentage of units past their EUL or within two years of exceeding their EUL (23% and 7% respectively). It also shows that for the largest business size category, there was a high percentage (72%) of program-eligible HVAC units for which the DNV GL team could not find a manufacture date. This is likely due to the field staff’s inability to document thorough details on every unitary HVAC unit found at these sites.

33 One topic of great interest in the evaluation of Massachusetts C&I energy efficiency programs has been whether these programs are adequately reaching mid-sized C&I customers (e.g., Project 19, Project 68). It should be noted that the middle size category from the Project 41 data includes customers in the 500,000-1,499,999 range which are actually smaller than Project 68’s current definition of a mid-sized customer, which begins at 1,500,000 kWh.
*The results presented above are weighted using the respondent-level sample weight created for P41. The percentage of units past their EULs in the
500,000-4.5 M kWh business size category are different to a statistically-significant degree from the percentage of units past their EULs for all other
business size categories and Massachusetts as a whole. The percentage of units past their EULs in the >4.5 M size range were also statistically
different from the percentage of units past their EUL statewide.

** The observed unit counts were are: <500,000 kWh (1,180), 500,000-4,500,000 kWh (8,713), >4,500,000 kWh (3,119), and the Statewide
(13,012)

Figure 6-10. shows the percentage of units past their EUL when the units without identifiable nameplates are removed from the denominator. It shows that the percentage of units past their EUL increase to about
two-fifths when the units with unidentifiable nameplates are removed.
Figure 6-10. EUL distribution by annual business electricity usage for all program-eligible units with identifiable nameplates

The following figures show the EUL-related manufacture date distributions for the most prevalent program-eligible unitary HVAC unit types. EUL distributions for package rooftop unit (RTU) ACs by electric PA territory are shown in Figure 6-11. The package RTU ACs in the former WMECO (now Eversource) service territory show the highest instance of units with vintages past the 15-year EUL. Conversely, package RTUs in the National Grid and Unitil service territories showed the fewest incidences of units past the 15-year EUL.
The results presented above are weighted using the respondent-level sample weights created for P41. The only percentages of units past their EULs which are statistically significant than others are: 1) WMECO’s percentages are statistically different than both National Grid’s and Eversource NSTAR’s 2) National Grid’s percentage is statistically different than the statewide percentage.

**The observed unit quantities: Cape Light Compact (110), National Grid (1,099), Eversource NSTAR (726), Unitil (26), Eversource WMECO (196)**

Figure 6-12 presents the EUL distribution for package RTU units across different business sizes. It shows that businesses in the middle size range have a higher percentage of units past their EUL, to a statistically-significant degree, than those in the smaller business range or those statewide.
Figure 6-12. EUL distribution for all package RTU AC units by annual electricity usage

The results presented above are weighted using the respondent-level sample weight created for Project 41. The percentage of units past their EUL in the 500,000-4,500,000 kWh business size range is different to a statistically-significant degree than those in the <500,000 kWh business size range and those statewide. However, none of the other percentages of units past their EUL are statistically different than each other.

**The weighted Package RTU EUL distributions are based on the following observed unit quantities; <500,000 kWh (333), 500,000-4,500,000 kWh (1,485), and >4,500,000 kWh (339)**

The EUL distribution of split-system AC units (<20-ton capacity) appears in Figure 6-13. It should be noted that the weighted estimates shown for units in the former WMECO territory of Eversource are heavily impacted by the high weighting associated with one smaller office that had a particularly high respondent level weight. For both the National Grid and former NSTAR territory of Eversource, the samples were fairly extensive. The contrast between the percent of former NSTAR vs National Grid units past EUL (41% more units in NSTAR are past the EUL) is interesting. Since the NSTAR service territory covers the greater Boston area, one possibility that this is partly due to buildings in downtown Boston being replaced less frequently due the greater cost and complexity of construction in that area. The average year built for a former NSTAR building was 1962, six years older than the average year built for a National Grid building (1968).\(^{34}\)

\(^{34}\) The customers only reported the age of the buildings for 416 of the Project 41 sites. The sample sizes for these self-reports were 196 for National Grid and 119 for former NSTAR.
Figure 6-13. EUL distribution for all split system AC units by electric PA

*The results presented above are weighted using the respondent-level sample weights created for P41. The percentage of units past their EUL in the National Grid territory is lower, to a statistically-significant degree, than the percentages of units past their EUL in the Cape Light Compact and Eversource Nstar services territories as well as statewide. The percentage of units past their EUL in the Eversource Nstar territory is higher, to a statistically-significant degree, than the percentage of units past their EUL statewide and in all the PA service territories except Unitil.

**The weighted Split System EUL distributions are based on the following observed unit quantities; Cape Light Compact (128), National Grid (590), Eversource Nstar (837), Unitil (9), Eversource WMECO (143)

When looking at split-system AC unit distributions across business size categories (Figure 6-14) the results appear more consistent. The largest usage category shows the smallest percentage of units near or past the 15-year EUL threshold. It should be noted that the large majority of split-system AC units (1,707 or 71% of all units observed) were found in the medium-sized category. Close to half of all split-system AC units in that medium category are within two years of or past their EUL.
*The results presented above are weighted using the respondent-level sample weight created for P41. The percentage of units past their EUL in the 500,000-4,500,000 kWh business size range is greater, to a statistically-significant degree, than those in the > 4,500,000 kWh business size range and those statewide. However, none of the other percentages of units past their EUL are statistically different than each other.

**The weighted Split System AC Unit EUL distributions are based on the following observed unit quantities; <500,000 kWh (233), 500,000-4,500,000 kWh (1,207), and >4,500,000 kWh (267) for a statewide total of 1,707.

Package terminal AC (PTAC) units were seen in greater quantities across the Project 41 sites than any other program-eligible HVAC unit type. PTACs are often found in hotel rooms, hospital rooms, or in similar areas with scattered occupancy. PTACs were only present at 56 out of 800 sites for Project 41, but when present, they were observed in large quantities. It was also very common for a site to have installed hundreds of identical units at the same time. Two-thirds of all PTAC units observed are found in lodging business types statewide. Figure 6-15 below shows the EUL distribution for PTAC units across electric PA service territories.

The chart shows that nearly all the PTACs in the Cape Light Compact service territory were past their EUL. This result is partly an effect of the small sample size of only 107 units at 4 sites. However, it is worth noting that the cooler temperatures of the Cape and the greater seasonality of HVAC usage mean that HVAC equipment is not used as frequently as it is in other parts of the state. This lower usage should make HVAC equipment last longer. Another possible contributing factor is that the Cape has a lot of small, independently-owned businesses (e.g. hotels/motels) and it is possible that these smaller companies might replace their PTACs less frequently due to financial constraints or the lack of corporate policies concerning equipment replacements.
The results presented above are weighted using the respondent-level sample weight created for P41. All the percentages of units past their EUL are different from each other to a statistically-significant degree except that the percent of WMECO units past their EUL is not significantly different from the statewide proportion.

**The weighted PTAC EUL distributions are based on the following observed unit quantities; Cape Light Compact (107), National Grid (2,438), Eversource Nstar (1,354), and Eversource WMECO (372)**

Figure 6-16 shows the EUL distribution of PTAC units by business size category. Sites in the smaller electricity usage category had the highest percentage of PTAC units past their EUL. By far, the most PTAC units (both in terms of raw quantities observed and weighted quantities) were in the medium usage category. Determining the vintage for PTAC units at sites in the largest electricity usage category proved somewhat elusive. Nameplates on PTAC units are often not accessible without partially dismantling the unit. When field staff were not able to confirm all units were of the same model and vintage, time limitations prohibited them from collecting nameplate photos for hundreds of units.
Window/wall or portable AC units are at or below a 2-ton cooling capacity, and generally can be removed during non-cooling months. In looking at the statewide TRM, the 15-year EUL appears to really run the limits of portable AC EULs. Figure 6-17 shows the distribution of window/wall AC vintages by EUL across PA electric service territories. Window AC unit nameplates can often be blocked by the window shroud to the point of being totally inaccessible. In the nameplate images taken, many nameplates were partially covered or placed at such an angle on the unit that they were illegible. This accounts for the large number of units in Figure 6-17 with unknown manufacture dates.
The results presented above are weighted using the respondent-level sample weight created for P41. None of the percentages of units past their EUL in this chart are different to a significantly-significant degree from each other.

