

New York State Energy Research and Development Authority (NYSERDA)

**Baseline Market Evaluation of
Renewable Heat New York**
Final Report

Prepared for:
NYSERDA
Albany, NY

November 2020

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NYSERDA Contract #: KEMA, Inc., a member of DNV-GL Agreement #10453

NYSERDA Record of Revision

Market Baseline Evaluation of Renewable Heat NY
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Revision Date	Description of Changes	Revision on Page(s)
November 2020	Original Issue	

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Table of Contents

List of Figures.....	5
List of Tables.....	5
1 INTRODUCTION.....	6
1.1 Program Description	6
1.2 Summary of Evaluation Objectives	7
1.3 Executive Summary.....	10
1.4 Interviews with Biomass Heating System Manufacturers.....	15
1.4.1 Company Characteristics	21
1.4.1 Supply Chain.....	21
1.4.2 Manufacturing Process.....	22
1.4.3 Barriers and Opportunities.....	22
1.4.4 Market Effects and Trends	25
1.5 Interviews with Biomass Heating System Installers	28
1.5.1 Company Characteristics and Equipment Awareness	28
1.5.2 Program Awareness & Participation.....	Error! Bookmark not defined.
1.5.3 Training Awareness and Assessment.....	31
1.5.4 High-Efficiency, Low-Emission Biomass Heating Systems & Program Influence.....	32
1.5.5 Program Satisfaction.....	37
1.6 Interviews with Code Enforcement Officers.....	38
1.6.1 Characterizing NY County and Local Building Code Offices.....	42
1.6.2 How Code Officials Learn About Biomass Heating Equipment	42
1.6.3 Program Awareness.....	43
1.6.4 Support for Adoption of RHNY Standards.....	44
1.6.5 Prevalence of Biomass Heating Systems	45
1.6.6 Training Opportunities	45
2 Methodology.....	46
2.1.1 The Biomass Heating System Manufacturers.....	46
2.1.2 Biomass Heating System Installers	47
2.1.3 Code Enforcement Officers	53

List of Figures

Figure 1-1: Participating Installer Satisfaction with RHNY	13
Figure 1-2: Barriers to Biomass Heating System Manufacture Mentioned by Manufacturer Representatives.....	24
Figure 1-3: Regions of New York State	Error! Bookmark not defined.
Figure 1-4: Areas served in New York State for participating installers.....	Error! Bookmark not defined.
Figure 1-5: Areas served in New York State for nonparticipating installers..	Error! Bookmark not defined.
Figure 1-5. Sources of Information for Biomass Heating Equipment Codes and Standards used by New York State Code Enforcement Officers	43
Figure 1-6: Whether Code Officials Would Support Adoption of RHNY Standards	45

List of Tables

Table 1-1: Evaluation Objectives.....	8
Table 1-2: Firmographic Comparison of Participating and Nonparticipating Biomass Heating System Installers.....	31
Table 1-3: Average Program Satisfaction Ratings from Participating Installers.....	38
Table 2-1: SIC/NAICS Codes Included in the InfoGroup New York HVAC Installer Dataset	47
Table 2-2: Additional InfoGroup Dataset Requested by the Market Evaluation Team.....	49
Table 2-3: Original Sample Design for Participating Pellet Stove Installers	50
Table 2-4: Original Sample Design for Participating Biomass Installers	50
Table 2-5: Original Sample Design for Biomass Heating System Installers.....	51
Table 2-6: Revised Installer Sample Frame and Disposition.....	52
Table 2-7: Response Rates by Sub-Sample	53
Table 2-8. Code Enforcement Officer Sample Frame and Completed Interviews.....	54

1 INTRODUCTION

1.1 Program Description

Renewable Heat New York (RHNY) is a component of the New York State Energy Research and Development Authority's (NYSERDA's) Clean Heating and Cooling Program¹. First launched in 2014, RHNY is implementing a multi-pronged market support strategy to encourage greater adoption of high-efficiency, low-emission biomass heating equipment installations. Key parts of the RHNY market strategy include:

- Direct incentives to contractors for installations to encourage adoption:
 - In 2020 incentives for residential pellet stoves are \$1,500 for most customers and \$2,000 for households with incomes up to 80% of the state or county median. The income-qualified households also qualify for an additional \$500 incentive for the recycling of their existing pellet stove.
 - In 2020 incentives for advanced cordwood boilers for most customers who are replacing an outdoor/indoor wood boiler or a whole house wood furnace are calculated as up to 25% of installed cost (up to \$7,000) with an additional \$5,000 for the recycling of the old boiler or furnace. These incentives are higher for households with incomes up to 80% of the state or county median and lower. Customers with existing oil heat or propane only qualify for the installation incentive (up to \$7,000).
- Research and development to advance high-efficiency, low-emission technologies
- Workforce development to train a skilled workforce
- Education and outreach to inform consumers and market participants. The primary marketing effort involves campaigns targeting eight New York communities which promote energy-efficient, low emission biomass energy technologies as well as air-sourced and ground-sourced heat pumps.
- Policy development support for state and local governments especially focused on encouraging the adoption of RHNY standards for biomass equipment into county and local building codes.

¹ <https://www.nysesda.ny.gov/-/media/Files/About/Clean-Energy-Fund/cef-renewable-heating-and-cooling-chapter.pdf>

While the program components are available statewide, the RHNY deploys a co-op marketing campaign in local clusters with the potential for market growth.

RHNY outputs and outcomes include implementation of biomass heating projects with a variety of customer sizes (e.g., large commercial, small commercial, and residential), training of individuals in the installation of biomass heating systems, and implementation of R&D projects.

1.2 Summary of Evaluation Objectives

Table **1-1** shows the evaluation objectives as described in the RHNY evaluation plan along with descriptions of the purposes and methods.

Table 1-1: Evaluation Objectives

Objective	Purpose	Method
Determine the market share of the biomass equipment installation industry and the profitability of RHNY installers	Measuring the baseline level of New York biomass market activity so that the effects of the RHNY market interventions can be tracked over time	In-depth interviews with NY biomass heating system manufacturers and installers (both those participating in RHNY and the nonparticipating installers)
Determine what percent of the biomass system design and installation workforce are trained in best practices	Measuring the baseline level of training in the installation of high-efficiency, low-emission biomass heating systems in NY so the effects of RHNY trainings can be measure over time	In-depth interviews with NY biomass heating system installers (both participating and non-participating)
Determine the percentage of high-efficiency, low-emission biomass installations that follow RHNY standards	Measuring the baseline level of market penetration of high-efficiency, low-emission biomass heating systems so that the effects of the RHNY market interventions can be tracked over time Determining the number of counties or localities that are adopting RHNY standards into their building codes	In-depth interviews with NY biomass heating system manufacturers and installers (both participating and nonparticipating) In-depth interviews with NY code enforcement officials
Measure the maturity of the supply chain and service network for high efficiency, low emission biomass technology	Measuring the baseline level of market infrastructure for high-efficiency, low-emission biomass heating systems so that the market infrastructure development aspects of the RHNY interventions can be tracked over time	In-depth interviews with NY biomass heating system manufacturers and installers (both participating and nonparticipating)
Measure customer satisfaction with installers and equipment immediately after installation and at intervals, thereafter, including after the first heating season	Determining whether RHNY installers and the incentivized equipment are providing NY customers with a positive experience that will engender word-of-mouth publicity for RHNY and encourage installers	Surveys of customers participating in RHNY ²

² In February 2020 NYSERDA decided not to field this customer participant survey due to changing program priorities.

