



Packaged Commercial HVAC Equipment Market Characterization

Final Report



Prepared for:
Northeast Energy Efficiency Partnership HVAC Sponsors
June 30 2006

Table of Contents

1.	Executive Summary	1-1
1.1	Research Objectives.....	1-1
1.2	Overview of Approach	1-1
1.3	Key Findings.....	1-1
1.4	Recommendations.....	1-2
2.	Introduction.....	2-5
2.1	Project Objectives	2-5
2.2	Program Descriptions	2-6
2.3	Overview of Approach	2-7
2.4	Organization of the Remainder of the Report.....	2-8
3.	Methodology	3-9
3.1	Objectives and Basic Approach.....	3-9
3.2	HVAC Distributor Population and Sample	3-11
3.3	Other Key Methods Issues.....	3-12
3.4	Formulas for Weighted Variables and Their Variance	3-13
4.	Results and Recommendations	4-18
4.1	Distributor Interviews.....	4-18
4.2	Supplemental Interviews	4-22
4.3	Key findings and Recommendations	4-24

Appendices:

Appendix A: HVAC Distributor Questionnaire with Responses

Appendix B: Supplemental Interview Questionnaire with Responses

1. Executive Summary

This Executive Summary presents an overview of results from a market characterization of packaged commercial HVAC equipment in the Northeast. This research was conducted for sponsors of the Northeast Energy Efficiency Partnership (NEEP) Commercial Packaged HVAC Initiative and reflects the market conditions in the Northeast (New England, New York and New Jersey). The Initiative promotes high efficiency unitary HVAC equipment based on the Consortium of Energy Efficiency (CEE) Tier 2 specifications for commercial equipment from 1 to 30 tons.

The goal of this market characterization was to assess the market conditions in the Northeast for high efficiency packaged commercial HVAC units and develop recommendations of program strategies that are likely to be effective in overcoming barriers to increasing sales of high efficiency equipment.

1.1 Research Objectives

The principal objectives of the project were to:

1. Estimate the number of packaged units that are sold within the Sponsors' areas, how many qualify as Tier 2, and the share installed in new construction versus replacement projects.
2. Assess the market for high efficiency packaged commercial HVAC equipment in the Sponsors' areas, with particular attention to barriers and other circumstances that have impeded the growth in market share, and identify opportunities to overcome these barriers.
3. Develop and support recommendations for changes to the Program that are likely to result in influencing additional sales of Tier 2 equipment within the Sponsors territories.

1.2 Overview of Approach

KEMA's primary approach to satisfy the objectives of this study involved conducting telephone interviews with HVAC distributors and other key market actors. The principal objective was to gather and analyze information from a sample of HVAC distributors to address the research objectives listed above, with an emphasis on market size and share of efficient units. KEMA employed a stratified sampling approach from the population HVAC distributors that sell packaged commercial HVAC equipment in the Sponsors territories. This survey was supplemented with additional interviews of other key market actors. The objective of these supplemental interviews was to provide background context and validation for the findings from the distributors.

1.3 Key Findings

The Sponsors' primary objective in undertaking this project was to develop a reliable estimate of the total number of packaged commercial HVAC units sold in the Program area per year and of the number of high efficiency (Tier 2) units sold. As illustrated in the table below, KEMA estimated that in 2005, annual sales of packaged commercial HVAC units in the 1-30 tons equaled 55,275 units. This is significantly higher than the 20,000 units initially estimated by the Sponsors. The majority of these sales involved smaller unit sizes with over half of the total units sold involving units less than 5 tons. Of the total sales, 20% of the units sold qualified as high efficiency (Tier 2) units. On a percent of sales basis, these were distributed fairly consistently across the 4 size ranges, ranging from 16.3 % to 21.8%. Based

on the Program data provided by NEEP, approximately 2,500 units were rebated through the Cool Choice Program in 2005. Using this estimate, the program provided rebates for approximately 4.5 % of the total units sold and 23% of the high efficiency units sold. It should be noted that if Sponsors include the number of qualifying units rebated through their other programs, the percent of total sales estimates would be slightly higher.

Overall Market Size of Packaged Commercial HVAC Equipment

	Size (tons)	Total Sales (# of units)	Qualifying SEER/EER	Sales of Qualifying Units	
				# of Units	% of Total
A	<5	27,724	13.0 SEER	5,883	21.2%
B	≥ 5 to <11	13,392	11.0 EER	2,184	16.3%
C	≥ 11 to < 20	4,955	10.8 EER	917	18.5%
D	≥ 20 to ≤ 30	9,204	10.0 EER	2,002	21.8%
Total		55,275		10,986	20%

Some additional key findings regarding the Program were:

- Approximately one third of total sales involved new installations. This presents a significant opportunity to target efforts to the new construction market.
- Sponsors were interested in learning if the current rebate levels accurately reflect the incremental cost between standard efficiency equipment and high efficiency equipment. Based on the distributor interviews, distributors representing 76% of the market reported that the current rebate levels accurately reflect the average incremental costs. This was consistent with responses from the key market actors that participated in the supplemental interviews.
- Based on the distributor interviews, distributors representing 84% of the market indicated that customers' perception of high first costs is the primary reason high efficiency units are not specified and installed more frequently. At the same time, distributors representing 76% of the market indicated that the current rebate levels accurately reflect the average incremental costs. This inconsistency demonstrates the need for additional outreach and educational efforts.
- Availability of high efficiency equipment does not appear to be a barrier to customers' purchasing high efficiency equipment. When availability has been an issue it typically has occurred in situations involving the replacement of failed equipment, particularly during the cooling season. When this occurs, contractors need to replace the equipment immediately with the most readily available unit in stock, which is often a standard efficiency unit.

1.4 Recommendations

Most of KEMA's recommendations focus on strengthening the existing program delivery to incorporate an outreach component to new market actors and segments. The following recommendations are provided at the overall regional level and not by utility or program.

Target new construction opportunities. Survey participants strongly indicated that the new construction market should be a focus of future Program marketing and outreach efforts. Distributors indicated that over one third of current packaged commercial HVAC units sold are for new installations, thus, there is a significant opportunity to increase the sales of high efficiency equipment by focusing on this market. Several market conditions unique to the new construction market can be leveraged to support this effort. First, the region is currently experiencing growth in the commercial new construction market. Most of these projects will involve an engineer or designer involved with specifying HVAC equipment. Second, unlike equipment replacement, new construction projects typically allow substantial lead time to incorporate high efficiency equipment. Third, respondents overwhelmingly indicated that the current rebate levels accurately reflect the incremental cost between a standard efficiency unit and a high efficiency unit. Finally, the majority of participants recommended increased outreach to designers and engineers as a means to improve program participation. Sponsors should take advantage of these conditions and incorporate a new outreach effort incorporating the design community.