**The weighted Window/Wall AC unit EUL distributions are based on the following “raw” observed unit quantities: Cape Light Compact (107), National Grid (568), Eversource Nstar (755), Unitil (3), and Eversource WMCO (45)**

Figure 6-18 shows the distribution of window/wall AC EUL by annual electricity usage below. The weighted statewide totals are very close to the totals seen in the <500,000 kWh usage category. Regardless of where they are found, very few window/wall ACs are more than 15 years old.
How accurately customers reported the age of their HVAC equipment

The collection of all these new manufacture dates gave us an opportunity to compare these dates with self-reported install dates. As noted, in cases where field staff could not find a manufacture date while onsite, they would ask the facility representative whether or not the unit was installed before or after January 2009. Our analysis showed that in cases where the facility representative said that the HVAC units were installed recently, their self-reports were reasonably reliable. Figure 6-19 shows the breakdown of manufacture date information for program-eligible HVAC units for which the self-reported install date was after January 2009. It shows that, in the vast majority of cases, when our team was able to find the equipment manufacture date, the equipment had been manufactured after January 2009. In addition, 1% of those recent self-reported installs were manufactured in 2008. These cases could also be considered to validate the self-reports given the typical delay between manufacture date and installation date. Only 2% of the units were manufactured prior to 2008, with most in that category dating well before 2008.
* The results presented above are weighted using the respondent-level sample weight created for P41.
** 3,271 program eligible units fell into this self-reported recent install age range (out of 13,012)

While this analysis suggests that self-reports on equipment installation dates have some reliability, it should be noted that we were asking the facility representatives to report on installation dates within a fairly broad time range (2009-2015). If we had asked them to provide more precise installation dates, it is likely that their recall accuracy would have declined. As discussed below, there was also a small percentage of respondents who were unwilling or unable to estimate the installation date range.

Figure 6-20 shows a similar analysis for program-eligible HVAC units that the facility representatives had self-reported as having installation dates prior to 2009. Once again, in a large majority of the cases, the manufacturer dates corresponded with the self-reported installation dates.

However, the figure also shows that the evaluators were not able to identify the manufacture date for a third of these older units, more than the twice the percentage as was the case for the newer units shown in Figure 6-20. While there is no way of knowing the exact age of the unknown vintage category, for a significant number the vintage was indeterminable due to weatherization of the nameplate. Several factors contribute to the weatherization of a nameplate to the point of it becoming illegible. The nameplate’s material, solar orientation, and proximity to the ocean or other corrosive elements all contribute to its durability. Included in the group of unknown manufacture dates are the units for which field staff could not physically access. Physical access limitations included restrictions imposed by the site contact, safety concerns, or a quantity of equipment so large at a single site that time constraints prevented field staff from fully documenting each unit.
For just 8% of all program-eligible units observed during the Project 41 study, the site contact was unwilling or unable to estimate if the unit was installed before or after January 2009. Figure 6-21 shows that of this group of unknown self-reported install date units, only 2% were shown to be manufactured after January 2009. Our team was unable to find the manufacture data for 70% of these units. This, along with site contacts’ lack of recall about installation date, suggests that these were mostly older units.
6.3 Conclusions

Because the HVAC nameplate lookups were a research task exclusively for the Upstream HVAC Evaluation, we feature these conclusions first. We then present the subset of findings from Project 61 that are relevant to the types of HVAC equipment that are eligible for the Initiative.

The average age of overall HVAC equipment

Key findings concerning the overall age of the Massachusetts unitary HVAC equipment included:

- **About a third of the program-eligible HVAC units in the Project 41 sample with identifiable manufacture dates were either past their Estimated Useful Life (EUL) or close to end of their EUL.** Twenty-six percent of the program-eligible HVAC units with identifiable manufacture dates were past their EUL. Another 6% were within 2 years of the end of their EUL.

- **The actual share of HVAC units past their EUL is likely larger than this.** This is because we would expect that the pool of units whose manufacture date we were unable to identify (35% of the total sample) would have a higher proportion past their EUL than the pool of units whose manufacture date we could identify. Many of the factors that would make a manufacture date unattainable, such as long-term sun or salt damage to the nameplate or the unavailability of manufacturer model information, would correlate with old equipment age.
Variations in age among different unitary HVAC equipment types

Key findings concerning variations in average unit age among different HVAC unitary equipment types included:

- **Water-sourced heat pumps, mini-split heat pumps, and mini-split ACs had the highest percentage of units in the field within two years of or past the EUL.** Generally installed in large quantities, water-sourced heat pumps had the highest percent of units past the 15-year EUL that were still in use. The difficulty of replacing water-sourced heat pumps, compared to replacing window AC units or PTACs, could contribute to their older vintage. Further, because this equipment is not central equipment, many building operators may maintain a stock of replacement units and/or repair vs. replace broken equipment. Smaller sample sizes for some technologies could also play a role.35

- **Other likely contributing factors to the greater average vintage of these HVAC equipment types include the types of businesses which use these HVAC technologies.** For example, over 90% of the mini split heat pumps that the Project 41 team found (n=704) were either in the lodging or healthcare business sectors. These are sectors where one would not expect much change in how the buildings are used, and accordingly, infrequent changes to HVAC system design.

- **Window/wall ACs, PTACs, and package RTU heat pumps had the fewest units in the field past the EUL.** There are several possible explanations for this. These equipment types are less expensive and easier to replace than other HVAC equipment types. Moreover, most units are installed and removed once a year, an activity that would likely make users more conscious of their AC unit's age and condition.

- **Geothermal heat pumps had the youngest average units in the field.** This was something we expected, since they are a relatively new technology.36

Variations in equipment age among PA service territories

There were some interesting differences among PAs as to the average of ages of the HVAC equipment. These included:

- **Across all program-eligible AC units, there was a higher percentage of units past their EUL in the Eversource and Cape Light Compact service territories than in the National Grid and Unitil service territories.** Figure 6-22 shows this age distribution across all units, regardless of whether nameplate information was available. Figure 6-23 shows the age distribution, by PA service territory for only those units with recoverable manufacture dates. It shows that a little more than a third of the units with identifiable ages in the Eversource and Cape Light Compact service territories are past their EUL. Possible reasons for these differences appear in the discussions below focusing on particular types of AC equipment.

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35 For example, while the Project 41 team tracked 1,285 water-sourced heat pumps, they were limited to just 8 sites.

36 Notably, the sample size for this technology was very small—just two sites.
The results presented above are weighted using the respondent-level sample weight created for Project 41. All the percentages of units past their EULs are different from each other to a statistically-significant degree except: 1) Cape Light Compact’s percentage of units past their EULs is not statistically different from those of Eversource NSTAR or Eversource WMECO 2) The percentages of units past their EULs are not statistically different between Eversource NSTAR and Eversource WMECO 3) Unitil’s percentage of units past their EULs is not statistically different from any of the other results. ** The observed unit quantities found within Electric PA territories; Cape Light Compact (556), National Grid (5,755), Eversource NSTAR (5,680), Unitil (44), Eversource WMECO (977), and the Statewide weighted totals (13,012)
The split AC systems were much older in the former NSTAR service territory than in the National Grid service territory. Nearly half (47%) of the split system AC units in the NSTAR service territory were past their EUL, compared to only 6% of the split system AC units in the National Grid service territory. Since the NSTAR service territory covers the greater Boston area, it is possible that this is partly due to buildings in downtown Boston being replaced less frequently, due the greater cost and complexity of construction in that area. The average year built for an NSTAR building in the Project 41 sample was 1962, six years older than the average year built for a National Grid building (1968).\(^{37}\) Further, system replacement may be correlated with tenant turnover in Class A office buildings.

Nearly all the PTACs found in the Cape Light Compact service territory were past their EUL. Ninety-four percent of the PTACs in this service territory were past their EULs. This result is partly an effect of the small sample size of only 107 units at 4 sites. However, it is worth noting that the cooler temperatures of the Cape and the greater seasonality of HVAC usage mean that HVAC

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\(^{37}\) The customers only reported the age of the buildings for 416 of the Project 41 sites. The sample sizes for these self-reports were 196 for National Grid and 119 for former NSTAR.
equipment is not used as frequently there as it is in other parts of the state. This lower usage should make HVAC equipment last longer.

Other findings concerning equipment age

- **The medium-sized businesses had the highest percentage of older HVAC units for two of the three largest equipment types.** For package RTUs and split systems ACs, the highest percentage of older units were in the medium-sized business category of 500,000-4,500,000 kWh of annual consumption.³⁸

- **The contacts at the Project 41 sites were reasonably accurate in estimating the age of their equipment, within a broad vintage range.** This study including comparing what the Project 41 onsite contacts had reported as the age of their equipment and what the DNV GL team found to be the actual manufacture dates based on the nameplate information. Our analysis showed that in cases where the facility representative said that the HVAC units were installed recently, their self-reports were reasonably reliable.

Figure 6-24 shows the breakdown of manufacture date information for program-eligible HVAC units with a self-reported install date after January 2009. It shows that in the vast majority of cases, when our team was able to find the equipment manufacture date, the equipment had been manufactured after January 2009. In addition, 1% of those recent self-reported installs were manufactured in 2008. These cases could also be considered to validate the self-reports, given the typical delay between manufacture date and installation date. Only 2% of the units were manufactured prior to 2008, with most in that category dating well before 2008.

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³⁸ One topic of great interest in the evaluation of Massachusetts C&I energy efficiency programs has been whether these programs are adequately reaching mid-sized C&I customers (e.g., Project 19, Project 68). It should be noted that the mid-size category from the Project 41 data includes some customers in the 500,000-1,499,999 range. This is actually smaller than Project 68’s current definition of a mid-sized customer, which begins at 1,500,000 kWh.
Figure 6-24. Self-reported units installed after 2008

- Manufactured after 1/2009: 15%
- Manufactured prior to 1/2009: 78%
- Manufactured in 2008: 2%
- Manufacture Date Unknown: 1%

*The results presented above are weighted using the respondent-level sample weight created for P41.