Objective	Purpose	Method
	to continue promoting the high-efficiency, low-emission technology	
Measure installer satisfaction with the program	Assessing whether RHNY is providing the training and incentives that will encourage installers to continue promoting the high-efficiency, low-emission technology	In-depth interviews with participating biomass heating system installers
Understand barriers to the adoption of high-efficiency, low-emission biomass heating systems	Determining what changes in program logic or market interventions that RHNY might need to make to increase adoption of the high-efficiency, low-emission technology	In-depth interviews with NY biomass heating system manufacturers and installers (both participating and nonparticipating) In-depth interviews with NY code enforcement officials
Measure indicators of market effects such as increased product availability and lower product prices	Assessing whether RHNY interventions in the NY biomass heating market might be having longer-lasting, sustainable market effects	In-depth interviews with NY biomass heating system manufacturers and installers (both participating and nonparticipating)
Measure differences in end user preferences based on their demographic or firmographic characteristics	Identifying opportunities for RHNY marketing and outreach to customize marketing messages and channels for customers in various age and income groups	Surveys of customers participating in RHNY

1.3 Executive Summary

This section contains a high-level summary of the market study and its key findings. More details on these findings appear in the main body of the report. These findings are based on in-depth interviews with seven representatives of manufacturers of biomass heating systems, 24 New York-based installers of biomass heating systems (both RHHY program-participating and nonparticipating) and 12 New York-based building code enforcement officials (both county-level and local level).³

The following are key findings from the in-depth interviews with these three different groups of New York biomass heating market actors:

- **There is mixed evidence that New York sales of high-efficiency low emission biomass systems are increasing:** Eight of the 12 participating installers thought that the sales of the high-efficiency low emission heating systems had increased in the past year primarily due to the NYSEERDA incentives. Yet the manufacturer representatives were divided on this question. Four of them said that demand for high-efficiency, low emissions biomass units had increased in the past year and three reported demand to have decreased. Only a third of the 12 nonparticipating installers said that sales of these units had increased in the past year.
- **The New York market for biomass heating systems faces significant market barriers .** All three groups of market actors interviewed by the Market Evaluation Team indicated that sales of biomass heating systems in New York – both the high-efficiency, low emission-models and standard systems -

³ There were various reasons for these small sample sizes, as discussed in more detail in the methodology section. In the case of the manufacturers, the eligible population was small (12 manufacturers). While the participating installers had a larger population than the manufacturers many of them were removed from the sample for this evaluation because they were concurrently being surveyed in another NYSEERDA evaluation, which reduced the participant sample frame to 72 installers. Although the population of nonparticipating installers was large (n=710), the sample size was small due to a poor response rate. The sample size for the code enforcement officers was intentionally small (n=12) because program staff had reported they had not done any work with code officials except for one training. Therefore, the intent of these interviews was to better understand how building codes were developed in New York in the various jurisdictions and get a baseline measurement of RHHY standard awareness among these code enforcement officers.

In the case of the manufacturer and participating installer interviews where the interviewers attempted to complete interviews with the full populations, sampling error was not an issue, but there are concerns with nonresponse bias.³ However, for the nonparticipating installer population, sampling error was a concern and the findings in this report should be interpreted with the understanding that while they have qualitative value, they do not meet the standards of statistical validity (e.g., 90%/10% precision) typically desired in such studies. With the application of a Finite Population Correction (FPC) factor to the standard error, the statistical precision for the manufacturers was 90%/24% and for the participating installers it was 90%/22%. The actual statistical precision achieved for the nonparticipating installers was 90%/27%.

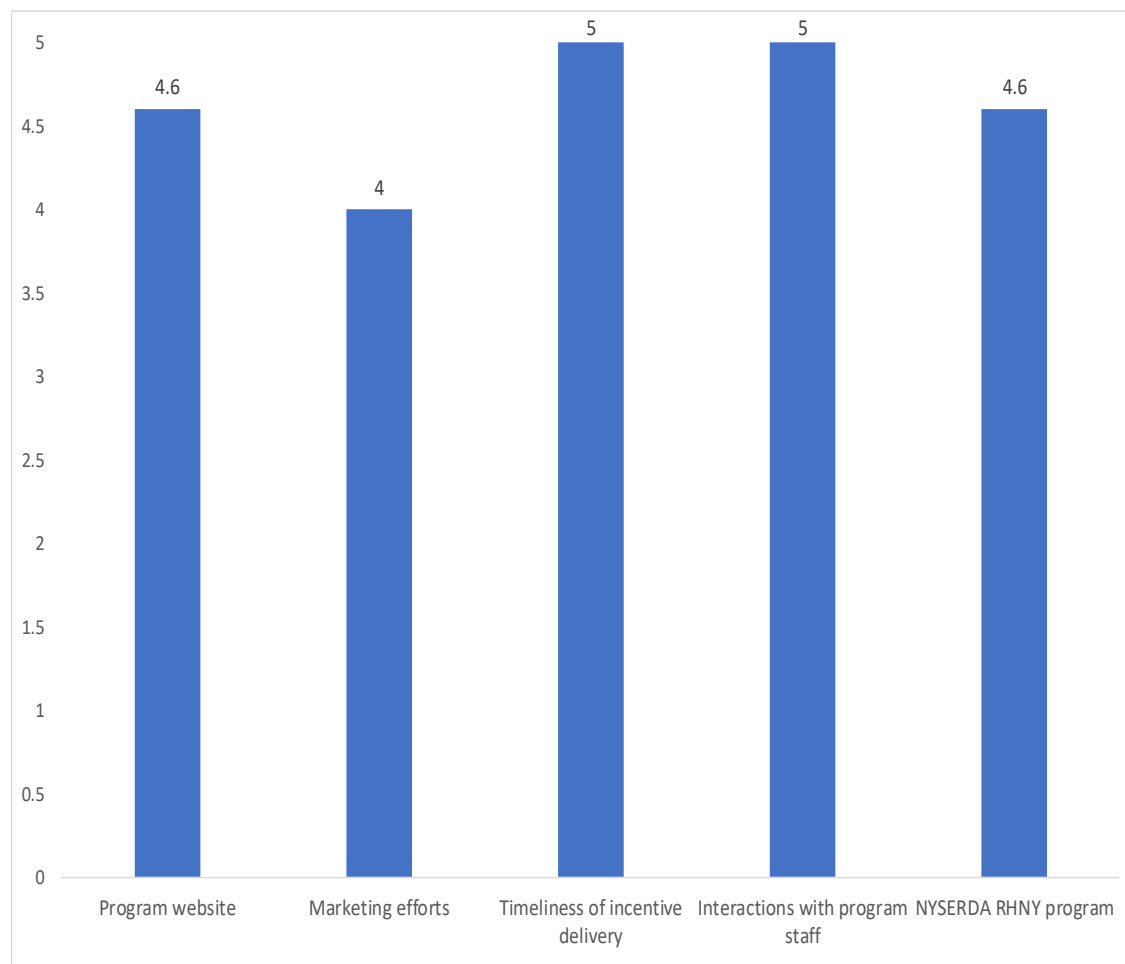
- were very limited. The manufacturers and installers cited several factors to explain this soft market including competition from cheaper fossil-based fuels, a lack of active biomass heating installers, and the high first cost of the biomass heating systems.