Better coordination with the residential HVAC programs. Distributors indicated that sales of packaged commercial HVAC equipment in the 1-30 ton range only represent 17% of their overall business. Most distributors (and contractors) of packaged HVAC equipment do not focus specifically on the commercial market; rather they sell to both the residential and commercial markets. As a result, a large overlap exists between the two sectors that Sponsors should explore. It was cited that Sponsors should coordinate their efforts with the residential programs to leverage the overall HVAC market and to provide consistent outreach and marketing messages. Distributors acknowledged that while the regional approach has simplified the process, there is still confusion created by delivering separate residential and commercial programs. As a result, Sponsors should investigate the possibility of delivering a single regional HVAC program that includes both residential and commercial equipment.

Reevaluate current marketing efforts. While overall Program awareness is high in the marketplace, redirecting marketing efforts to end users and the design and engineering community was cited as a key component to increasing the demand for high efficiency equipment. Participants indicated that if end use customers and designers request high efficiency equipment, then manufacturers and distributors will bring this equipment into the market. General awareness of energy efficiency is fairly high among end users; however, it was recommended that future marketing messages should focus on providing more specific information on HVAC related energy efficiency options.

Modify the current marketing message. Respondents suggested that Program marketing should take advantage of the current high cost of electricity and incorporate this into its marketing message. This message should highlight the resulting quicker paybacks and increased energy savings. Additional efforts should also aim to educate customers on the issues of high first cost and incremental costs. There appears to be a disconnect between distributors perception that the high first cost is the primary reason high efficiency units are not specified more and their view that the current incentive levels accurately reflect the average incremental costs. A big gap exists that the Program needs to address by providing additional education of the true costs of upgrading to a more energy efficiency unit in terms of both equipment replacements and new installations.

Simplify the paperwork required from Program participants. While participants overwhelmingly reported that it is easy to participate in the Program and that the prescriptive incentive structure works well, many believed that the program could be further improved by reducing the required paperwork. Despite an already simple application form, the market actors feel this is still too involved. One suggestion was to

simplify the process by providing an instant rebate directly to the contractors thereby providing them a direct incentive to specify high efficiency equipment.

Finally, for future research efforts, Sponsors should attempt to identify and track the various market actors involved within the HVAC market in their region. It was a very time consuming and challenging effort to identify the key market actors to contact as part of this research. For example, quite a few of the distributor contacts provided by the Sponsors indicated that they were not HVAC distributors or did not focus on HVAC (refrigeration and control systems were stated) equipment. Also, the Sponsors contact databases often contained outdated information. Future research efforts and overall program management could benefit by refreshing this information on an on-going basis.

Implementing some or all of these strategies should have a direct impact on influencing the sales of high efficiency HVAC equipment into the region.

2. Introduction

This report presents the results of a market characterization of packaged commercial HVAC equipment in the Northeast. This research represents Phase II of the market research identified by the Sponsor's¹ of NEEP's Commercial Packaged HVAC Initiative to support on-going program planning. Sponsors are program administrators (utilities and public agencies) funded by system benefits charges, with service territories including: Connecticut, Maine, Massachusetts, New Jersey, New York, Rhode Island, and Vermont.

Program Sponsors are concerned about the relatively low number of efficient packaged commercial HVAC units that have received rebates through Cool Choice and other complimentary commercial HVAC Programs ("the Program"). In 2004, Cool Choice issued rebates on 2,165 eligible units in a market the Sponsors estimated at the time to be approximately 20,000 units per year. Over the past few years, the number of annual units rebated through Cool Choice ranged from 2,000 to 2,500 units, thus, the number of rebated units as a portion of total units shipped to the region appeared to be running in the range of 10 -12 percent. The Sponsors believe that this participation rate should be higher, especially given the level of incentives, which have been set at the Sponsors' estimate of 100 percent of incremental cost. Sponsors recognize the need for a better understanding of the market as a basis for program improvements. As a result, this study is meant to answer the basic questions: why is the activity so low and how can we increase it?

In this section we review the project objectives and provide a brief description of the Program, summarize the research approach and describe the organization of the remainder of the report.

2.1 Project Objectives

The goal of this market characterization was to assess the market conditions in the Northeast for high efficiency packaged commercial HVAC units and develop recommendations of program strategies that are likely to be effective in overcoming barriers to increasing sales of high efficiency equipment in the Northeast.

The principal research objectives of the project were to:

- Assess the market for high efficiency packaged commercial HVAC units in the Sponsors territories, with particular attention to barriers and other circumstances that have impeded the growth in their market share, and identify opportunities to overcome these barriers.
- Determine the number of packaged commercial HVAC units that are sold within the Sponsors territories, how many qualify as high efficiency (Tier 2), and develop an understanding of where these units are being installed.
- Develop and support recommendations for changes to the Program that are likely to result in influencing additional sales of Tier 2 equipment within the Sponsors territories.

¹ Participating Sponsors of this study include: Cape Light Compact, Connecticut Light & Power, Efficiency Maine, Efficiency Vermont, Long Island Power Authority, National Grid, New Jersey BPU, NSTAR, NYSERDA, United Illuminating, and Western Massachusetts Electric.

Based on these objectives, the focus of the research questions was as follows:

1. What is the current volume of all packaged commercial HVAC equipment sold in the Sponsors territories?
2. What share of total units are sold into new construction versus replacement projects?
3. What is the current market share of Tier 2 equipment in the Sponsors territories?
4. What are the motivating factors for promoting and selling Tier 2 equipment?
5. What barriers are encountered in promoting and selling Tier 2 equipment?
6. What is the perception on the current incentive levels and structure? Do they have an impact on the sales presentation? Is there a better approach to impact the sales of Tier 2 equipment?
7. What are the current market conditions of product availability for Tier 2 equipment?
8. What roles do the various market actors (manufacturers,, distributors, contractors and designers) play in specifying HVAC equipment? How does this role differ in new versus replacement situations? Does this role vary by size or type of customer?
9. To what extent is efficient equipment viewed as a competitive advantage? In what situations is it an advantage or disadvantage?
10. What is the overall awareness of the Program in the marketplace? What motivations and barriers exist in using the programs? What is the assessment of the effect of the Program on their own practices? On customer behavior?
11. What is the level of customer recognition of high efficiency HVAC equipment?
12. What are customers' perceptions of the advantages and disadvantages of high efficiency HVAC equipment?
13. To what extent are other building professionals and tradesmen involved in equipment selection? How does their involvement vary with type and size of project?