**3,271 program eligible units fell into this self-reported recent install age range (out of 13,012)

While this analysis suggests that self-reports on equipment installation dates have some reliability, it should be noted that we were asking the facility representatives to report on installation dates within a fairly broad time range (2009-2015). If we had asked them to provide more precise installation dates, the accuracy of their recall would likely have declined. As discussed below, there was also a small percentage of respondents who were unwilling or unable to estimate the installation date range.

Findings concerning market penetration

As mentioned above, the research concerning energy efficiency market penetration and program penetration came from the Assessment of the Share of Incentivized High Efficiency Equipment (Project 61). Because the Initiative was not fully implemented until 2014, our analysis focused on the effects of the upstream rebates in that program year. One impact of this narrow focus was that only two types of program-eligible HVAC equipment—package/split AC units and package/split HP units—had adequate sample sizes to allow for meaningful analysis.

Figure 6-25 shows the percentages of 2014 package/split AC units and package/split HP units that were energy efficient. The charts show that when looking at the unweighted totals, the percentages of these equipment types which were energy efficient were very low – in the 18%-38% range. When the weights were applied, the energy-efficient share of the package/split HP units nearly tripled, although the energy-efficient share of the package/split AC units declined by about 25%. The small sample size of the package/split HP units meant that the site weights had a bigger impact.
The Project 61 team then looked at the percentage of energy-efficient package/split AC and package/split HP units (the percentages in Figure 6-25) that had received rebates from the Initiative. Figure 6-26 shows that the Initiative was capturing about a quarter of the 2014 energy-efficient package/split AC installations. However, it was not impacting any of the 2014 energy-efficient package/split HP installations (although the sample size for this measure was very small). Notably, in 2014, these measures were only eligible for upstream rebates.
Figure 6-26. The share of energy-efficient 2014 package/split AC units and package/split HP units that received upstream rebates

- Package/Split AC (n=31): 24%
- Package/Split HP (n=6): 0%
7 RECOMMENDATIONS & CONSIDERATIONS

This section presents both recommendations and considerations for the PAs based on the research and findings presented in the previous sections of this report. First, we offer four recommendations.

- **Recommendation 1: Update the incentivized technologies to include VRF.** Every interviewee group we spoke with, including program managers and implementers, non-Massachusetts program managers and market actors, noted that VRF technology should be included among the technologies incentivized by the Initiative. It should be noted that VRF technology should only be included if cost-effective and appropriate for the market.

- **Recommendation 2: Address insufficient rebate processing times.** The current rebate processing times present a barrier to participation for distributors, especially those who cannot cover the incremental costs between the standard and higher efficiency equipment. While there are a number of approaches that the PAs could take to address the rebate processing times, we offer the following two approaches as the most viable:
  
  o Create a reservation system such that distributors can reserve funds for projects that have been booked. This type of system provides reasonable assurances to the distributors that they will receive payment if the project is completed. This is helpful in addressing concerns that the program will run out of funds or otherwise change in the interim between booking a project and receiving payment.
  
  o Provide partial payment to distributors in advance of completing the project. By paying some portion of the incentive at the outset of the project, the PAs are at least sharing the burden of the incremental cost between the standard and higher efficiency equipment.

As noted above, indications are that the new program vendor was brought on, at least in part, to address administrative burdens such as lengthy rebate processing timelines.

- **Recommendation 3: Develop a focused marketing campaign.** Our best practices review combined with our review of program marketing to date indicates that the Initiative will likely benefit from the creation of a marketing approach that both demonstrates the value of the incentives to distributors and end-users and can be leveraged to increase knowledge and awareness among targeted populations, including contractors and end-users. An intentional marketing plan which focuses on the more effective methods for interaction and long-term engagement with distributors will foster increased awareness and knowledge of the Initiative. Therefore, the PAs should review and consider adopting the marketing best practices employed by the non-MA programs contacted for this research effort. 39 Our interviews suggested several themes related to increasing or preserving sales and/or profits which could be leveraged in these targeted campaigns including:
  
  o Leveraging the Initiative to stay competitive
  
  o Understanding the profit margin on high efficiency equipment vs. standard

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39 The PAs may find the work being done at Efficiency Vermont to be pertinent. A summary of this work is presented in the following, publicly available, ACEEE proceeding: http://aceee.org/files/proceedings/2016/data/papers/7_460.pdf
In addition to these three recommendations, we present the following considerations.

- **Consider dropping lower volume or smaller equipment from the Initiative.** Several groups that we interviewed noted that the upstream incentive structure worked best with those technologies that were either high volume or larger in size.

- **Increase consistency of incentive structure.** The perception of the Initiative among key market actors may be improved with increased consistency of the incentive structure. Currently, the Initiative allows for distributors to determine what percentage of the incentive is passed through to the customer. The PAs should consider adding specific structure so that there is not variability in the percentage of incentive that is passed through. Further, by allowing the distributors to keep a small percentage of the incentive to defray increased administrative costs, the PAs will address the concerns voiced by some non-participating distributors.

- **Increase incentive levels.** Again, if adopted, this change would address a perception in the market that the incentive levels are not sufficient enough to cover the incremental costs between the standard and higher-efficiency equipment. Similar to the previous consideration, by increasing the incentive, the PAs will address the concerns voiced by some non-participating distributors.

- **Continue to foster long-term relationships with distributors based on constant engagement.** One of the key findings from the non-Massachusetts program manager interviews was that deep collaboration and constant engagement with distributors is crucial for a successful upstream program. One program implementer stressed that the program must work for the distributors, with incentives calibrated around real-world costs to create a value proposition that distributors will buy in to. Conversely, another program implementer explained how their lack of engagement with distributors was having a direct negative impact on program performance.

  Another program reiterated the theme of patience and said that it takes time to change embedded practices and business models. This program said that the first two years of the program were a struggle and it took a lot of effort to engage the market but by the third year the distributors were fully on board with the value proposition of the program and activity took off.

- **Conduct targeted research on geographic areas where HVAC equipment is particularly old to investigate barriers to replacement.** In this report, we have provided plausible hypotheses to explain why the HVAC equipment is much older in some PA service territories than in others. However, some of these pockets of older HVAC equipment merit further investigation to identify additional barriers. For example, we have theorized that nearly half (47%) of the split AC systems in the NSTAR territory of Eversource are past their EUL because buildings in Boston tend to be older partly due to the higher cost and complexity of new construction in the city. However, a phone survey targeted at Project 41 participants in the former NSTAR territory who have older equipment might reveal other barriers to implementation which may be more important. A similar targeted survey could help explain why nearly all of the PTACs in the CLC service territory are past their EUL.
APPENDIX A: FINAL C&I UPSTREAM HVAC/HP INITIATIVE’S PROGRAM MANAGER IN-DEPTH INTERVIEW GUIDE

Goal of Interviews:
We plan to complete up to five in-depth interviews with PA representatives who are involved in managing this initiative. We will attempt a census of the PAs sponsoring the initiative and will combine interviews where it makes sense. The topics we plan to cover include:

- **Background**
  - Individual role in the design and delivery of the upstream HVAC/HP initiative;
  - Program theory from the perspective of PA implementation staff;
  - Perception of the potential for the upstream model (versus downstream);

- **Program changes**
  - Recent or planned changes in the initiative beyond those detailed in the three-year planning documents;
    - This will include a discussion of any expected changes to the initiative as a result of the expected changes to building energy code as well as federal standards.

- **Interaction with implementers**
  - Interactions with the implementation contractor, EFI;

- **Difference between participant and non-participant distributors**
  - Understanding of the non-participating distributor market and how non-participating distributors may differ from participating distributors;

- **Marketing and outreach**
  - Details on the initiative’s statewide and PA-specific marketing and outreach efforts to participating and non-participating distributors;
    - Including activities to encourage installation of incentivized equipment by participating distributors and activities to target and recruit non-participating distributors.
  - Details on the initiative’s statewide and PA-specific marketing and outreach efforts to other market actors and C&I customers;
    - Including activities to encourage installation of incentivized equipment.

- **Barriers**
  - Perception of the barriers to participation, particularly in terms of barriers for participating distributors to installing more incentivized measures;

- **Overall program feedback**
  - Aspects of the initiative that are perceived to be going well according to program staff; and
  - Any challenges the initiative may be facing.