- **General market awareness of high-efficiency, low-emission biomass systems was high, but awareness of the Renewable Heat NY (RHNY) program was lower.** All nonparticipating biomass system installers reported being aware of high-efficiency, low-emission residential wood pellet stoves and all of them rated their familiarity with the technology as either somewhat familiar or very familiar. However, only half of the nonparticipating installers were aware of RHNY and its incentives. Only one of the twelve New York Code Enforcement Officers (CEOs) surveyed reported being aware of the RHNY program.
- **Awareness of the RHNY trainings was high among participating installers but participation was low, likely due to alternative training options. However, there was interest in RHNY trainings among nonparticipating installers.** Two thirds of the participating installers surveyed indicated they were aware of the RHNY training offered but only two respondents reported to have taken some form of the trainings available through RHNY.
- **Nonparticipating installers reported installing high-efficiency, low-emission biomass systems, but at a lower rate than participating installers.** The nonparticipating installers reported that about 60% of their sales of residential pellet stoves in New York in the past year (2018) were high-efficiency, low-emission models. In contrast, the participating installers said that 75% of their biomass heating systems sold in New York were RHNY-qualifying units.⁴
- **The RHNY program appears to be capturing most of the qualifying equipment sales of participating installers.** The participating installers reported that 67% of their program-qualifying systems sold in New York in the past year received program incentives. When asked why they did not sell all their program-qualifying systems through the RHNY program, participating installers reported factors such as burdensome paperwork, unfamiliarity with the program, and some of these sales predating their program participation.

⁴ Because the Market Evaluation Team assumed that many of the nonparticipating installers would be unfamiliar with RHNY, it could not use terms like “program-qualifying” in the interview questions. Therefore, there is some uncertainty as to comparability between the program-qualifying systems reported by the participating installers and the high-efficiency, low-emission systems reported by the nonparticipating installers.

- ***Both participating and nonparticipating RHNY installers reported that the profit margins are higher for the high-efficiency, low-emission biomass systems than for the standard systems.*** The participating RHNY installers reported an average profit margin of 34% for the high-efficiency, low-emission biomass systems compared to 26% for the standard biomass systems. The nonparticipating installers reported an average profit margin of 27% for the high-efficiency, low-emission biomass systems compared to 25% for the standard biomass systems.
- ***Participating installers are very satisfied with RHNY.*** The Market Evaluation Team asked the participating RHNY installers about their levels of satisfaction with various aspects of RHNY and the program overall. The interviewers asked the participating biomass installers to use a five-point satisfaction scale where five indicated “very satisfied” and one indicated “very dissatisfied.” Figure 1-1 shows that the participating installers were very satisfied with RHNY with the lowest average satisfaction rate (for RHNY’s marketing efforts) being 4.0.

Figure 1-1: Participating Installer Satisfaction with RHNY



- The participating installers had several suggestions for improving RHNY:*** Suggestions made by multiple respondents included increasing the level of program marketing and outreach, providing information on the future duration of the program on the program website, providing a larger incentive for income-qualified customers, and allowing EPA-certified wood stoves to be program-qualifying. Suggestions which were each made by a single respondent included providing opportunities for financing through third party sources, doing more program outreach to senior citizens, and creating a list of qualified distributors of high-efficiency, low-emission heating systems.
- Code enforcement officers surveyed were divided as to their willingness to adopt RHNY standards into building codes.*** Slightly less than half (45%) of the code enforcement officers surveyed said they would support adoption of these standards with 27% opposing adoption and another 27% uncertain about adoption. Those code enforcement officers who opposed adoption of standards cited factors including this technology being not very prevalent in their jurisdictions and the level of effort

involved in adoption being a strain on limited staff resources. Those code enforcement officers who were uncertain about adoption of standards said that NY State Uniform Fire Prevention & Building codes and other federal/state regulations were the primary sources for their codes and standards or that they might consider adoption after further research. ***Future evaluations should clarify whether project costs include the impacts of incentives:*** As discussed in the body of the report, an unexpected finding was participating installers reporting the average costs of standard biomass heating systems to be *higher* than the average costs they reported for high-efficiency low-emission systems. This was surprising because the nonparticipating installers reported standard systems being less expensive and the incentives which the RHNY program offers are intended to mitigate presumed higher incremental costs for the high-efficiency low emission systems. The Market Evaluation Team suspects some of the participating installers interviewed may have reported the costs of for high-efficiency, low-emission systems after the buydown effects of the RHNY incentives. Future evaluations should clarify this.

2 Market Characterization and Assessment Results

This section of the report contains more detailed findings than appeared in the Executive Summary. It first examines whether this study collected any information that might support or challenge the “testable hypotheses” of program effects that appears in the RHNY evaluation plan. It then examines whether this market baseline evaluation can verify any of the RHNY performance metrics which are also in the evaluation plan. This is followed by the evaluation findings from interviews with three groups of market actors: manufacturers of biomass heating systems sold in New York; New York biomass heating system installers; and New York building code enforcement officials.

2.1 Testing Hypotheses of Program Effects

One of the evaluation objectives was to test the six hypotheses of program effects mentioned in the RHNY evaluation plan. The original scope of this evaluation was to conduct a market baseline evaluation to establish initial biomass heating system market conditions in New York followed by two years of follow-up studies to measure trends in key market indicators over time. Because this study’s scope was later limited to just the market baseline evaluation, the Market Evaluation Team did not have a time series of evaluation results that would allow it to measure these trends in market indicators. For reasons cited in the previous section, the market baseline evaluation also did not conduct any customer surveys.

The absence of this market trend and customer data limited the ability of the Market Evaluation Team to test these hypotheses of program effects. However, as **Table 1-2** shows, the study did collect some information which sheds light on these hypotheses of program effects.