2.2 Program Description

The Sponsors currently offer a variety of complimentary commercial HVAC Programs to promote increased market penetration of energy efficiency of packaged commercial HVAC systems: split and single units, cooling capacity 1 ton to 30 tons. Starting in 1999, NEEP's Commercial Packaged HVAC Initiative has promoted high efficiency unitary HVAC equipment and economizer controls based on the Consortium of Energy Efficiency (CEE) Tier 2 specification. To date, using financial incentives, special promotions, and marketplace education, initiative Sponsors have succeeded in helping to pull into the Northeast a wider range of products that meet the Tier 2 specification and to increase sales of high efficiency units. This has been accomplished through both joint and coordinated promotions across the region.

Cool Choice, a joint regional program, implemented from New Jersey to Vermont, uses targeted marketing to encourage the sale and installation of Tier 2 qualifying equipment when customers replace or install packaged HVAC systems up to 30 tons in capacity, including dual enthalpy economizer controls. Complementing Cool Choice, Long Island Power authority (LIPA), NSTAR and Efficiency Maine each offer similar commercial HVAC programs under their own umbrella programs. New York

State Energy Research and Development Authority (NYSERDA) offers a marketing and training program for HVAC contractors on Demand Control Ventilation for HVAC systems and an Advanced HVAC Diagnostics program for HVAC technicians.

2.3 Overview of Approach

KEMA's primary approach to satisfy the objectives of this study involved conducting telephone interviews with HVAC distributors and other key market actors. The principal objective was to gather and analyze information from a sample of HVAC distributors to address the research questions listed above, with an emphasis on market size and share of efficient units. KEMA employed a stratified sampling approach from the population of HVAC distributors that sell packaged commercial HVAC equipment within the Sponsors territories. The sample was divided into four strata based on experience with the Program and number of employees at each location. These interviews were supplemented with additional interviews with other key market actors. The objective of these supplemental interviews was to gather strategic information from a small, carefully selected sample of market actors to address the research questions above as well as to support the information gathered from the distributors.

2.3.1 Distributor Interviews

The principal objective of the distributor interviews was to gather and analyze information from a sample of HVAC distributors that addressed the research questions listed in Section 2.1, with an emphasis on market size and share of efficient units (Tier 2). A secondary objective was to gather strategic insight into barriers and motivations that have affected sales of efficient HVAC units and participation. Recognizing that many distributors sell to both commercial and residential markets, the interviews focused only on that portion of the distributors business that involved packaged commercial HVAC equipment. KEMA proposed to complete between 35-40 interviews and was successful in completing a total of 41 distributor interviews.

Gathering market share data from this hard to reach group has been a challenge in previous research efforts. In order to enhance the response rate and capture information on the most critical items, the distributor interview guide was structured to focus on gathering market share data and some additional basic information regarding the Program. In addition to inquiring about the market share, the guide included a short series of questions on: establishment data, sales practices, the importance of energy efficient HVAC equipment in the firm's business strategy, and, awareness of HVAC programs. The final interview guide and overall results of the distributor interviews are included in Appendix A.

2.3.2 Supplemental Interviews

KEMA proposed to conduct up to ten additional interviews with key market actors that were likely to provide thoughtful comment and insight into central issues of this research. Given the limited number of interviews, we canvassed the Sponsors to identify the other market actors they felt would add the most value. Sponsors identified potential market actors from the following: Cool Choice program delivery staff, experienced HVAC researchers, customer representatives, utility representatives and HVAC contractors.

These interviews were structured to obtain responses to the thirteen research questions and to support the information gathered from the HVAC distributor interviews. These interviews were completed after the

majority of the interviews with HVAC distributors were completed and followed an informal open-ended questionnaire. KEMA completed a total of eight interviews with ten market actors. The interview guide and overall results of the supplemental interviews are included in Appendix B.

2.4 Organization of the Remainder of the Report

Section 3 of this report presents the research methodology that was used to develop the sample of HVAC distributors that were included in this research and discusses how the sample data were expanded to the population of distributors serving the Program areas.

Section 4 presents the results of the HVAC distributor interviews along with the key findings from the supplemental interviews. The interviews guides for both the distributor and supplemental interviews along with the final responses are included in the attached Appendices.

3. Methodology

This section presents the research methodology that was used to develop the sample of HVAC distributors that were included in this research and discusses how the sample data were expanded to the population of distributors serving the Program areas.

3.1 Objectives and Basic Approach

The Sponsors primary objective in undertaking this project was to develop a reliable estimate of the total number of packaged commercial HVAC units sold in the Program area per year and of the number of high efficiency units sold. Moreover, the Sponsors believed that HVAC distributors would provide the most reliable information for estimating market size and the market share of high efficiency units.

From previous studies, we knew that distributors were very heterogeneous in size, business practices, and willingness to share data. Therefore, it would be difficult to predict how one set of methods might work relative to others. To address this situation, we designed sampling procedures and survey questions to support several alternative methods for estimating total unit sales and high-efficiency market share. Our intent was to position ourselves to be able to make best use of the data we were able to obtain from the sample distributors.

3.1.1 Sampling and Sample Expansion Methods

Sampling. KEMA used a stratified random sample design. For this study we defined the following four strata of distributors:

- Distributors who were identified by the Sponsors as having been involved with the program in some capacity. These are referred to as “participating” distributors.
- Distributors listed by Dun & Bradstreet with 5 – 24 employees.
- Distributors listed by Dun & Bradstreet with 25 – 49 employees.
- Distributors listed by Dun & Bradstreet with 50 – 249 employees.

We grouped all “participating” distributors into one stratum in order to avoid confusion estimating the total population in the various strata defined by size. To avoid duplication, any HVAC distributor identified by the Sponsors also on the list of potential HVAC distributors from Dunn and Bradstreet, were removed from the Dunn and Bradstreet list and included only in the Sponsors’ stratum. We also thought it was reasonable to hypothesize that participating distributors would share an interest in promoting high efficiency units and would therefore report consistently higher market share for Program qualifying equipment. If this were the case, grouping them into their own stratum would contribute to increasing the precision of the estimate of the number of high-efficiency units sold.

Sample Expansion. KEMA applied two different basic methods to various survey items to expand sample results to the population of distributors serving the program area and to calculate the appropriate variances for the estimates.