The purpose of conducting these interviews is to two-fold: 1) to ensure that the evaluation team has the most accurate and up to date information on past, current and future initiative design; and 2) to identify key areas of interest for this key stakeholder group.
**Background**

1. What is your official title and role?
2. How long have you been in this role?
3. Briefly describe your overall responsibilities?
4. What are your responsibilities in the design and delivery of the upstream HVAC/HP initiative?
5. What is the current mix of equipment the program offers?
6. How would you describe the goals of this program?
7. Program theory explains how a program’s activities relate to the barriers it seeks to overcome and the goals it hopes to achieve. Please describe in a few sentences the program theory behind the upstream HVAC/HP initiative?
8. What performance metrics are used to evaluate whether the program goals are achieved?
   a. PROBE for metrics beyond energy savings.
9. Many of the HVAC measures currently rebated by the upstream initiative were previously rebated by the downstream prescriptive program. Do you believe there is a difference in the savings potential between upstream and downstream programs?
   a. [IF YES] Why do you say that?
   b. PROBE for measures that qualify for upstream still going through the downstream custom program.

**Program changes**

1. Are there any planned changes coming up for the initiative beyond those detailed in the three-year planning documents?
   a. [IF YES] What changes? What products? Why specifically? For example are the products not performing? Is it a cost effectiveness issue?
2. Any expected changes to the initiative as a result of the expected updates to Federal building energy code or the Massachusetts amendments to the IECC 2015 code?
   a. [IF YES] What changes?

**Interactions with the implementation contractor**

1. What is EFI’s role in the implementation of the upstream HVAC initiative?
2. What is the nature of your interactions with EFI?
   a. PROBE for the typical content and frequency of these interactions
3. As the program manager do you interact with program participants?
   a. [IF YES] What is the nature of your interactions with program participants? [Probe for the typical content and frequency of these interactions]
b. [IF NO] Why not?

4. How has EFI’s performance been in terms of program management?
   a. [IF NEGATIVE] Why? What is the nature of their shortcomings?

Marketing and Outreach

Participating Distributors

1. What type of marketing material or sales support does the PA provide to participating distributors?

2. Does the PA have any routine check-ins with participating distributors to provide them with updates in program rules or other program information?
   a. [IF YES] What is the nature of these check-ins?
   b. PROBE for typical program information provided and the means of communication (email blasts, newsletters, etc.)
   c. [IF NEWSLETTER] Request a sample copy

3. Does the PA have any activities to support installation of incentivized equipment by participating distributors?
   a. [IF YES] What are these activities?
   b. [IF NO] Why not?

4. What percentage of distributors you have reached out to are now participating in the program?
   a. PROBE for what they consider to be a participating distributor. e.g. do all MA locations of a distributor need to be participating?
   b. PROBE for what they consider to be a non-participation distributor

Non-participating Distributors

5. What type of marketing material or sales support does the PA provide to non-participating distributors?

6. Does the PA have activities to target and recruit non-participating distributors?
   a. [IF YES] What are these activities?
   b. [IF NO] Why not?

7. Does the PA have any activities to support installation of incentivized equipment by non-participating distributors?
   a. [IF YES] What are these activities?
   b. [IF NO] Why not?

Other Marketing and Outreach Activity
8. Does the PA undertake any marketing/outreach activities to target and recruit other market actors (including manufacturers)?
   a. [IF YES] What are these activities?
   b. [IF NO] Why not?

9. What about C&I customers?
   a. [IF YES] What are these activities?
   b. [IF NO] Why not?

Difference between participant and non-participant distributors
1. How would you describe the characteristics of most of the participant distributors in this program?
2. How would you describe the characteristics of most of the non-participant distributors in this program?
3. How would you describe distributors and non-distributor participants across these factors:

<table>
<thead>
<tr>
<th></th>
<th>Distributor</th>
<th>Non-Distributor</th>
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<td>annual sales</td>
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<td>company size</td>
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<tr>
<td>revenue</td>
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<tr>
<td>product mix</td>
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</table>

4. To the best of your knowledge, how often have non-participant distributors been previously approached to participate in the initiative?

5. In your opinion, what are the primary reasons a distributor does not (or would not) participate in this initiative?
   a. PROBE for key differences between the participating and non-participating groups.

Barriers
1. What sort of barriers (if any) have the PA encountered related to program implementation?
2. What sort of barriers (if any) have the PA encountered in trying to recruit distributors into the program?
   a. PROBE for details
3. What sort of barriers (if any) have the PA encountered related to participating distributors installing incentivized measures?
   a. PROBE for details
b. PROBE: what about the differences between high participating and low participating distributors?

Overall Program Feedback

1. What aspects of this upstream program would you consider a success?
2. What aspects of this upstream program do you think need to be changed and how so?
3. What lessons have you learned from implementing this program so far?
4. Would you say that these lessons have relevance beyond the upstream HVAC/HP initiative?
   a. [IF YES] why specifically?
   b. [IF NO] what makes them specific to this initiative?
5. Are there any other types of equipment that should be eliminated in this upstream model?
   a. [IF YES] explore which ones. PROBE for both HVAC and non-HVAC
6. Are there any other types of equipment that should be added to this upstream model?
   a. [IF YES] explore which ones. PROBE for both HVAC and non-HVAC
7. On a scale of 1 to 5 where 1 is "not at all satisfied" and 5 is "extremely satisfied", how satisfied are you with this program?
   a. [Less than 4] Why do you say that?

Non-MA Programs

1. Finally, as part of this study we are also reaching out to other upstream HVAC programs - are you aware of any other utilities or program administrators with an upstream HVAC program?
   a. [IF YES] What is your assessment of the positives and negatives of the non-MA program offering(s)?
   b. [IF YES] Is there anything more that you’d like to learn about the non-MA program offering(s)?
APPENDIX B: FINAL C&I UPSTREAM HVAC/HP INITIATIVE’S PROGRAM IMPLEMENTER IN-DEPTH INTERVIEW GUIDE

Goal of interviews:
We plan to complete up to five in-depth interviews with representatives of EFI and CLEAResult who are involved in implementing the C&I Upstream HVAC/HP initiative. These would include interviews with program staff at EFI as well as with up to three field representatives whose position is to recruit HVAC distributors and manufacturers into the initiative.

The topics we plan to cover with the EFI program managers would be similar to those we describe in the PA program manager survey instrument. We also plan to ask them about the high-level lessons learned from their 2014 market actor research conducted on behalf of the PA implementation team.

Our interviews with the EFI field representatives will focus on their outreach efforts. The topics we plan to cover include how they contact HVAC distributors and manufacturers, how frequently the interact with them, sales pitches they use to promote the initiative, questions or concerns the distributors and manufacturers have about the initiative, barriers to participation, and what could be done to engage additional distributors through the initiative.

Background

1. What is your official title and role?
2. How long have you been in this role?
3. Briefly describe your company’s overall responsibilities in implementing the upstream HVAC/HP initiative for the PAs?
4. Briefly describe your own responsibilities in implementing the upstream HVAC/HP initiative for the PAs?
5. How would you describe the goals of this program?
6. Program theory explains how a program’s activities relate to the barriers it seeks to overcome and the goals it hopes to achieve. Please describe in a few sentences the program theory behind the upstream HVAC/HP initiative?
7. What performance metrics are used to evaluate whether the program goals are achieved?
   a. PROBE for metrics beyond energy savings.
8. Many of the HVAC measures currently rebated by the upstream initiative were previously rebated by the downstream prescriptive program. Do you believe there is a difference in the savings potential between upstream and downstream programs?
   a. [IF YES] Why do you say that?
   b. PROBE for measures that qualify for upstream still going through the downstream custom program.
Program changes
1. Are you aware of any planned changes coming up for the initiative beyond those detailed in the PAs three-year planning documents?
   a. [IF YES] What changes? What products? Why specifically? For example are the products not performing? Is it a cost effectiveness issue?
2. Are you expecting any changes to the initiative as a result of the expected updates to Federal building energy code or the Massachusetts amendments to the IECC 2015 code?
   a. [IF YES] What changes?

Interactions with the Program Administrators (PA)
1. Briefly describe the PAs’ role in the implementation of the upstream HVAC initiative.
2. What is the nature of your interactions with the PAs?
   a. PROBE for the typical content and frequency of these interactions

Interactions with Participating Distributors
Marketing & Outreach
1. What type of marketing material or sales support do you provide to participating distributors?
2. During the recruiting process, how did you first contact participating HVAC distributors and manufacturers?
3. How frequently do you interact with them after establishing contact?
4. What are the sales pitches you use to promote the initiative?
5. What paperwork does a distributor need to complete in order to participate in the initiative?
   a. PROBE: How often is the paperwork updated? Annually? As needed?
6. What percentage of distributors you have reached out to are now participating in the program?
   a. PROBE for what they consider to be a participating distributor. e.g. do all MA locations of a distributor need to be participating?
   b. PROBE for what they consider to be a non-participation distributor

Implementation Process
1. Do you have any routine check-ins with participating distributors to provide them with updates in program rules or other program information?
   a. [IF YES] What is the nature of these check-ins?
   b. PROBE for typical program information provided and the means of communication (email blasts, newsletters, etc.)
   c. [IF NEWSLETTER] Request a sample copy
2. What kind of support do you provide to participating distributors in terms of the program participation process?
   a. [IF YES] What are these activities?
   b. [IF NO] Why not?
3. Briefly describe the process by which participating distributors receive incentives for any qualifying equipment sold?
4. Are you aware of any questions or concerns the distributors and manufacturers have about the initiative?
   a. If yes, what are they?