Table 1-2: Testing Hypotheses of Program Effects

Hypotheses of Program Effects	Relevant Evidence from the Study
1. If NYSERDA provides incentives to improve the economics of installing a high-efficiency, low emissions biomass heating appliances, then	<ul style="list-style-type: none"> • <i>Increasing consumer purchases of high-efficiency low emissions biomass heating systems:</i> The evidence for this hypothesis was mixed. Two-thirds of the participating installers thought that the sales of the high-efficiency low emission units were increasing primarily due to the NYSERDA incentives. Yet the manufacturers

Hypotheses of Program Effects	Relevant Evidence from the Study
<p>more consumers will choose to do so.</p>	<p>were divided as to whether sales of these units were increasing and only a third of the nonparticipating installers saw increased sales.</p> <ul style="list-style-type: none"> ○ Eight of the 12 participating installers (67% of the respondents) noticed recent increases in demand for the high-efficiency low-emission systems with seven of them attributing the increased demand to incentives provided by RHNY. ○ All seven manufacturer representatives said they noticed changes in the demand for high-efficiency, low emissions biomass heating systems in New York compared to the previous year. However, they were split on the direction of the changes. Four respondents reported demand for high-efficiency, low emissions biomass heating systems had increased, each citing a different explanation. Three respondents reported demand for these systems had decreased, all of which cited the relatively low price of oil during the last few years. ○ Only a third of the nonparticipating installers observed a recent increase in general demand for the high-efficiency low-emission systems. ○ Participating installers reported a higher percentage of high-efficiency low emissions biomass heating systems (75% on average) among their total installations compared to nonparticipating installers (60%).
<p>2. If high-efficiency, low-emissions biomass heating appliances are made cleaner and more efficient, then the customer value proposition</p>	<p><i>Increasing consumer purchases of high-efficiency low emissions biomass heating systems: See the evidence cited for hypothesis 1.</i></p>

Hypotheses of Program Effects	Relevant Evidence from the Study
will improve and installations will increase.	
<p>3. If suggested standards and language on high-efficiency biomass technology for building and related codes exists then it will be adopted into building codes at the county-level, making it easier to install advanced biomass technologies.</p>	<ul style="list-style-type: none"> ● <i>Getting RHNY standards adopted into county-level building codes:</i> <ul style="list-style-type: none"> ○ At the time of this evaluation the program staff had reported they had yet to do much outreach to building code officials. This was confirmed by the interviews with code officials with only one of the twelve respondents citing some familiarity with the RHNY program. ○ After informing all code enforcement officer respondents of the RHNY’s program’s objectives, the interviewers asked whether they would encourage the adoption of RHNY standards within their jurisdictions. Five of the 11 code officials (46%) who responded to this question said that they would push for adoption of these standards. Three of these code officials (27%) said they would not push for these standards and the remaining three (27%) were not sure what they would do.
<p>4. If reliable supply chain and service networks are fully developed, then the likelihood of high-efficiency, low-emissions biomass heating appliances to be viewed as favorable to the next-best alternative will increase.</p>	<p>Developing reliable supply chain and service networks: The evidence for this was mixed.</p> <ul style="list-style-type: none"> ● Four of the seven manufacturer representatives mentioned a lack of active installers of biomass heating systems in the New York marketplace as a barrier to sales. This indicates that the service networks are not fully developed. However, the recommendations of these manufacturers that more installer training is needed indicates that the program’s emphasis on training is in line with market needs. ● There was evidence that the marketplace was providing some of this training outside the NYSERDA RHNH program. Ten of the of twelve participating respondents (83%) mentioned they had participated in non-NYSERDA trainings on high-efficiency, low-

Hypotheses of Program Effects	Relevant Evidence from the Study
	<p>emission biomass heating systems. Seven of these installers said they took these trainings from their manufacturer/supplier.</p> <ul style="list-style-type: none"> • However, the existence of these manufacturer/supplier training options does not necessarily devalue the NYSERDA RHNY program’s own trainings. First it is not clear how broadly advertised or available these manufacturer/supplier trainings are.⁵ Second, the assertion of the manufacturers above that there is a scarcity of trained installers indicates that a broader range of training options is needed. • The manufacturer interviews indicated that the biomass heating system supply chain in the New York market is relatively short. Just one of the seven manufacturer representatives reported they engage with wholesalers or distributors in New York state in order to get their products to the market. The other six representatives said they self-distribute their products to either end-users or installation contractors. This shorter supply chain should make it easier for the RHNY program to impact the New York market by narrowing the scope of market actors it needs to influence.
<p>5. If education and outreach on high efficiency, low emission biomass heating appliances is increased, then consumer awareness of and confidence in the technology will increase.</p>	<ul style="list-style-type: none"> • <i>Increasing consumer awareness of and confidence in high efficiency, low emission biomass heating systems:</i> Since NYSERDA chose not to field the participating customer survey, the Market Evaluation Team was unable to test this hypothesis.
<p>6. If less efficient biomass heating appliances are</p>	<ul style="list-style-type: none"> • <i>High-efficiency low emission biomass heating systems improving ambient air quality:</i> The Market Evaluation Team had planned to

⁵ For example, it is possible that these manufacturer/supplier trainings are only open to installers who are already purchasing equipment from that manufacturer/supplier.

Hypotheses of Program Effects	Relevant Evidence from the Study
replaced with high-efficiency, low-emissions biomass heating appliances then there will be a positive impact on ambient air quality.	measure this by asking the participating end users whether they have noticed any changes in indoor air quality since the installation of the new equipment. However, the cancellation of the participating customer survey precluded this.

2.2 Program Performance Metrics

The Market Evaluation Team also examined whether its research could assess whether the RHNY program was making progress towards its performance metrics listed in the RHNY evaluation plan. The following table lists the RHNY performance metrics listed in the evaluation plan for which program evaluation was listed as one of the possible data sources (vs. other data sources such as program tracking data or websites).

Table 1-3: Examining RHNY Program Progress Towards Performance Metrics

Output/ Outcomes	Indicators	Evidence from the Evaluation
Biomass heating system design and installation workforce are trained in best practices	Percent of biomass heating system design and installation workforce trained in best practices	<ul style="list-style-type: none"> • Eight of the 12 participating installers were aware of the trainings offered these trainings with two respondents reporting to have taken some form of it (one took onsite training and one online training). • Ten of the of twelve participating respondents (83%) mentioned they had participated in non-NYSERDA trainings on high-efficiency, low-emission biomass heating systems. Seven of these installers

Output/ Outcomes	Indicators	Evidence from the Evaluation
		<p>said they took these trainings from their manufacturer/supplier.</p> <ul style="list-style-type: none"> • Installer interviews were only conducted for the baseline year and so no data were available on long-term changes in the percent of installers trained in best practices.
Percentage of installations following Renewable Heat NY Standards	Percentage of installations following Renewable Heat NY Standards	<ul style="list-style-type: none"> • On average, the participating installers reported that 75% of their biomass heating systems sold in New York were RHNY-qualifying units. • The Market Evaluation Team also asked nonparticipating installers what percentage of their biomass heating systems sold or installed in New York in the past year were high-efficiency, low-emission systems. They reported that about 60% of their residential pellet stoves were in this category. • Installer interviews were only conducted for the baseline year and so no data were available on long-term changes in the percent of installations following RHNY standards.
Fully developed supply chain and service network in place	Number of system designers and installers, equipment manufacturers, bulk fuel supply network participants	See evidence presented for Hypothesis 4 above.