- **Simple application of sampling weights.** This is the standard method for expanding sample data to the population when stratified sampling is used. Basically, each respondent's estimate of his or her firm's sales is weighted by a factor that reflects the ratio of the number of firms in the stratum to all firms in the population. The sum of the weighted responses across all strata serves as the estimate of total sales. A similar approach can be applied in estimating the number of high efficiency units sold.
- **Ratio estimation.** Ratio estimation offers the opportunity to reduce the variance of sales and market size estimates by taking advantage of potential regularities in the relationship between two variables that describe a given population. In this case, we hypothesized that sales would have a regular relationship to number of employees at the sample location. Thus, we estimated the ratio of sales to number of employees from the sample data for each stratum. We then applied that ratio to the total number of employees in all firms in each stratum. We had reliable estimates of the total number of employees from the Dun & Bradstreet database that we used as the sample frame.

There is no way to know in advance of data collection which of the two methods will provide more reasonable and precise results. Much depends on respondents' willingness to provide sales information, their accuracy in reporting sales and employment, and the strength of the actual relationship between the variables used to create the ratio -- unit sales and employment. As the analysis turned out, we found that the two methods yielded similar estimates of total packaged commercial HVAC unit sales and total unit sales of high efficiency equipment. However, the simple application of sampling weights yielded estimates with lower variance (hence greater precision) than those derived from the ratio estimation. We therefore opted to use the former.

KEMA used a variant of the sample weights method to expand the results of survey items related to distributor practices and perceptions to the population. Examples of these kinds of questions include:

How often does your organization discuss energy efficiency options with your customers and contractors? or

How important do you think energy efficient HVAC options are in marketing your organization's products?

Specifically, we included a second weight for each observation equal to the percentage of the total employment in a stratum accounted for by the sample firm. This effectively weighted the answers for employment by the sample firms, so that the answers provided by larger firms received a larger weighting in the final results. The intent here was to provide answers to these questions in terms of a portion of the market (defined ultimately by unit sales) rather than as a simple percentage of firms.

See Section 3.4 for the formulas used for creating the weighted variables and for calculating their variance.

3.2 HVAC Distributor Population and Sample

To collect the data used by this study, the population of potential distributors of packaged commercial HVAC equipment was divided up into the four strata as shown in Table 3-1. The idea behind the stratification was to try to place companies into smaller groups consisting of similar companies rather than having a single group of more diverse companies. So, when we expanded from the random sample of HVAC distributors that completed a survey to the population of HVAC distributors, the sample of HVAC distributors in a stratum would represent the other similar companies in that stratum. Assuming that firms within a given strata are more resemble each other on the variables we are interested than they do firms in the other strata, the stratification procedure should yield better precision than a simple random sampling procedure.

Table 3-1
Population and Sample

Stratum Description	Estimated HVAC Distributor Population	# Completes	
		Target	Obtained
1 Sponsor list	29	20	18
2 D&B list: 5 to 9, 10 to 24 employees at site	94	10	16
3 D&B list: 25 to 49 employees at site	13	5	3
4 D&B list: 50 to 99, 100 to 249 employees at site	6	5	4
Total	142	40	41

Note: D&B refers to Dun and Bradstreet.

We placed distributors identified by the Sponsors in their own stratum for several reasons. Distributors that participated in the program may be different from distributors that have not participated in the program in a variety of ways, including total sales of HVAC equipment and sales of high efficiency equipment. Also, we expected that distributors identified by the Sponsors did in fact distribute packaged commercial HVAC equipment. Consequently, the final count of distributors of packaged commercial HVAC equipment in this stratum based on the survey results was likely to be the same or very similar to the initial count.

The three remaining strata consist of companies with at least 5 employees, listed in Dun and Bradstreet with any of four primary standard industrial classification codes:

- 50750000 Warm air heating and air conditioning
- 50750100 Air conditioning and ventilation equipment and supplies
- 50750101 Air conditioning equipment, except room units, not elsewhere classified
- 50750200 Warm air heating equipment and supplies

The list of potential HVAC distributors from Dun and Bradstreet was restricted to companies with at least 5 employees because we thought it was unlikely companies with fewer employees would distribute packaged commercial HVAC equipment. The companies on the list were placed into three strata based on

number of employees. Different sized companies may have different experiences and, in particular, sales of HVAC equipment are likely related to company size.

For each stratum, we set a target number of survey completes based on several factors. However, as it turned out, we essentially completed as many surveys as we could with distributors identified by the study sponsors, medium distributors, and large distributors. In order to meet the goal of 40 total completes, we completed more surveys with small distributors of packaged commercial HVAC equipment than the target number.

3.3 Other Key Methods Issues

3.3.1 Estimate HVAC Distributor Population

This study estimates that there are 142 companies that distribute packaged commercial HVAC equipment in Connecticut, Maine, Massachusetts, New Jersey, New York, Rhode Island, and Vermont (Table 3-1). To arrive at this number we revised the initial count of distributors of packaged commercial HVAC equipment in each stratum based on the portion of sample firms that “screened in” to the survey by reporting that they did indeed distribute commercial HVAC equipment.

3.3.2 Sales Estimates

On the survey, KEMA collected the respondents’ estimates of the number of commercial packaged HVAC units sold in 2005 for the following size classes: less than 5 tons, 5 to 10 tons, 11 to 19 tons, and 20 to 30 tons.

3.3.3 High Efficiency Equipment Sales Data

Sales of high efficiency equipment were collected as a proportion of the total sales of packaged commercial HVAC equipment in a given size class. Therefore, the first step was to multiply this proportion by a respondent’s total sales of packaged commercial HVAC equipment in that size class to obtain the sales of high efficiency equipment in that size class. A handful of respondents provided data on their sales of all packaged commercial HVAC equipment, but did not provide data on their sales of high efficiency equipment. For these respondents, we estimated their sales of high efficiency equipment. This allowed us to use as much of the data collected as possible and to keep the data on the sales of high efficiency equipment in line with the data on the sales of all packaged commercial HVAC equipment. For the handful of respondents that only provided data on their sales of all packaged commercial HVAC equipment, we assumed their sales of high efficiency equipment as a proportion of their total sales in a given size class was equal to the average proportion observed in the data.²

² The average proportion of high efficiency equipment sales in a given size class was estimated using standard sampling weights.