Interactions with Non-Participating Distributors

Marketing & Outreach

1. What type of marketing material or sales support do you provide to non-participating distributors?
2. Do you undertake any activities to target and recruit non-participating distributors?
   a. [IF YES] What are these activities? PROBE for frequency of interaction with the same company/company location.
   b. [IF NO] Why not?
3. In your opinion, what (else) could be done to engage additional distributors through the initiative?
   a. PROBE for both companies that are not participating and individual locations of a company that isn’t participating.

Implementation Process

1. Do you undertake any activities to support installation of incentivized equipment by non-participating distributors?
   a. [IF YES] What are these activities?
   b. [IF NO] Why not?
2. It is our understanding that the PAs and EFI conducted an initial investigation into why there was lower than expected activity in this program (more units of incentivized equipment) from participating distributors. Are you familiar with this investigation?
   a. If yes, were you able to identify any reasons for the lower than expected activity?

Difference between Participant and Non-participant distributors

1. How would you describe the characteristics of most of the participant distributors in this program?
2. How would you describe the characteristics of most of the non-participant distributors in this program?

3. How would you describe distributors and non-distributor participants across these factors:

<table>
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<tr>
<td>product mix</td>
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</tbody>
</table>

4. To the best of your knowledge, how often have non-participant distributors been previously approached to participate in the initiative?

5. In your opinion, what are the primary reasons a distributor does not (or would not) participate in this initiative?
   a. PROBE for key differences between the participating and non-participating groups.

Other Marketing and Outreach Activity

1. Do you undertake any marketing/outreach activities to target and recruit other market actors (including manufacturers)?
   a. [IF YES] What are these activities?
   b. [IF NO] Why not?

2. What about C&I customers?
   a. [IF YES] What are these activities?
   b. [IF NO] Why not?

Barriers

1. What sort of barriers (if any) have you faced related to program implementation?
   a. PROBE for details

2. What sort of barriers (if any) have distributors and manufacturers faced related to program participation?
   a. PROBE for details

Overall Program Feedback

1. What aspects of this upstream program would you consider a success?
2. What aspects of this upstream program do you think need to be changed and how so?
3. What lessons have you learned from implementing this program so far?
4. Would you say that these lessons have relevance beyond the upstream HVAC/HP initiative?
   a. [IF YES] why specifically?
   b. [IF NO] what makes them specific to this initiative?

5. Are there any other types of equipment that should be eliminated in this upstream model?
   a. [IF YES] explore which ones. PROBE for both HVAC and non-HVAC

6. Are there any other types of equipment that should be added to this upstream model?
   a. [IF YES] explore which ones. PROBE for both HVAC and non-HVAC

7. On a scale of 1 to 5 where 1 is ”not at all satisfied” and 5 is ”extremely satisfied”, how satisfied are you with this program?
   b. [Less than 4] Why do you say that?

**Non-MA Programs**

1. Finally, as part of this study we are also reaching out to other upstream HVAC programs - are you aware of any other utilities or PAs with an upstream HVAC program?
   c. [IF YES] What is your assessment of the positives and negatives of the non-MA program offering(s)?
   d. [IF YES] Is there anything that you’d like to learn about the non-MA program offering(s) that would help the PAs to improve the program offering in MA?
APPENDIX C: FINAL NON-MA PROGRAM MANAGER IDI GUIDE

Background
1. What is your official title and role?
2. How long have you been in this role?
3. Briefly describe your responsibilities related to the design and delivery of the upstream HVAC program [PROGRAM ADMINISTRATOR]?
4. What are your responsibilities in the design and delivery of the upstream HVAC/HP program?

Program Theory & Goals
1. Is the upstream program at [PROGRAM ADMINISTRATOR] focused on market transformation, resource acquisition, or both?
   a. Why do you say that?
2. Please describe in a few sentences the barriers that the program seeks to overcome?
3. What are the components of the program that address these barriers?
4. What are the primary goals of your upstream program?
   a. PROBE for energy as well as non-energy goals
   b. PROBE for quantifiable goals beyond energy savings
5. Who established these goals?
6. How were the goals established?
7. How are you measuring progress towards those goals?
   a. PROBE for each goal mentioned above [LIMIT to 3 primary goals]
8. What performance metrics are used to evaluate whether the program goals are achieved?
   a. PROBE for metrics beyond energy savings.
9. In general, are you achieving your goals?
   a. PROBE for high level reasons.
10. What are the data reporting requirements for your program? Have you asked – and had any success with – obtaining full category (standard and HE) sales data?

Program Measures & Incentives
1. [IF REBATED MEASURES FOR PROGRAM ARE LISTED ON WEBSITE] According to my research, your program provides rebates for the following types of energy-efficient equipment? [READ LIST]
   a. Is this information correct? [IF NO, MAKE APPROPRIATE CORRECTIONS TO THE LIST]
2. [IF PROGRAM’S REBATED MEASURES ARE NOT PUBLICLY AVAILABLE] Please list the measures which are incentivized under your program.

3. Does [PROGRAM ADMINISTRATOR] also offer any downstream HVAC incentives?
   a. [IF YES] Is there any evidence of measures that qualify for the upstream program being rebated under the downstream program?

4. Are there any types of equipment that you are considering adding to the upstream program?

5. Are there any types of equipment that you are considering eliminating from the upstream program?

6. Please briefly describe the current incentive structure for your upstream HVAC program.

7. How did you establish the incentive structure for your program?

8. Did you elicit feedback from others outside of [PROGRAM ADMINISTRATOR] when considering the incentive structure?
   a. [IF YES] PROBE for with distributors? Manufacturers? Other programs?

9. Do you think the program’s incentives are properly aligned with the program goals?
   a. Why or Why not?

10. How long does it typically take from the time you received documentation from the HVAC contractor/distributor that the program-qualified HVAC equipment has been sold/installed, and when this distributor/contractor receives the incentive?

11. So you have any methods or mechanisms to speed up incentive payment?

12. Have you experienced any negative issues with the timing of incentive payments?
   a. [IF YES] Please explain these issues and anything you’ve done to address them

13. Does your program require the complete upstream/midstream incentive to be passed through to the customer?
   a. Why or Why not?

14. Do you have a separate sales person (SPIFF) incentive which rewards distributors/contractors for selling a certain volume of program-rebated HVAC equipment?
   a. Why or Why not?

15. Do you offer any other financial compensation to participating distributors? (i.e. administrative or marketing cost sharing)
   a. Why or Why not?

**Stakeholder Engagement**

1. How do you typically recruit distributors into the program?

2. What roll do manufacturers play in distributor recruitment and engagement?

3. How many distributors are currently enrolled in the program?
a. What percent of the addressable market do you think that represents?

4. Of the enrolled or participating distributors, what percent would you describe as active participants in the program?
   a. PROBE for definition of active participation
   b. IF NEEDED explain that we’ve read about programs that sign up a bunch of distributors but only a fraction of them actually engage with the program and go on to do something.

5. Have you taken any steps to address this level of participation?
   a. [IF YES] Please describe what you have done.

**Participating Distributors**

6. What type of marketing material or sales support do you provide to participating distributors?

7. Does the program have any routine check-ins with participating distributors to provide them with updates in program rules or other program information?
   a. [IF YES] What is the nature of these check-ins?
   b. PROBE for typical program information provided and the means of communication (email blasts, newsletters, etc.)
   c. [IF NEWSLETTER] Request a sample copy

8. Does the program have any activities to support installation of incentivized equipment by participating distributors?
   a. [IF YES] What are these activities?
   b. [IF NO] Why not?

**Non-participating Distributors**

9. What type of marketing material or sales support does the PA provide to non-participating distributors?

10. Does the PA have activities to target and recruit non-participating distributors?
    a. [IF YES] What are these activities?
    b. [IF NO] Why not?

11. Does the PA have any activities to support installation of incentivized equipment by non-participating distributors?
    a. [IF YES] What are these activities?
    b. [IF NO] Why not?

**Marketing and Outreach Activity**

12. Do you undertake any marketing/outreach activities to target and recruit other market actors (including manufacturers)?
Barriers
1. What barriers to success have you encountered while implementing in your upstream program?
   a. PROBE for implementation, recruitment, measurement, and equipment installation
   b. PROBE for concerns/impact of federal code change on program offerings and cost-effectiveness
2. How did you overcome those barriers?
3. Are there any barriers that you have not been able to overcome?
   a. [IF YES] What are they?
   b. [IF YES] Why have you not been able to overcome the barrier(s)?

Program Impacts
1. Has your upstream HVAC program been evaluated?
2. Has the savings impact been measured and verified?
   a. [IF YES] Can you please share the report with me?
   b. [IF YES] What was your overall realization rate?

Market Penetration (Sales)
1. Are you measuring the market penetration of efficient HVAC equipment sales in your territory?
   a. [IF YES] How are you measuring it?
   b. [IF YES] Have you experienced any challenges obtaining the data necessary to measure market penetration?
      i. [IF YES] What are the main challenges?
      ii. [IF YES] How did you overcome them?