2.3 Interviews with Biomass Heating System Manufacturers

One objective of RHNY is to encourage manufacturers of biomass boilers and wood pellet stoves to produce more high-efficiency, low-emission biomass heating systems. To learn more about these market actors and the opportunities and barriers that exist for the adoption of these clean technologies, the Market Evaluation Team interviewed representatives of seven manufacturers of biomass heating systems. These interviews were completed in the first quarter of 2019. This section summarizes the findings from these interviews.

2.3.1 Company Characteristics

The Market Evaluation Team asked the manufacturers of the biomass heating systems firmographic questions to characterize their businesses. These included questions on their roles within the company, company size, location, and which market segments they targeted.

The biomass heating system manufacture representatives surveyed all held high positions within their companies including four owners, one president, one vice president, and one sales manager. Their companies had an average of 15 full-time employees with the largest having 70. The companies had an average of five New York-based employees with a high of 14. Some manufacturers had all their employees working in New York while others had none.

The Market Evaluation Team asked the biomass heating system manufacturer representatives about their target customer types. Four respondents indicated they serve both the residential and commercial market, two reported only selling residential systems, and one manufacturer only sold units for commercial use.

The biomass heating system manufacturer representatives only reported an average of seven residential and three commercial biomass boilers sales in New York in 2018. All seven respondents said that 100% of their sales in New York were high-efficiency, low-emission models.

2.3.1 Supply Chain

The Market Evaluation Team asked the biomass heating system manufacturer representatives about their supply chain for their systems, including any distributors and/or contractors they work with. Just one of the seven representatives reported they engage with wholesalers or distributors in New York state in order

to get their products to the market. The other six representatives said they self-distribute their products to either end-users or installation contractors. To further illustrate this market dynamic, while most manufacturers of biomass heating systems did not engage with distributors, all seven respondents said they were familiar with at least some contractors that install their biomass heating products.

2.3.2 Manufacturing Process

The RHNY evaluation plan identified the following researchable questions:

1. Are [biomass heating system] manufacturing plants using automation in their manufacturing process?
2. To what extent is automation implemented in the manufacturing process?

The Market Evaluation Team asked the biomass heating system manufacturer representatives whether their companies manufactured biomass heating systems in New York. If they did, the interviewers asked more about the manufacturing process, including if the manufacturing process was automated.

Two of the seven manufacturer representatives said their companies manufactured their systems in New York. One of these respondents said that all their biomass heating systems were manufactured using an automated process. In contrast, the other respondent that manufactured biomass heating systems in New York said they do not use any automation in their manufacturing process. “There is no reason to get into automation until you get to a certain level of sales,” said this respondent. The respondent also said that the company did not have plans to introduce automation into its process and that only a dramatic increase in sales would influence them to begin automation.

2.3.3 Barriers and Opportunities

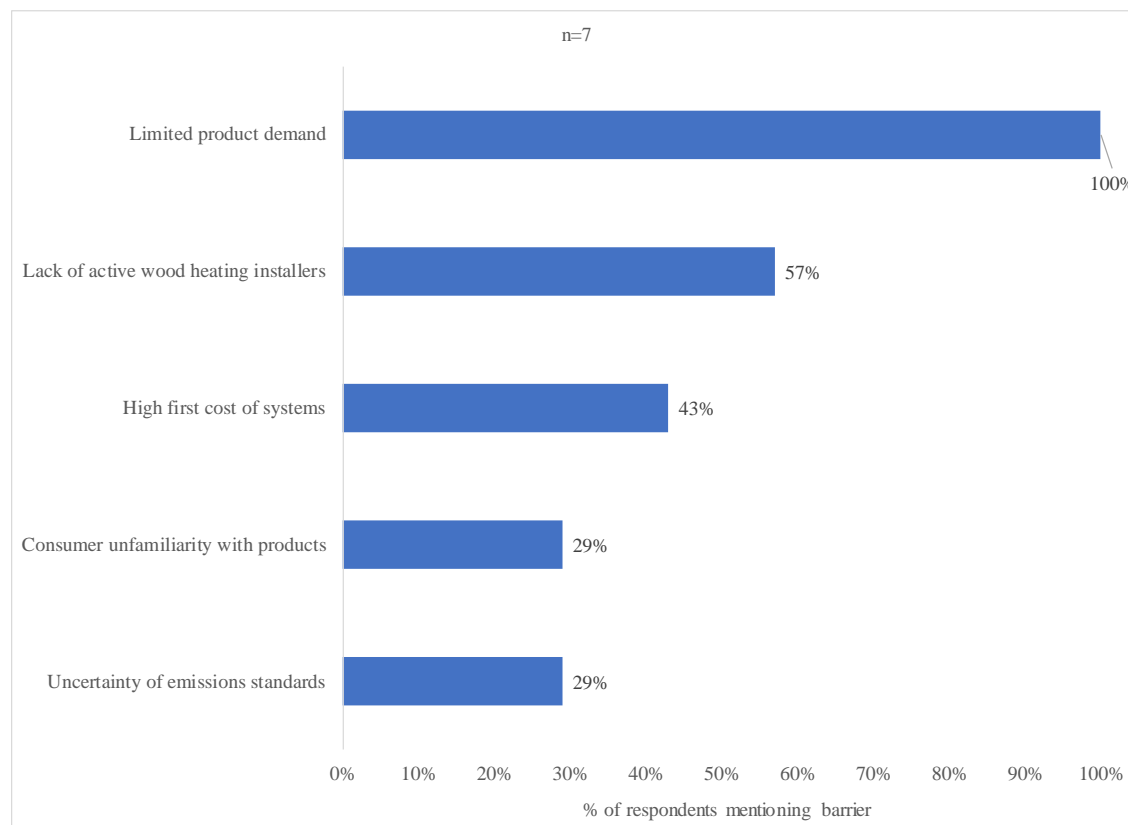
The Market Evaluation Team asked the biomass heating system manufacturer representatives about possible barriers to the manufacture of high-efficiency, low-emission biomass heating systems and what could be done to reduce those barriers. The interviewers asked separately about barriers to manufacturing residential and commercial systems, although most respondents said the barriers were the same for both. Figure 1-2 shows the barriers that the manufacture representatives identified. The following are some additional explanations of these barriers along with suggested solutions from the manufacturer representatives surveyed.

- *Limited product demand:* During the interview, all the manufacturer representatives mentioned limited product demand as a major limiting factor of their production. Five of the seven respondents specifically called out low prices for competing fuels (most often oil) as a barrier. “We as a

manufacturer can produce [biomass heating systems] all day long,” said one representative interviewed, “but the market is predicated on alternate fuel prices. When crude oil and propane are high, consumers are seeking alternatives. In the last several years, there have been low [oil and propane] prices, and sales turned accordingly.”