3.4 Formulas for Weighted Variables and Their Variance

3.4.1 Sampling Weights Only

For a given equipment size class c , the sales of all packaged commercial HVAC equipment $S1_c$ were estimated using only sampling weights (N_k / n_{ck}) as follows:

$$\hat{S1}_c = \sum_{k=1}^4 \sum_{i=1}^{n_{ck}} (\hat{N}_k / n_k) S_{cki} ,$$

where

- $\hat{S1}_c$ = estimate of the number of packaged commercial HVAC units sold in size class c
- n_{ck} = the number of respondents in stratum k that provided data on their sales of all packaged commercial HVAC equipment in size class c
- $\hat{N}_k$ = estimate of the number of distributors in the population in stratum k
- S_{cki} = the number of packaged commercial HVAC units sold in size class c by respondent i in stratum k

For a given equipment size class c , the sales of high efficiency equipment $H1_c$ were estimated using only sampling weights in a similar manner:

$$\hat{H1}_c = \sum_{k=1}^4 \sum_{i=1}^{m_{ck}} (\hat{N}_k / n_k) H_{cki} ,$$

where

- $\hat{H1}_c$ = estimate of the number of high efficiency units sold in size class c
- m_{ck} = the number of respondents in stratum k that provided data on their sales of high efficiency equipment in size class c^3
- $\hat{N}_k$ = estimate of the number of distributors in the population in stratum k
- H_{cki} = the number of high efficiency units sold in size class c by respondent i in stratum k

3.4.2 Ratio Estimators

The ratio estimator for sales of all packaged commercial HVAC equipment in a given size class used number of employees as the denominator. Hence, it produced an estimate of the number of packaged commercial HVAC units sold in a given size class per employee. This ratio was then applied to the estimate of total employment to obtain an estimate of the sales of packaged commercial HVAC equipment in that size class. The ratio estimator for sales of high efficiency equipment in a given size class used sales of all packaged commercial HVAC equipment in that size class as the denominator. Hence, it produced an estimate of the number of high efficiency units sold in a given size class per

³ As discussed earlier, for the handful of respondents that provided data on their sales of all packaged commercial HVAC equipment, but did not provide data on their sales of high efficiency equipment, we estimated their sales of high efficiency equipment. Therefore, $m_{ck} = n_{ck}$.

packaged commercial HVAC unit sold in that size class. This ratio was then applied to the estimate of the sales of all packaged commercial HVAC equipment in that size class to obtain an estimate of the sales of high efficiency equipment in that size class.

Also for each equipment size class, the sales of all packaged commercial HVAC equipment were estimated using a ratio estimator. First, for a given size class c , the ratio of the sales of packaged commercial HVAC equipment to employment SRE_c was estimated as follows:

$$\hat{SRE}_c = \sum_{k=1}^4 \sum_{i=1}^{n_{ck}} \left(\frac{\hat{N}_k / n_{ck}}{\hat{N}_k / n_{ck}} \right) \frac{S_{cki}}{E_{ki}},$$

where

- $\hat{SRE}_c$ = estimate of the number of packaged commercial HVAC units sold in size class c per employee
- n_{ck} = the number of respondents in stratum k that provided data on their sales of all packaged commercial HVAC equipment in size class c
- $\hat{N}_k$ = estimate of the number of distributors in the population in stratum k
- S_{cki} = the number of packaged commercial HVAC units sold in size class c by respondent i in stratum k
- E_{ki} = the number of persons employed full time by respondent i in stratum k

The estimate of the number of packaged commercial HVAC units sold in size class c per employee $\hat{SRE}_c$ was then applied to the estimate of total employment to obtain an estimate of the sales of packaged commercial HVAC equipment in size class c $\hat{S2}_c$.

$$\hat{S2}_c = \hat{SRE}_c \times \sum_{k=1}^4 \sum_{i=1}^{n_{ek}} \left(\frac{\hat{N}_k / n_{ek}}{\hat{N}_k / n_{ek}} \right) E_{ki},$$

where

- $\hat{SRE}_c$ = estimate of the number of packaged commercial HVAC units sold in size class c per employee
- n_{ek} = the number of respondents in stratum k that provided employment data
- $\hat{N}_k$ = estimate of the number of distributors in the population in stratum k
- E_{ki} = the number of persons employed full time by respondent i in stratum k

The software used for the analysis (SAS) provided directly the error associated with $\hat{SRE}_c$ and the error associated with the estimate of total employment $\hat{E}$. The error associated with the combination of these two estimates $SD(\hat{S2}_c)$ was calculated as follows:

$$SD(\hat{S}_c) = \hat{SRE}_c \times \hat{E} \times \sqrt{\left(SE(SRE_c) / \hat{SRE}_c \right)^2 + \left(SD(E) / \hat{E} \right)^2},$$

where

$\hat{SRE}_c$	=	estimate of the number of packaged commercial HVAC units sold in size class c per employee
$\hat{E}$	=	estimate of total employment
$SE(SRE_c)$	=	error associated with $\hat{SRE}_c$
$SD(E)$	=	error associated with $\hat{E}$

3.4.3 Ratio Estimator for High Efficiency Equipment Unit Sales

Also for each equipment size class, the sales of high efficiency equipment were estimated using a ratio estimator. First, for a given size class c , the ratio of the sales of high efficiency equipment to the sales of all packaged commercial HVAC equipment HRS_c was estimated as follows:

$$\hat{HRS}_c = \sum_{k=1}^4 \sum_{i=1}^{n_{ck}} \frac{\left(\hat{N}_k / n_{ck} \right) H_{cki}}{\left(\hat{N}_k / n_{ck} \right) S_{cki}},$$

where

$\hat{HRS}_c$	=	estimate of the number of high efficiency units sold in size class c per packaged commercial HVAC unit sold in size class c
n_{ck}	=	the number of respondents in stratum k that provided data on their sales of all packaged commercial HVAC equipment in size class c ⁴
$\hat{N}_k$	=	estimate of the number of distributors in the population in stratum k
H_{cki}	=	the number of high efficiency units sold in size class c by respondent i in stratum k
S_{cki}	=	the number of packaged commercial HVAC units sold in size class c by respondent i in stratum k

The estimate of the number of high efficiency units sold in size class c per packaged commercial HVAC unit sold in size class c $\hat{HRS}_c$ was then applied to an estimate of all packaged commercial HVAC units sold in size class c ($\hat{S}_c$ or $\hat{S}_c$) to obtain an estimate of the sales of high efficiency equipment in size class c $\hat{H}_c$.