Lessons Learned & Best Practices
1. What aspects of your upstream program would you consider a success?
2. What aspects of your upstream program do you think need to be changed?
   a. Why do you say that?
3. What lessons have you learned from implementing this program so far?
4. Are there any other best practices or lessons learned that you can share with me that would help other upstream HVAC programs be successful?
APPENDIX D: FINAL C&I UPSTREAM HVAC/HP INITIATIVE MANUFACTURER IDI GUIDE

Goal of interviews:
DNV GL interviewers will complete up to 5 in-depth interviews with representatives of Massachusetts HVAC manufacturers. The topics we plan to cover include:

- Production & Demand Issues
- Perception of the Market
- Market Share
- Program Experience

Introduction
Hello, DNV GL has been hired by the Massachusetts Energy Efficiency Program Administrators and Energy Efficiency Advisory Council (EEAC) to gather feedback from HVAC/Heat Pump equipment manufacturers who operate in Massachusetts in order to help the MA PAs improve their Energy Efficiency program offerings for program partners like you. [IF NEEDED: Earlier this year you spoke with my colleague from NMR and agreed to have a brief follow-up discussion regarding the MA PAs Upstream HVAC/HP program].

About the Company
Let’s start by getting a little information about you and your company to help us put the rest of your answers in context.

F1. What is your official title?

F2. How long have you been in this role?

F3. Approximately how many employees does your business have?

F4. How many locations does your company have?

  F4a. How many of these are located in Massachusetts?

F5. What are your company’s annual sales? [IF NEEDED: an estimate is fine]
[IF NECESSARY: We use this information to get a rough estimate of your company’s size to make sure we are making “apples-to-apples” comparisons between HVAC distributors of similar size.]

F6. About what percentage of your annual sales typically are to Massachusetts?

F7. About what percentage of your total sales in Massachusetts comes from:

  F7a. Residential equipment ______%
  F7b. Commercial equipment ______%

F8. Does your company do any distribution of HVAC equipment to installation contractors, in addition to equipment sales to HVAC distributors?
F9. Next, I’d like you to think about only your commercial sales in Massachusetts. About what percentage of commercial equipment sales are from HVAC equipment? What about Heat Pump equipment?

F9a. HVAC ______%
F9b. HP ______%

F10. [IF F9a+F9b < 100%]: What other commercial equipment do you sell?

Production & Sales

PD1. Would you say that energy-efficient HVAC and/or heat pumps are a particular focus of your company’s product offerings?

PD1a. Why or why not?

PD2. Next, I’ll ask about your sales of specific high efficiency HVAC and heat pump equipment.

PD2a. First, consider your total HVAC/HP annual sales in Massachusetts. About what percentage of the total do the sales of <HVAC/HP EQUIPMENT TYPE> make up?

PD2b. And about what percent of the sales of <HVAC/HP EQUIPMENT TYPE> is high efficiency equipment?

<table>
<thead>
<tr>
<th>&lt;HVAC/HP EQUIPMENT TYPE&gt;</th>
<th>% of total HVAC/HP sales</th>
<th>% high efficiency sold</th>
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<tbody>
<tr>
<td>Commercial Unitary and Split Air Conditioning Systems (Air Cooled, including all types of heating)</td>
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<tr>
<td>Commercial Unitary Air Conditioning Systems (Evaporatively Cooled, including all types of heating)</td>
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<tr>
<td>Commercial Unitary Air Conditioning Systems (Water Cooled, including all types of heating)</td>
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<tr>
<td>Commercial Unitary Heat Pump Systems (Air Cooled)</td>
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<tr>
<td>Commercial Unitary Heat Pump Systems (Water Source)</td>
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<tr>
<td>Ground Water – Water Source Heat Pump Equipment (Open Loop)</td>
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<td></td>
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<tr>
<td>Ground Loop - Water Source Heat Pump Equipment (Closed Loop)</td>
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<tr>
<td>Energy Savings Control and Fan Motor Options (Dual Enthalpy Economizer Controls and Electronically Commutated Motors (ECM) for HVAC Fans)</td>
<td></td>
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<tr>
<td>Ductless Mini-split Heat Pumps</td>
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</table>

PD3. Did your company receive any incentives or support for producing or selling any of the high efficiency equipment you mentioned?

PD3a. [IF YES] What was that?
PD4. In general, are there any factors or barriers preventing your company from producing or selling more high efficiency HVAC/HP equipment?

PD4a. [IF YES] Please describe these factors or barriers.

Program Awareness

A1. Are you aware of an initiative called the commercial and industrial Upstream HVAC/Heat Pump Initiative, sponsored by the Massachusetts Energy Efficiency Program Administrators?

Yes 1 [SKIP TO A3]
No 2 [READ A2]
Don't know -97 [READ A2]
Refused -98 [READ A2]

A2. [IF A1 = No] You may know this as the “Mass Save Upstream HVAC/HP program.” Participating distributors receive an incentive directly from the MA PAs for sales of qualifying HVAC/HP equipment. The program is implemented by EFI on behalf of the MA PAs. Does this sound familiar?

Yes 1 [SKIP TO A3]
No 2 [SKIP TO D1]
Don't know -97 [SKIP TO D1]
Refused -98 [SKIP TO D1]

A3. How did you first become aware of this initiative?

Program Effect on Production & Sales

[ASK PE1-PE4 IF A1 or A2 = Yes]

PE1. Have your manufacturing and stocking practices for high efficiency HVAC/HP equipment in Massachusetts changed since the launch of the MA PAs upstream HVAC/HP initiative?

PE1a. [IF YES] In what way(s)? [Increased? Decreased? Reason(s) why?]

PE2. Has demand for high efficiency HVAC/HP equipment changed in Massachusetts since the launch of the MA PAs upstream HVAC/HP initiative?

PE2a. [IF YES] In what way(s)? [Increased? Decreased? Reason(s) why?]

PE3. How do you expect your manufacturing and stocking practices for high efficiency HVAC/HP equipment to change in Massachusetts over the next year? 2 years? 5 years? [PROBE: Will they increase? Decrease? Stay the same?]

PE4. To what extent will the MA PA upstream HVAC/HP initiative have a role in these changes?
Program Design

D1. Next, I'd like your thoughts on the types of HVAC/HP equipment supported by this initiative. The initiative provides incentives to distributors on qualifying HVAC/HP equipment including:

<table>
<thead>
<tr>
<th>HVAC/HP EQUIPMENT TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Unitary and Split Air Conditioning Systems (Air Cooled, including all types of heating)</td>
</tr>
<tr>
<td>Commercial Unitary Air Conditioning Systems (Evaporatively Cooled, including all types of heating)</td>
</tr>
<tr>
<td>Commercial Unitary Air Conditioning Systems (Water Cooled, including all types of heating)</td>
</tr>
<tr>
<td>Commercial Unitary Heat Pump Systems (Air Cooled)</td>
</tr>
<tr>
<td>Commercial Unitary Heat Pump Systems (Water Source)</td>
</tr>
<tr>
<td>Ground Water – Water Source Heat Pump Equipment (Open Loop)</td>
</tr>
<tr>
<td>Ground Loop - Water Source Heat Pump Equipment (Closed Loop)</td>
</tr>
<tr>
<td>Energy Savings Control and Fan Motor Options</td>
</tr>
<tr>
<td>(Dual Enthalpy Economizer Controls and Electronically Commutated Motors (ECM) for HVAC Fans)</td>
</tr>
<tr>
<td>Ductless Mini-split Heat Pumps</td>
</tr>
</tbody>
</table>

D2. Do you think this is the right mix of energy efficiency measures rebated by the initiative?

D2a. Why do you think so?

D3. Are there any other types of equipment that you think should be added to this initiative?

D4. Are there any other types of equipment that you think should be eliminated from this initiative?

D5. You may recall that distributors receive incentives for HVAC equipment ranging from $30 to $125 through this initiative. Do you think these incentive levels are sufficient to encourage distributors like yours to sell these higher efficiency units and to encourage customers to buy these higher efficient HVAC products?

D5a. Why or why not?

D5b. [IF NO] Which high efficiency HVAC products need different incentive levels? What incentive level do you suggest?

Closing Comments

CC1. Do you have any other input regarding this initiative that we haven't already discussed?
APPENDIX E: FINAL C&I UPSTREAM HVAC/HP INITIATIVE
PARTICIPATING DISTRIBUTOR IDI GUIDE

Goal of interviews:
DNV GL interviewers will complete up to 10 in-depth interviews with representatives of Massachusetts distributors that currently participate in the C&I Upstream HVAC/HP initiative. The topics we plan to cover include:

- Participation Process
- Program Design
- Program Activity
- Market Conditions
- Firmographic Information

Introduction
[READ] According to our records your company is a participating distributor in the Massachusetts Energy Efficiency Program Administrators’ Upstream HVAC/HP program. [IF NEEDED: You may know this as the "Mass Save Upstream HVAC/HP program." Participating distributors receive an incentive directly from the MA PAs for sales of qualifying HVAC/HP equipment. The program is implemented by EFI on behalf of the MA PAs.] DNV GL has been hired by the MA PAs and Energy Efficiency Advisory Council (EEAC) to gather feedback from the HVAC distributors who are participants in this program.