- *Lack of active biomass heating installers:* Four manufacturer representatives mentioned a lack of active installers of biomass heating systems in the New York marketplace as another barrier to sales. “There are only a handful of good installers championing the cause,” said one manufacturer representative interviewed. “[Other installers] tend to be too busy to get involved with these more custom biomass installations.” Another respondent said: “it’s not a priority” even for most of the contractors that do install biomass systems and noted that some metropolitan areas (e.g., Rochester) have few or no contractors installing these systems. When asked how this barrier could be reduced, one manufacturer representative suggested NYSERDA hold more contractor training sessions on this technology preferably between heating and cooling seasons (late spring or early fall) when installers re-tool their skill sets.

Figure 1-2: Barriers to Biomass Heating System Manufacture Mentioned by Manufacturer Representatives



Note: The percentages sum to greater than 100% because manufacturer representatives identified multiple barriers.
 Source: Q1 2019 Market Evaluation Team interviews with manufacturers of biomass heating systems

- High first cost of systems:* Three of the seven manufacturer representatives mentioned the cost to purchase and install biomass systems as a barrier. Two of these respondents said they thought that cost barriers were more significant on commercial systems than residential. When asked about ways to reduce the cost barrier, all three respondents talked about removing the requirement of new external thermal storage capacity to qualify for incentives, which they said added “thousands of dollars” to the overall cost of installing biomass heating systems. One respondent, commenting on the high cost of commercial systems, said that NYSERDA should open the program to systems that burn different fuel types, such as wood chips, which are significantly less expensive as a fuel source. Doing so would somewhat offset the high up-front cost of these systems.
- Uncertainty of emissions standards:* Two manufacturer representatives interviewed mentioned a lack of certainty in emissions standards for their equipment as a barrier to production. One respondent

cited uncertainty over whether recently promulgated federal Environmental Protection Agency regulations would take effect. The other respondent discussed the “complex web of regulations” surrounding allowable emissions. According to the manufacturer, while standard testing protocols for biomass heating systems are readily translated into pounds of emissions per BTU of energy, NYSERDA’s standards revolve around PM 2.5. Since no universally accepted testing of these systems gives certified PM 2.5 values up-front, additional, very expensive testing is needed to meet the standard. To alleviate this barrier, the respondent recommended establishing an equivalency from standard testing protocols results to PM 2.5 values.

- *Consumer unfamiliarity with biomass heating systems:* Two of the four manufacturer representatives who had cited lack of installers as a barrier linked that barrier with low customer awareness of biomass heating systems and an “intimidation factor” due to unfamiliarity with the ease of operating these systems (specifically called out for residential customers). “The onus has been put on us manufacturers to inform the public that these [program] monies exist and that this technology is readily available, but we are not at the table when people are replacing their heating systems,” said one representative surveyed.

To reduce these barriers, the two respondents recommended NYSERDA conduct more educational outreach to customers. These respondents suggested this outreach should be “more of a friendly, home-spun style,” introducing people to modern biomass heating and emphasizing the ease and dependability of these technologies. They also recommended that this customer education include information on the program incentives, energy savings, case studies, and the local economic benefits of equipment manufacture and fuel supply all taking place within New York.

2.3.4 Market Effects and Trends

The Market Evaluation Team asked the manufacturer representatives questions to better understand recent market changes as well as the future of the market for biomass heating systems. The topics included trends they have noticed in the costs, availability, and demand for the biomass heating systems as well as what trends they forecast going forward.

Only one of the respondents said his company had noticed a change in the wholesale costs of high-efficiency, low-emission biomass heating systems in New York in the previous year. This manufacturer representative said the company had noticed a decrease in wholesale costs as some competitors dropped their prices to compete with low fossil fuel costs. The other six respondents did not notice changes in the

wholesale costs of high-efficiency, low-emission biomass heating systems in New York in the previous year.

Only one of the seven manufacturer representatives said they had noticed a change in the general availability of high-efficiency, low-emission biomass heating systems in New York in the previous year. The manufacturer rep interviewed said they noticed the availability increasing slightly as word-of-mouth grew and the market picked up steam. The other six respondents did not notice any changes in the general availability of high-efficiency, low-emission biomass heating systems in New York in the previous year.

All seven manufacturer representatives said they noticed changes in the demand for high-efficiency, low emissions biomass heating systems in New York compared to the previous year. However, they were split on the direction of the changes. Four respondents reported demand for high-efficiency, low emissions biomass heating systems had increased, each citing a different explanation: fuel prices beginning to creep upwards, older systems needing to be replaced, NYSERDA program incentives increasing, and established installers becoming more comfortable with the technology. Three respondents reported demand for high-efficiency, low emissions biomass heating systems had decreased, all of which cited the relatively low price of oil during the last few years. As one of these manufacturer representatives explained, “Oil was down in 2016-2017. In 2018, oil became more expensive, but to ramp up sales [of biomass heating systems] it takes a while for consumers seeing those higher oil prices.”

Six of the seven respondents said they thought that biomass heating systems would improve in various ways in the coming years. Three of these manufacturer representatives outlined incremental steps that would not necessarily constitute a “new generation” of technologies but rather steady improvements. These included small increases in combustion efficiency and small decreases in emissions, as well as improvements in controls, building integration, and user interface to make biomass heating technology easier to operate and more accessible to a wider range of customers.

Three of the manufacturer representatives discussed larger technological developments occurring over the next few years. Two of those interviewed mentioned developing, for the first time, residential-scale high-efficiency, low emissions systems that burn wood chips as opposed to wood pellets. This would be a major market development, they explained, because wood chips cost significantly less than wood pellets as a fuel source, opening the market to more people. One respondent said their company would soon introduce a new biomass boiler system with an integrated thermal storage tank, satisfying the thermal storage requirement for the NYSERDA program in a more cost-effective way than previously possible.

Finally, the Market Evaluation Team asked the manufacturer representatives what types of market interventions or program support would most effectively encourage further innovation in the biomass heating market. Most of the respondents reiterated already-stated program support that would encourage higher demand, such as modifying the thermal storage requirement and doing more customer education campaigns. Two respondents stated that establishing a thermal renewable energy credit system (such as those used in New Hampshire and Massachusetts) would encourage innovation in the biomass heating market.

2.3.5 Key Findings and Conclusions

Some key findings and conclusions from the in-depth interviews with the biomass heating system manufacturers included:

- *The biomass heating market has not experienced much recent change in the wholesale costs or availability of equipment:* Only one of the seven surveyed manufacturers said his company had noticed a change in the wholesale costs of high-efficiency, low-emission biomass heating systems in New York in the previous year. In addition, only one of the seven manufacturer representatives said they had noticed a change in the general availability of high-efficiency, low-emission biomass heating systems in New York in the previous year.
- *The biomass heating market faces stiff competition from cheaper fossil-based fuels:* Five of the seven representatives of manufacturers of biomass heating equipment cited low prices for competing fuels (most often oil) as a barrier to sales of their equipment. "We as a manufacturer can produce [biomass heating systems] all day long," said one rep, "but the market is predicated on alternate fuel prices. When crude oil and propane are high, consumers are seeking alternatives. In the last several years, there have been low [oil and propane] prices, and sales turned accordingly."
- *Lack of active biomass heating installers:* Four manufacturer reps mentioned a lack of active installers of biomass heating systems in the New York marketplace as another barrier to sales. "There are only a handful of good installers championing the cause," said one manufacturer representative interviewed. "[Other installers] tend to be too busy to get involved with these more custom biomass installations." Another representative interviewed stated "it's not a priority" even for most of the contractors that do install biomass systems and noted that some metropolitan areas (e.g., Rochester) have few or no contractors installing these systems.
- *High first cost of systems:* Three of the manufacturer representatives interviewed mentioned the cost to purchase and install high-efficiency, low-emission biomass systems as a barrier to market adoption.