⁴ As discussed earlier, for the handful of respondents that provided data on their sales of all packaged commercial HVAC equipment, but did not provide data on their sales of high efficiency equipment, we estimated their sales of high efficiency equipment.

$$\hat{H}2_c = \hat{HRS}_c \times \hat{S}_c,$$

where

$$\begin{aligned} \hat{HRS}_c &= \text{estimate of the number of high efficiency units sold in size class } c \text{ per packaged} \\ &\quad \text{commercial HVAC unit sold in size class } c \\ \hat{S}_c &= \text{estimate of all packaged commercial HVAC units sold in size class } c, \text{ either } \hat{S}1_c \\ &\quad \text{or } \hat{S}2_c \end{aligned}$$

SAS provided directly the error associated with $\hat{HRS}_c$ and the error associated with $\hat{S}_c$. The error associated with the combination of these two estimates $SD(\hat{H}2_c)$ was calculated as follows:

$$SD(\hat{H}2_c) = \hat{HRS}_c \times \hat{S}_c \times \sqrt{\left(SE(HRS_c) / \hat{HRS}_c \right)^2 + \left(SD(S_c) / \hat{S}_c \right)^2},$$

where

$$\begin{aligned} \hat{HRS}_c &= \text{estimate of the number of high efficiency units sold in size class } c \text{ per} \\ &\quad \text{packaged commercial HVAC unit sold in size class } c \\ \hat{S}_c &= \text{estimate of all packaged commercial HVAC units sold in size class } c, \text{ either} \\ &\quad \hat{S}1_c \text{ or } \hat{S}2_c \\ SE(HRS_c) &= \text{error associated with } \hat{HRS}_c \\ SD(S_c) &= \text{error associated with } \hat{S}_c \end{aligned}$$

3.4.4 Weighted Variables for Qualitative Survey Results

The survey results (i.e., all results other than the sales estimates), in addition to using standard sampling weights, are effectively weighted by employment.⁵ If only sampling weights had been used, the categorical survey results (e.g., yes/no, increased/decreased/stayed the same) would have been interpreted as the “proportion of HVAC distributors.” Typically, survey results have this interpretation. Because sampling weights were used in combination with employment, the categorical survey results are instead interpreted as “proportion of the market.” Including employment in the calculation of the survey results recognizes that HVAC distributors with more employees are likely to have more sales and therefore a greater effect on the market than distributors with fewer employees. We had planned to use sampling weights in combination with the packaged commercial HVAC equipment sales data, but these data were not always provided. Therefore, we decided to use employment data, which were always provided,

Just as the categorical survey results are interpreted as “proportion of the market,” the non-categorical survey results also reflect market conditions. Non-categorical survey results are typically averages (e.g., average proportion of total HVAC units sold that were for new installations). When sampling weights are used in combination with employment, averages are effectively calculated as employment weighted averages. HVAC distributors with more employees have a larger effect on these averages than distributors with fewer employees.

⁵ Technically speaking, we used a ratio estimator to estimate each survey result, where both the numerator and denominator were expressed in terms of employment.

Each survey result was calculated using sampling weights and effectively weighted by employment as follows:

$$\hat{Y}_{qj} = \sum_{k=1}^4 \sum_{i=1}^{n_{ek}} \frac{(\hat{N}_k / n_{ek}) E_{ki} \times y_{qjki}}{(\hat{N}_k / n_{ek}) E_{ki}},$$

where

- $\hat{Y}_{qj}$ = survey result qj . e.g., $q = S1$, $j = \text{yes}$: Proportion of the market that specifies/recommends equipment as part of their typical job duties. $qj = M3$: average proportion of total HVAC units sold that were for new installations.
- n_{ek} = the number of respondents in stratum k that provided employment data
- $\hat{N}_k$ = estimate of the number of distributors in the population in stratum k
- E_{ki} = the number of persons employed full time by respondent i in stratum k
- y_{qjki} = e.g., categorical question: If respondent i in stratum k answered question q and gave response j , then $y_{qjki} = 1$. If respondent i in stratum k answered question q but gave a different response than j , then $y_{qjki} = 0$.
e.g., non-categorical question: If respondent i in stratum k answered question q , then y_{qjki} = their response to the question.
For both categorical and non-categorical questions: If respondent i in stratum k did not answer the question, then y_{qjki} = missing and is not included in the analysis.

4. Results and Recommendations

This section provides the results from the HVAC distributor interviews and supplemental interviews. It discusses the market size for packaged commercial HVAC equipment, current sales practices, the role of energy efficient HVAC equipment and general awareness of the Sponsors HVAC programs. Finally, it contains key findings and recommendations for improvements in program delivery based on feedback from the key market actors.

4.1 Distributor Interviews

The principal objective of this task was to gather and analyze information from a sample of distributors that will be used to address the research questions listed above, with an emphasis on market size and share of efficient units. To gather this critical information, the study used structured interviews consisting of approximately two thirds closed-ended questions.

KEMA completed a total of 41 HVAC distributor interviews with HVAC distributors who were located in New England, New York or New Jersey and sell the majority of the equipment within this region. Since our main objective was to gather strategic insights into distributor's response to efficient product offerings and the Program, KEMA worked with the Sponsors to identify those distributors who were likely to have given these issues at least some passing consideration and that have been approached to participate in the Program.

The focus of this research was on the distributors experience with packaged commercial HVAC equipment. Many HVAC distributors serve both residential and commercial markets so it was important to structure the questions to highlight this distinction throughout the interview. To insure the participants understood the focus of the questions, the interview guide was set up so that the introduction and individual questions emphasized that we were seeking their experiences and views on the packaged commercial HVAC market and the energy efficiency programs in the Northeast. Thus, the interviewers were continually focusing the interviewee's attention on the commercial HVAC market.

The HVAC market has a number of unique segments and is not a "one size fits all" market. Most HVAC distributors perform a blended role and do not fulfill the typical "distributor" role as a wholesaler. The majority of the distributors deal directly with HVAC contractors. However, in the commercial market distributors also work directly with end use customers and design build contractors. As a result it is important to note that when we inquired with the distributors about their "customers" this could include end users and could involve direct experience with the Program and receipt of rebates.

The following sections summarize the results of the overall research questions as presented in the interview guide. The final interview guide, including responses to the individual questions, is included in Appendix A.

4.1.1 Establishment Data

Every attempt was made to insure that we were speaking with the person within each organization that was responsible for overseeing sales of packaged commercial HVAC equipment. Based on the initial screening questions, a number of interviews were discontinued if the organization did not sell and

distribute packaged commercial HVAC equipment within the Sponsors territory. Key findings from the 41 interviews completed are as follows:

- Distributors indicated that sales of packaged commercial units (1-30 tons) represent 17% off their overall business.
- Distributors indicated that Trane represented the highest proportion of the **packaged commercial** units sold (14%) of any individual manufacturer identified.
- Distributors selling equipment in New York and New Jersey represented the highest proportion of the market selling packaged HVAC equipment.
- The simple mean of full time employees at the location of the participating organization was 29.