I1. Are you familiar with your company’s participation in this program?
I1a. [IF Yes]: Great, is now a good time to speak with you regarding this participation? This should take no more than 30 minutes of your time. [IF NEEDED schedule call-back]
I1b. [IF No] Can you connect me with the person at your company who is familiar with this participation?
[ONCE CONNECTED, REPEAT INTRO SECTION]

About the Company
[READ] First I have some questions about you and your company to help us put your answer in context.

F1. What is your official title?
F2. How many years have you been in this role?
F3. Approximately how many employees does your business have?
F4. How many locations does your company have?
F4a. How many of these are located in Massachusetts?
F5. [IF F4a > 1] Is the decision to participate in a program such as the upstream HVAC/HP program made at the local office level?
F5a. [IF NOT] Who makes this decision? At what level of the company is it made?
F6. What are your company’s annual sales? [IF NEEDED: an estimate is fine]
[IF NECESSARY: We use this information to get a rough estimate of your company’s size to make sure we are making “apples-to-apples” comparisons between HVAC distributors of similar size.]

F7. About what percentage of your annual sales typically are to Massachusetts?

F8. About what percentage of your total sales in Massachusetts comes from:

F8a. Residential equipment _____%

F8b. Commercial equipment _____%

F9. Does your company do any direct installations of HVAC equipment, in addition to equipment sales to HVAC installation contractors?

F10. Next, I’d like you to think about only your commercial sales in Massachusetts. About what percentage of commercial equipment sales are from HVAC equipment? What about Heat Pump equipment?

F10a. HVAC _____%

F10b. HP _____%

F11. [IF F10a+F10b < 100%]: What other commercial equipment do you sell?

Recruitment Process

R1. When did your company start participating in the Massachusetts Upstream HVAC/Heat Pump (HP) initiative? (e.g., month/season and year)

R2. How did you first become aware of the Massachusetts Upstream HVAC/HP initiative?

R3. What motivated your company to get involved with this initiative?

R4. Did you have any initial concerns about participating?

R4a. [IF YES] What were the initial concern(s)?

R4ai. Have these been resolved?

R5. In your opinion, what are the benefits for distributors participating in this initiative?

R6. What are the benefits for the HVAC/HP installation contractors?

R7. What about end-use customers?

R8. What are the disadvantages, if any, for distributors participating in this initiative?

R9. [IF >1 LOCATION IN MA] How many of your locations in Massachusetts participate in this initiative?

R9a. [IF FEWER THAN ALL PARTICIPATING] Why do you think some locations are not participating?

R9b. What would be needed to encourage more locations to participate?

Participation Process

P1. About how many incentives has your company received through this initiative since you started participating?
P1a. [IF >0] Primarily for which type(s) of equipment?

P1b. [IF NONE] Why haven’t you received any incentives in this initiative?

P2. Has the initiative provided any type of support to your company? Please describe. [IF NEEDED: marketing materials, staff training, initiative updates, etc.]

P2a. [IF YES] What type of support have you received?

P2b. [IF YES] Has your company received sufficient levels of support from the initiative?

P3. What type of support from the initiative, if any, would help you sell more program-eligible HVAC/HP equipment?

P4. How are you informed of changes to the initiative? (e.g., email, letter/postcard, telephone call, in-person visit, Web site, etc.)

P4a. What is your preferred method of communication for learning about updates in program rules or other program information?

P4b. How do you inform your sales or other staff members about updates to the program?

P5. How frequently do the implementers of this initiative [PROMPT IF NECESSARY – “EFI staff”] contact your company?

P6. Would you prefer to hear from the initiative implementer more often, less often or about the same frequency of contact?

P6a. [IF LESS OR MORE] Please explain.

Stocking and Sales Practices

SS1. Have your stocking practices for program qualified high efficiency HVAC/HP equipment changed since your company started participating in the initiative?

SS1a. [IF YES] In what way(s)? [e.g. whether increased/decreased and reason(s) why]

SS1ai. [PROBE] Would you attribute this [increase/decrease] to the HVAC/HP initiative? How so?

SS1aII. [PROBE] What types of qualified equipment are you stocking more of?

SS2. Have you noticed any changes in the availability of high efficiency HVAC/HP equipment from manufacturers?

SS2a. [IF YES] What are these changes? What is driving these changes?

SS3. When an installation contractor is selecting HVAC/HP equipment, about what percentage of the time does sales or other staff inform them about a high efficiency equipment option, if available?

SS3a. [IF <100%] Why do you sometimes not recommend the high efficiency option?

SS4. When an installation contractor is selecting HVAC/HP equipment, about what percentage of the time are they already aware of the initiative?
SS5. About what percent of the time do you think that the incentive was an important factor in getting the installation contractor to choose qualifying equipment when they otherwise would not have done so?

SS6. Does your company include information about the incentives received through the initiative in either the marketing and sales processes?

SS6a. In what way(s)? Can you describe specific examples?

SS6b. [PROBE] Do you mention this in any of your marketing materials? Why or why not?

SS6bi. [IF YES] Please describe some examples of how you do this.

SS7. Does your company pass through the incentive for eligible HVAC/HP equipment, in full or in part, to the purchaser of the equipment?

SS7a. [IF YES] How do you determine how much of the incentive to pass through? What is the typical percentage passed through? How obvious is it to the purchaser that they received a discount? [PROBE FOR: Is it a line item deduction in the invoice? Are they informed verbally? Other?]

SS7b. [IF NO] Why not?

SS8. Next, I’ll ask about your sales of HVAC/HP equipment that are eligible for an incentive under the HVAC/HP program.

[READ A-C FOR EACH EQUIPMENT TYPE LISTED IN MATRIX, RECORD RELEVANT RESPONSES]

SS8a. Among all the <HVAC/HP EQUIPMENT TYPE> your company sold in Massachusetts since you started participating in the initiative, about what percentage were qualified equipment under the program?

SS8b. [SKIP IF NONE] Of these units sold, what percentage received an incentive through the initiative?

SS8c. [IF <100%] Why wasn’t all of this equipment incentivized?
<table>
<thead>
<tr>
<th><strong>&lt;HVAC/HP EQUIPMENT TYPE&gt;</strong></th>
<th>% Qualified Equipment: incentive submitted to HVAC/HP initiative</th>
<th>Why not all EE equipment incented through Initiative?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Unitary and Split Air Conditioning Systems (Air Cooled, including all types of heating)</td>
<td>% qualified through initiative _____%</td>
<td></td>
</tr>
<tr>
<td>Commercial Unitary Air Conditioning Systems (Evaporatively Cooled, including all types of heating)</td>
<td>% qualified through initiative _____%</td>
<td></td>
</tr>
<tr>
<td>Commercial Unitary Air Conditioning Systems (Water Cooled, including all types of heating)</td>
<td>% qualified through initiative _____%</td>
<td></td>
</tr>
<tr>
<td>Commercial Unitary Heat Pump Systems (Air Cooled)</td>
<td>% qualified through initiative _____%</td>
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<td></td>
</tr>
<tr>
<td>Ground Water – Water Source Heat Pump Equipment (Open Loop)</td>
<td>% qualified through initiative _____%</td>
<td></td>
</tr>
<tr>
<td>Ground Loop - Water Source Heat Pump Equipment (Closed Loop)</td>
<td>% qualified through initiative _____%</td>
<td></td>
</tr>
<tr>
<td>Energy Savings Control and Fan Motor Options (Dual Enthalpy Economizer Controls and Electronically Commutated Motors (ECM) for HVAC Fans)</td>
<td>% qualified through initiative _____%</td>
<td></td>
</tr>
<tr>
<td>Ductless Mini-split Heat Pumps</td>
<td>% qualified through initiative _____%</td>
<td></td>
</tr>
</tbody>
</table>
Barriers
B1. What problems or barriers, if any, has your company faced related to participation in this initiative?
B2. In your opinion, how can the problem(s) or barrier(s) be minimized or eliminated?
   B2a. What could the initiative do, if anything, to help minimize or eliminate the barrier(s)?
B3. What could the initiative do to encourage more participation by companies like yours?
   B3a. Are there any differences in approaches the initiative should take based on equipment type?
      Customer type? Other factors?

Program Design
Next, I’d like your thoughts on the types of HVAC/HP equipment incentivized through this initiative.
PD1. [READ EQUIPMENT TYPES LISTED IN STOCKING & SALES PRACTICES MATRIX]. Do you think this is
    the right mix of energy efficiency measures incentivized by the initiative?
    PD1a. Why do you think so?
PD2. Are there any other types of equipment that you think should be added to this initiative?
PD3. Are there any other types of equipment that you think should be eliminated from this initiative?
PD4. Distributors receive incentives for HVAC equipment ranging from $30 to $125 through this initiative.
    Do you think the current incentive levels are sufficient to encourage distributors like your company to sell
    these higher efficiency units and to encourage customers to buy these higher efficient HVAC products?
    PD4a. Why or why not?
    PD4b. [IF NO] Which high efficiency HVAC products need different incentive levels? What incentive
           level do you suggest?
PD5. In general, more efficient HVAC/HP equipment costs your company more to purchase. What portion of
    this additional cost do the incentives cover?
    PD5a. Does this vary by equipment type? How so?