Two respondents indicated cost barriers were more significant on commercial systems than residential.

- *Other barriers:* The manufacturers and installers interviewed identified uncertainty as to the qualifying emissions standards for the equipment and lack of consumer familiarity with high efficiency low emission biomass heating systems as additional barriers to sales.

2.4 Interviews with Biomass Heating System Installers

Another objective of RHNY is to encourage contractors to promote and install high-efficiency, low-emission biomass heating systems. To learn more about these installers of biomass heating systems and the challenges and opportunities they face, the Market Evaluation Team completed interviews with 24 installers of biomass heating systems. Of the installers interviewed, 15 are non-HVAC businesses (12 RHNY participants; three nonparticipants) and nine HVAC businesses (one RHNY participant; eight nonparticipants). These interviews were completed in the second quarter of 2019.

As discussed in more detail in the Methodology section, the sample of eligible companies available for interview was smaller than the Market Evaluation Team had anticipated in both the Evaluation Plan and in the initial sample design memoranda. These smaller sample frames were primarily due to two factors:

- 1) Due to concerns about respondent fatigue, NYSERDA directed the Market Evaluation Team to remove from the sample frame HVAC contractors which were being contacted under another NYSERDA evaluation around the same time. This reduced the sample frame for participating HVAC contractors installing biomass heating technologies (i.e., high-efficiency, low-emission biomass heating systems) to only 10 companies; and
- 2) Biomass heating technologies are much less commonly sold than other heating technologies and sellers of these technologies cannot be preidentified by any SIC/NAICs business codes. Therefore, the Market Evaluation Team's interviewers screened installers, both participating and nonparticipating, to find those who sold these technologies. About 80% of the companies contacted were deemed ineligible because they did not sell biomass heating systems.

2.4.1 Company Characteristics and Equipment Awareness

The Market Evaluation Team asked installers of renewable heating systems a series of firmographic questions to better understand the renewable heat technology installer market in New York.

Table 1-4 summarizes these respondents by RHNY participant installers and nonparticipant installers.⁶ Respondents reported a range of 1-15 full-time employees with an average of six employees. For nonparticipant installers, the reported range is 1-21 full-time employees also with an average of six. The interviewers spoke primarily with employees at a high level of the participating RHNY installer business, including six business owners, four managers (general or office), and two sales associates. For nonparticipant installers, the interviewers spoke with seven company owners/presidents, three sales managers, and one respondent who refused to provide a company title.

The interviewed installers were asked how they first learned about high-efficiency, low-emission biomass heating systems such as residential pellet stoves or biomass boilers. For RHNY participants, equipment manufacturers/vendors and online research (both through NYSERDA/RHNY and general research) were the top responses provided. Other responses included learning about these systems from being in the industry for a long time (four installers), from a customer (one installer), from a previous employee (one installer), and the Cornell Cooperative Extension (one installer).

All nonparticipant installers reported being both aware and either somewhat or very familiar with high-efficiency, low-emission residential wood pellet stoves. Like participant RHNY installers, the nonparticipant installers reported that equipment manufacturers/vendors were the most frequent source of first learning about these RH systems. Seven of the eleven nonparticipating installers mentioned manufacturers as their first information source, followed by trade associations (three installers) and general internet research (one installer). Other sources of learning about these systems for nonparticipants include trade shows, customers, and general industry experience. Two nonparticipant installers reported being aware of biomass boilers that were high-efficiency, low-emission models, although only one of them had sold such a model in the past year.

The thirteen RHNY participating installers reported an average of 92 residential pellet stoves being installed over the past year with a minimum of seven and a maximum of 350. Two of these thirteen respondents said they installed biomass boilers in the past year with one installing 1-2 cordwood boilers, and 10-15 small pellet boilers (average of 14). The other respondent stated that they had not installed very many pellet boilers since there are no bulk suppliers for pellet boilers in the area serviced by the

⁶ If the respondent provided a range for a response, the mean was used for analysis (i.e. 20-30 units is recorded as 25 units).

respondent. Boilers and gas fired space heaters were the most frequent heating and cooling equipment types installed for participating RHNY respondents, excluding biomass heating systems.

The eleven nonparticipating installers reported an average of 15 residential pellet stoves being installed over the last 12 months with a minimum of one and a maximum of 50. One respondent stated that they sold one biomass boiler in the past year. Gas-fired and electric space heaters were the most frequent heating and cooling equipment types installed for nonparticipating respondents, excluding biomass heating systems.

Seven of the eleven nonparticipating installers said they service biomass heating systems in addition to installing them. Of the seven nonparticipating installers who also serviced the systems, four mentioned that when they are on a service call, they discuss with customers the possibility of replacing the older systems with new high-efficiency, low-emission systems.

Table 1-4: Firmographic Comparison of Participating and Nonparticipating Biomass Heating System Installers

Question Topic	Participants (n=13)	Nonparticipants (n=11)
Average full-time employees	6	6
Sources of learning about high-efficiency, low-emission biomass heating systems:		
Equipment manufacturers/vendors	62%	58%
NYSERDA or Renewable Heat NY webpage	31%	0%
Internet/online research	23%	8%
Trade association	0%	25%
Other	46%	33%
Other technologies company installs:		
Furnaces	38%	36%
Boilers	46%	36%

Heat pumps co-op advertising incentives from NYSERDA.

The Market Evaluation Team asked the nonparticipating installers whether they were aware of the RHNY program. Exactly half said they were aware. When asked where they first learned about the program, four mentioned equipment manufacturers/vendors, two mentioned learning about the program either at trade shows or through industry contacts, and one mentioned hearing about it from a trade association.

The interviewers asked the program-aware nonparticipant installers why they had not joined the program. Six of these respondents stated that the paperwork and perceived hassle of program participation was administratively burdensome for a small business. Other reasons for nonparticipation in RHNY included the scenarios where they were trying to join the program but the process had not yet been completed, unawareness of the program at the time of their most recent installation, and the equipment they typically sell not qualifying for the program. When asked where they typically go to get information about incentive programs, the nonparticipating installers most frequently mentioned equipment manufacturers/vendors followed by the NYSERDA website, trade associations, and trade shows.

2.4.2 Training Awareness and Assessment

The Market Evaluation Team asked participating RHNY installers whether they were aware of NYSERDA's onsite or online training for high-efficiency low-emission biomass heating systems. Two thirds of the respondents were aware of these trainings with two respondents reporting to have taken some form of it (one took onsite training and one online training).