4.1.2 Market Size

The primary objective of the interviews was to determine the number of packaged commercial HVAC units that were sold within the Sponsors territories and to estimate the how many qualified as high efficiency (Tier 2). Sales data on the number of packaged commercial units sold was provided by a substantial number of distributors with only 7 distributors unable to provide specific sales data. The market size within the Sponsors territories is characterized as the following:

- Estimated total sales of packaged commercial HVAC for units ranging from 1-30 tons equaled 55,275 units. The 90/10 confidence interval for this estimate, developed using methods described in Section 3, is ± 23 percent or 12,687 units. Approximately half of these sales were from units less than 5 tons. The confidence intervals for sales estimates in the various size categories range from 19 to 70 percent of the estimated total.
- 20% (10,986 units) of the total units sold qualified as high efficiency (Tier 2) units, distributed fairly consistently across the 4 size ranges. The 90/10 confidence interval for this estimate, developed using methods described in Section 3, is ± 27 percent or 3,006 units.
- Based on 2005 Program data, approximately 2,500 units⁶ were rebated through the Program. Thus, the Program provided rebates for approximately 4.5 % of the total units sold and 23% of the high efficiency units sold.
- Distributors indicated that 36% of the total units sold were for new installations as opposed to replacing existing units.

⁶ This estimate reflects the number of units rebated only through the Cool Choice program in 2005 as provided by NEEP. This number may be increased by adding the number of qualifying units rebated through the Sponsors other complimentary commercial HVAC programs such as NYSERDA's and NSTAR along with sponsors new construction programs.

Overall Market Size of Packaged Commercial HVAC Equipment

	Size (tons)	Total Sales (# of units)	Qualifying SEER/EER	Sales of Qualifying Units	
				# of Units	% of Total
A	<5	27,724	13.0 SEER	5,883	21.2%
	90/10 confidence interval	± 10,304		± 2,640	
B	≥ 5 to <11	13,392	11.0 EER	2,184	16.3%
	90/10 confidence interval	± 3,446		± 713	
C	≥ 11 to < 20	4,955	10.8 EER	917	18.5%
	90/10 confidence interval	± 918		± 362	
D	≥ 20 to ≤ 30	9,204	10.0 EER	2,002	21.8%
	90/10 confidence interval	± 6,486		± 1,195	
Total		55,275		10,986	20%
90/10 confidence interval		± 12,687		± 3,006	

4.1.3 Sales Practices

This series of questions attempt to qualify the distributor's perception of the availability of high efficiency equipment, the roles played by the various market actors when specifying HVAC equipment and what extent energy efficiency is viewed as a competitive advantage. Key findings from the overall sales practices related to packaged commercial HVAC equipment are as follows:

- Distributors representing 65% of the market are involved in equipment specification in all or most sales situations.
- 55% of the sales in which distributors are directly involved with equipment specification involve new construction projects.
- Distributors discuss energy efficiency options with their customers and contractors in 79% of all or most sales situations.
- Distributors representing 66% of the market missed an opportunity in the past 12 months to sell a high efficiency unit because the unit was not available.

4.1.4 Role of Energy Efficient HVAC Equipment

This series of questions sought to describe the role that energy efficiency options play within each organization and identify the motivating factors and barriers to selling high efficiency equipment. Key findings include:

- Distributors who represent 66% of the market reported that energy efficiency options are somewhat or very important in marketing their products.

- Distributors who represent 59% of the market reported that the importance has increased in the past 12 months.
- Distributors who represent 84% of the market indicated that customers' perception of high first costs is the primary reason that high efficiency units are not specified and installed more frequently. This was followed by the customers' lack of understanding about efficiency (22%). Only 3% of the market indicated that equipment availability was the primary reason why efficient units were not installed more often.
- Distributors who represent 61% of the market indicated that manufacturers provide marketing and other support to promote high efficiency equipment. This occurs primarily through providing marketing brochures and other literature along with computer modeling software to compare various options.

4.1.5 Awareness of HVAC Programs

The final series of questions sought to describe the distributors' awareness and involvement with the Cool Choice Program and other commercial HVAC programs in the Northeast. Key findings include:

- Distributors who represent 82% of the market have heard of the Sponsors programs, prior to the interview.
- Distributors who represent 28% of the market have participated in the Sponsors programs.
- Distributors who represent 92% of the market feel that these kinds of programs are effective in encouraging HVAC contractors to sell more efficient equipment.
- Distributors indicated that the prescriptive rebate structure (\$/ton) and the ease to participate work well in terms of helping organizations promote high efficiency equipment.
- Distributors reported that if they were to change any aspect of the program it would be to reduce the amount of paperwork and provide more advertising to end use customers.
- Distributors who represent 43% of the market reported that rebates have a large impact on motivating sales staff to promote energy efficient equipment. They report that they make more money when they sell high efficiency models.
- Distributors suggested that the best approach the program could take to increase demand for high efficiency units is to provide more education to end uses, architects and engineers. Several also reported that it may help to increase the incentive levels.
- Overall, distributors who represent 76% of the market reported that the current rebate levels accurately reflect the average incremental cost, although several reported that rebate levels for units under 5 tons were too low.

4.1.6 HVAC Technologies

One final question was included to obtain distributors views on what new technologies they see emerging that may offer additional opportunities for energy efficiency. There was no dominant technology identified, however, a couple of distributors indicated ECM motors and variable speed drives, demand control ventilation and DC inverter technology may provide additional opportunities.

4.2 Supplemental Interviews

The objective of the supplemental interviews was to supplement the information gathered through the distributor interviews, from a small, carefully selected sample of market actors. These interviews followed an open-ended structure focused on the thirteen research questions, and were used to gauge and/or confirm the responses from the HVAC distributors.

KEMA proposed to conduct up to ten additional interviews with key market actors that were likely to provide thoughtful comment and insight into central issues of this research. Given the limited number of interviews, we canvassed the Sponsors to identify the other market actors they felt would add the most value. Sponsors identified potential market actors from the following: Cool Choice program delivery staff, experienced HVAC researchers, customer representatives, utility representatives and contractors.

KEMA proposed to complete up to ten interviews with a small group of market actors who were familiar with the Program and identified by the Sponsors. The potential market actors were segmented into the following categories:

- 2-3 interviews with Program delivery staff
- 2-3 interviews with participating HVAC contractors
- 2-3 interviews with inactive HVAC contractors
- 1 interview with a customer representative for national accounts
- 1 interview with an experienced HVAC market researcher, such as a designer
- 1 interview with a utility representative with industry savvy

KEMA completed a total of eight interviews with ten market actors as follows: 3 participating HVAC contractors, 1 inactive HVAC contractor, 1 designer, 1 utility representative, and 2 Program delivery staff (4 participants). Despite multiple attempts, we were unable to complete an interview with the one customer representative provided. The interview guide and overall results of the supplemental interviews are included in Appendix B.

Following is a summary of the general trends and responses to the research questions.