Satisfaction with HVAC/HP Initiative
Finally, I’d like to ask you about your satisfaction with different aspects of this initiative.
S1. Using a five-point satisfaction scale, where 1 is ‘very dissatisfied’ and 5 is ‘very satisfied,’ how would you
    rate your satisfaction level with:
    S1a. Paperwork to apply for incentives? [IF NEEDED: using 1 to 5 scale]
       S1ai. [IF SATISFACTION < 4] Why do you think so?
    S1b. Incentive processing times? [IF NEEDED: using 1 to 5 scale]
       S1bi. [IF SATISFACTION < 4] Why do you think so?
    S1c. Support provided by the initiative staff? [IF NEEDED: using 1 to 5 scale]
       S1ci. [IF SATISFACTION < 4] Why do you think so?
S1d. Any marketing materials provided by the initiative? [IF NEEDED: using 1 to 5 scale]

S1di. [IF SATISFACTION < 4] Why do you think so?

S1e. The HVAC/HP initiative overall? [IF NEEDED: using 1 to 5 scale]

S1ei. [IF SATISFACTION < 4] Why do you think so?

S2. Do you have any recommendations for improving any aspect of the HVAC/HP Initiative?

Closing Comments

CC1. Do you have any other input regarding this initiative that we haven’t already discussed?
APPENDIX F: FINAL C&I UPSTREAM HVAC/HP INITIATIVE NON-PARTICIPATING DISTRIBUTOR IDI GUIDE

Goal of interviews:
DNV GL interviewers will complete up to 10 in-depth interviews with representatives of Massachusetts distributors that are not currently involved in implementing the C&I Upstream HVAC/HP initiative. The topics we plan to cover include:

- Program Awareness
- Barriers to Participation
- Program Design
- Market Conditions
- Firmographic Information

Introduction

[READ] Hello, DNV GL has been hired by the Massachusetts Energy Efficiency Program Administrators and Energy Efficiency Advisory Council (EEAC) to gather feedback from HVAC/Heat Pump equipment distributors who operate in Massachusetts in order to help the MA PAs improve their EE program offerings for program partners like you.

I1. According to our records your company is a distributor of C&I HVAC/Heat Pump equipment in Massachusetts. Is that correct?

I1a. [IF Yes]: Great, is now a good time to speak with you? This should take no more than 30 minutes of your time. [IF NEEDED schedule call-back]

I1b. [IF No]: Does your company sell C&I HVAC and/or Heat Pump equipment to end-use customers and/or contractors?

I1bi. [If No]: Thank and Terminate

I1c. [If Don’t Know]: Is there someone I can speak to about the equipment your company sells? [ONCE CONNECTED, REPEAT INTRO SECTION]

About the Company

[READ] Let’s start by getting a little information about you and your company to help us put the rest of your answers in context.

F1. What is your official title?

F2. How long have you been in this role?

F3. Approximately how many employees does your business have?

F4. How many locations does your company have?

F4a. How many of these are located in Massachusetts?
F5. How many total employees does your company have? [IF NEEDED: an estimate is fine]
[IF NECESSARY: We use this information to get a rough estimate of your company’s size to make sure we are making “apples-to-apples” comparisons between HVAC distributors of similar size.]

F6. About what percentage of your annual sales typically are to Massachusetts?

F7. About what percentage of your total sales in Massachusetts comes from:

   F7a. Residential equipment  _____%
   F7b. Commercial equipment  _____%

F8. Does your company do any direct installations of HVAC equipment, in addition to equipment sales to HVAC installation contractors?

F9. Next, I’d like you to think about only your commercial sales in Massachusetts. About what percentage of commercial equipment sales are from HVAC equipment? What about Heat Pump equipment?

   F9a. HVAC  _____%
   F9b. HP    _____%

F10. [IF F9a+F9b < 100%]: What other commercial equipment do you sell?

**Stocking and Sales Practices**

SS1. Would you say that energy-efficient HVAC and/or heat pumps are a primary focus of your company’s marketing efforts or product offerings?

   SS1a. Why or why not?

SS2. About what percentage of your total annual HVAC/HP sales in Massachusetts do the sales of high-efficiency equipment make up?

   SS2a. [IF <50%] Why doesn’t high-efficiency equipment make up a larger percentage of your overall sales in Massachusetts? [PROBE FOR: availability, sales practices (e.g. do they focus on cost vs. quality), etc.]

SS3. Did your company receive any incentives or support for selling any of the high efficiency equipment you mentioned?

   SS3a. [IF YES] What was that?

SS4. In general, are there any factors or barriers preventing your company from selling more high efficiency HVAC/HP equipment?

   SS4a. [IF YES] Please describe these factors or barriers.

**Program Awareness**

A1. Are you aware of an initiative called the commercial and industrial Upstream HVAC/Heat Pump Initiative, sponsored by the Massachusetts Energy Efficiency Program Administrators?

   Yes  1 [SKIP TO A3]
   No   2 [READ A2]
   Don’t know -97 [READ A2]
A2. [IF A1 = No] You may know this as the "Mass Save Upstream HVAC/HP program." Participating distributors receive an incentive directly from the Massachusetts Energy Efficiency Program Administrators (MA PAs) for sales of qualifying HVAC/HP equipment. The program is implemented by EFI on behalf of the MA PAs. Does this sound familiar?

Yes: 1 [READ A3]
No: 2 [SKIP TO B1]
Don't know: -97 [SKIP TO B1]
Refused: -98 [SKIP TO B1]

A3. How did you first become aware of this initiative?

A4. Is your company currently participating in this initiative?

Yes: 1 [CONTINUE USING PARTICIPANT DISTRIBUTOR GUIDE]
No: 2
Don't know: -97
Refused: -98

**Barriers to Participation**

[IF A1 OR A2 = YES; ASK B1-B5]

B1. What are your primary reasons for not participating in the initiative?

B2. What do you think would be the benefits to distributors from participating in this initiative?

B3. How do you think the sponsors of this initiative could increase participation among distributors like yours?

B4. Has anyone associated with the upstream HVAC/HP initiative contacted your company, whether it was by email, postcard/letter, telephone call, in-person visit or any other type of communication?

   B4a. [IF YES] Please describe this interaction (timing, number and types of contact, etc.)

   B4b. [IF YES] Did you receive any type of marketing materials or sales support associated with this initiative?

   B4c. [IF YES] What did they talk with you about?

   B4d. [IF YES] Was there any more or different information they could have provided to encourage your participation?

B5. [IF YES] Do you think your company might be interested in participating in this initiative? Why or why not? [If say yes and volunteer have plans to participate, probe on when they plan to participate]

[IF A1 AND A2 = NO; ASK B6]

B6. The HVAC/HP initiative pays distributors incentives ranging from $30 to $125 for per unit for the sale of certain high efficiency HVAC and heat pump equipment. The objective of the initiative is to encourage distributors to increase their sales of these high-efficiency equipment types. It also provides marketing support, staff training, and other services. It requires documentation of sales and a participation agreement. In light of this information:
B6a. What do you think might be the benefits for your company if you opted to participate in this initiative?

B6b. Are there any other benefits you could see for distributors in general?

B6c. What are the reasons you are not interested in participating in the C&I Upstream HVAC/HP Initiative?

B6d. Are there any other reasons you could see for distributors in general?

B6e. How do you think the sponsors of this initiative could increase participation among distributorships like yours?

B6f. Based on the information you now have do you think your company might be interested in participating in this initiative? Why or why not?

Program Design

PD1. Next, I’d like your thoughts on the types of HVAC/HP equipment rebated to distributors through this initiative. The initiative provides incentives to distributors on qualifying HVAC/HP equipment including:

<table>
<thead>
<tr>
<th>HVAC/HP Equipment Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Unitary and Split Air Conditioning Systems</td>
</tr>
<tr>
<td>Commercial Unitary Heat Pump Systems</td>
</tr>
<tr>
<td>Ground Source Heat Pump Systems</td>
</tr>
<tr>
<td>Ductless Mini-split Heat Pumps</td>
</tr>
<tr>
<td>Controls and Fans</td>
</tr>
</tbody>
</table>

PD2. Are there any other types of equipment that you think should be added to this initiative?

PD3. Are there any other types of equipment that you think should be eliminated from this initiative?

PD4. You may recall that distributors receive incentives for HVAC equipment ranging from $30 to $125 through this initiative.

   PD4a. Is this incentive level sufficient for distributors, like yourself, to participate in this program?

   PD4b. Why or why not?

   PD4c. Do you feel the incentive would encourage more sales of these qualifying energy efficient equipment?

PD5d. Why or why not?
ABOUT DNV GL
Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter, and greener.