4.2.1 Results of Supplemental Interviews

Overall, responses from the small group of market actors that completed the supplemental interview supported many of the key findings from the distributor interviews. Key findings identified by this group include:

- Educating customers and designers should be a major priority.
- General awareness of energy efficiency is high in the marketplace; however, more focus is needed on developing a better understanding of the Program specifics.
- The Program could benefit by simplifying and reducing the amount of paperwork involved and the time lag involved with receiving rebates.

- The Program needs to address the disconnect that exists between owners and tenants.
- All felt that overall; the current rebate levels are satisfactory.

Some general observations related to the research questions follow.

- This group was unable to provide estimates of the current volume of units sold in the region, however, when asked to react to the estimates derived through the distributor interviews most indicated that these were reasonable estimates. Overall, most felt that sales of high efficiency (Tier 2) units represented a fairly low percentage of the total units sold in the market with responses ranged from 1-20%. These responses were very consistent with the 20% resulting from the market sales data quantified through the distributor interviews.
- This group provided higher estimates of the percent of units installed in new constructions versus equipment replacement than the distributors. Those market actors closest to the Program, provided estimates that were consistent with the market sales data. However, the other participants indicated that the share of total units installed in new construction ranged from 50-90%.
- All participants indicated that potential energy and cost savings along with the high cost of electricity are the two primary motivating factors in promoting energy efficient equipment. Most respondents indicated that the two primary barriers to promoting energy efficient equipment were the higher first cost of purchasing higher efficiency equipment and the disconnect between who pays the energy bill and who pays for the equipment.
- Most felt that the current incentive levels were reasonable and did a good job covering most of the incremental costs, especially for the larger size units. They indicated that in general, they have not received any complaints.
- Many participants reported a strong desire to simplify the process and reduce the amount of paperwork. They also indicated that the Program may benefit by providing the incentives directly to the contractors, providing the contractors with a spiff for completing the paperwork or by providing an instant rebate option similar to the MotorUp program.
- Overall, respondents reported that lack of product availability for high efficiency units is not an issue. When there is a problem with equipment availability it is more likely to involve equipment replacement rather than new installations, especially during the cooling season. They reported that contractors are still stocking low end base models so when a unit fails they typically cannot afford the extra time it takes to receive a high efficiency unit.
- In general, manufacturers will build what is demanded and distributors will supply whatever is ordered. The key is getting contractors to specify high efficiency equipment in their proposals to customers and build demand. Most reported the design community could play an important role that they currently do not fill.
- Most felt that overall Program awareness with customers was pretty low. Most customers get their information from their engineer and most feel that awareness and understanding is low among designers and engineers. For design built jobs, awareness is low among general contractors and they are only concerned with avoiding delays and costs.

4.3 Key findings and Recommendations

Based on the results of the distributor interviews, the total number of packaged commercial HVAC units sold in the Sponsors territories is almost three times higher than the Sponsors had estimated. However, the market share data confirmed that the Program is only influencing a small portion of the total units sold in the region. As a result this presents a number of opportunities for the Sponsors to modify the Program to potentially influence additional sales of high efficiency equipment within the Sponsors' territories.

Target new construction opportunities. Survey participants strongly indicated that the new construction market should be a focus of future program marketing and outreach efforts. Distributors indicated that over one third of current packaged commercial HVAC units sold are for new installations, thus, there is a significant opportunity to increase the sales of high efficiency equipment by focusing on this market. Several market conditions unique to the new construction market can be leveraged to support this effort. First, the region is currently experiencing growth in the commercial new construction market. Most of these projects will involve an engineer or designer involved with specifying HVAC equipment. Second, unlike equipment replacement, new construction projects typically allow substantial lead time to incorporate high efficiency equipment. Third, respondents overwhelmingly indicated that the current rebate levels accurately reflect the incremental cost between a standard efficiency unit and a high efficiency unit. Finally, the majority of participants recommended increased outreach to designers and engineers as a means to improve program participation. Sponsors should take advantage of these conditions and incorporate a new outreach effort incorporating the design community.

Better coordination with the residential HVAC programs. Distributors indicated that sales of packaged commercial HVAC equipment in the 1-30 ton range only represent 17% of their overall business. Most distributors (and contractors) of packaged HVAC equipment do not focus specifically on the commercial market; rather they sell to both the residential and commercial markets. As a result, a large overlap exists between the two sectors that Sponsors should explore. It was cited that Sponsors should coordinate their efforts with the residential programs to leverage the overall HVAC market and to provide consistent outreach and marketing messages. Distributors acknowledged that while the regional approach has simplified the process, there is still confusion created by delivering separate residential and commercial programs. As a result, Sponsors should investigate the possibility of delivering a single regional HVAC program that includes both residential and commercial equipment.

Reevaluate current marketing efforts. While overall Program awareness is high in the marketplace, redirecting marketing efforts to end users and the design and engineering community was cited as a key component to increasing the demand for high efficiency equipment. Participants indicated that if end use customers and designers request high efficiency equipment, than manufacturers and distributors will bring this equipment into the market. General awareness of energy efficiency is fairly high among end users; however, it was recommended that future marketing messages should focus on providing more specific information on HVAC related energy efficiency options.

Modify the current marketing message. Respondents suggested that Program marketing should take advantage of the current high cost of electricity and incorporate this into its marketing message. This message should highlight the resulting quicker paybacks and increased energy savings. Additional efforts should also aim to educate customers on the issues of high first cost and incremental costs. There appears to be a disconnect between distributors perception that the high first cost is the primary reason high efficiency units are not specified more and their view that the current incentive levels accurately reflect the average incremental costs. A big gap exists that the Program needs to address by providing additional

education of the true costs of upgrading to a more energy efficiency unit in terms of both equipment replacements and new installations.

Simplify the paperwork required from Program participants. While participants overwhelmingly reported that it is easy to participate in the Program and that the prescriptive incentive structure works well, many believed that the program could be further improved by reducing the required paperwork. Despite an already simple application form, the market actors feel this is still too involved. One suggestion was to simplify the process by providing an instant rebate directly to the contractors thereby providing them a direct incentive to specify high efficiency equipment.

Finally, for future research efforts, Sponsors should attempt to identify and track the various market actors involved within the HVAC market in their region. It was a very time consuming and challenging effort to identify the key market actors to contact as part of this research. For example, quite a few of the distributor contacts provided by the Sponsors indicated that they were not HVAC distributors or did not focus on HVAC (refrigeration and control systems were stated) equipment. Also, the Sponsors contact databases often contained outdated information. Future research efforts and overall program management could benefit by refreshing this information on an on-going basis.

Implementing some or all of these strategies should have a direct impact on influencing the sales of high efficiency HVAC equipment into the region.