The respondent who took the onsite training reported being very satisfied with the opportunity. However, the respondent who took the online training stated that it focused primarily on types of biomass heating systems which his company did not install. The four respondents who were aware of the training opportunities but had not taken any said that they did not take the training because they were either nationally certified (two of the respondents), did not believe it was necessary for what they do (one respondent) or they already had received adequate training from equipment manufacturers/vendors (one respondent).

The interviewers asked the remaining third of the participating RHNY installers who were previously unaware of the NYSERDA RHNY trainings if they would be interested in taking the trainings now that they are aware. Two of the four respondents were not interested, one was interested, and the last respondent was unsure. The two uninterested respondents stated that they already receive enough training from the manufacturers and would need to know what they would receive from NYSERDA training that they were not already getting from the manufacturers.

Ten of the of twelve participating RHNY respondents (83%) mentioned they had participated in non-NYSERDA trainings on high-efficiency, low-emission biomass heating systems. Seven of these installers said they took these trainings from their manufacturer/supplier. One reported taking the training from a national certification entity and another as part of a broader course on boilers. The last of these installers who participated in these non-NYSERDA trainings could not recall who had offered the training.

The Market Evaluation Team posed a similar set of training-related questions to the nonparticipating installers interviewed. Although no nonparticipant installers were aware of either the NYSERDA onsite or online trainings, five of the eight respondents reported interest in taking these trainings. Those who were not interested in these trainings said that they did not sell enough of the systems to justify the training, that they had already received enough training, or that they simply would need more information about what the training would offer. Over half (56%) of the nonparticipating installers said they had taken training in high-efficiency, low-emission systems from non-NYSERDA entities such as equipment manufacturers, conventions, and trade guilds.

2.4.3 High-Efficiency, Low-Emission Biomass Heating Systems & Program Influence

The Market Evaluation Team asked participating RHNY installers what percent of the biomass heating systems they sold or installed in New York in the past year were high-efficiency, low-emission models

that would qualify for RHNY incentives. On average, the participating RHNY installers reported that 75% of their biomass heating systems sold in New York were RHNY-qualifying units. When asked why they did not sell all program-qualifying units, the participating RHNY installers were most likely to report that some of their units would not qualify for incentives. One of these installers also said that whether they sell program-qualified systems “all depends on customer preference.”

The participating RHNY installers said that, on average, two thirds of the high-efficiency, low-emission systems sold in New York in the past year received RHNY incentives.

Of the respondents who sold units that did not receive incentives from RHNY, one said that 90-95% of their units did not receive incentives because the units did not meet program certification requirements. Another respondent noted that the units that did not receive incentives were sold before they joined the program. A third respondent said that the units sold outside the program pre-dated their involvement with the program.

The Market Evaluation Team also asked nonparticipating installers what percentage of their biomass heating systems sold or installed in New York in the past year were high-efficiency, low-emission systems. They reported that about 60% of their residential pellet stoves were in this category.⁷ When asked why all their recent pellet stoves sales/installations were not high-efficiency, low-emission models, system cost was the cited as the primary barrier (six respondents) followed by customer preference (two respondents), and not typically having those systems in the store (one respondent).

The interviewers asked both participating RHNY and nonparticipating installers about the typical price points and profit margins for the installation of both high-efficiency low-emissions systems and standard systems. Some respondents were able to separate equipment costs and labor costs out, while others simply reported the total.⁸ According to the participating RHNY installers, the average total cost (including both equipment and labor) for high-efficiency, low-emission systems was \$2,220 where the average equipment

⁷ Because the Market Evaluation Team assumed that many of the nonparticipating installers would be unfamiliar with RHNY, it could not use terms like “program-qualifying” in the interview questions. Therefore, there is some uncertainty as to comparability between the program-qualifying systems reported by the participating installers and the high-efficiency, low-emission systems reported by the nonparticipating installers.

⁸ To calculate the average for total cost, an average was taken including (1) those respondents who gave one number for costs and (2) the summation of equipment and labor costs for those respondents who separated their answer by equipment cost and labor cost.

cost was \$1,927 and the average labor cost was \$556. The average reported margin received on these high-efficiency low-emission projects was 34%.

The participating RHNY installers who were only able to estimate total system costs reported that the average cost of their standard systems was \$2,875. Those who were able to break out the equipment and labor costs provided an average equipment cost of \$2,833 and an average labor cost of \$556. The average reported margin on these standard projects was 26%.

It is surprising that the average reported costs of the standard systems were higher than those of the high-efficiency low-emission systems, especially since the nonparticipating installers reported the standard systems being less expensive. However, the Market Evaluation Team suspects some of the participating RHNY installers interviewed may have reported the costs of for high-efficiency, low-emission systems after the buydown effects of the RHNY incentives. In addition, since the participating RHNY installers had reported that 75% of their sales were high-efficiency, low-emission systems, it is possible that economies of scale in equipment purchase and availability factors reduced the equipment costs of the efficient systems compared to the standard systems.

According to nonparticipating installers, the average total cost for high-efficiency low-emission systems for both equipment and labor was just under \$4,000 while the average cost of just the equipment was \$3,000 and the average cost of labor was \$1,000. The average reported margin on the high-efficiency, low-emissions systems was 27%. For standard systems for nonparticipant installers, the average total cost was \$3,560 with an average equipment cost of \$1,749 and an average labor cost of \$1,144. The average reported margin on these standard projects was 25%.

The Market Evaluation Team also asked the participating RHNY and nonparticipating installer respondents about changes in wholesale costs, general availability, and general demand for high-efficiency, low-emission residential pellet stoves. Eight participating RHNY installers (67% of the respondents) said they had noticed a change in wholesale costs for these systems, with seven observing increases and one a decrease. The reported average estimated wholesale cost increase was 7%. The respondents who reported these changes in wholesale costs cited tariffs, the cost of steel or other raw materials, emissions testing, and operations as contributing factors. Of the nonparticipating installers, five respondents noted changes in wholesale costs with four mentioning a price increase due to ordinary market conditions and manufacturing costs and one mentioning a price decrease as manufacturers are promoting this type of heating technology.

Only two participant RHNY installers (17% of the total respondents) said they had noticed a change in general availability of high-efficiency low-emissions residential pellet stoves, with the remainder noticing no change in availability. One of two installers who reported noticing a change in availability of the high-efficiency low-emissions systems said that availability had increased due to supply and demand. In contrast, the other reported limited availability of these products and their distributors.

Seven of the responding nonparticipant installers (78%) said that the high-efficiency, low-emission biomass heating systems were becoming more readily available and easier to find. These respondents attributed this increased availability to manufacturers promoting this type of technology, incentive programs, and customer preferences increasing demand.

Eight of the participating RHNY installers (67% of the respondents) noticed recent increases in demand for the high-efficiency low-emission systems with seven of them attributing the increased demand to incentives provided by RHNY. The remaining respondent attributed the increased demand for the high-efficiency low-emission systems to lower costs for wood pellets and heating system maintenance. Only a third of the nonparticipating installers observed a recent increase in general demand for the high-efficiency low-emission systems; none provided explanations for this reported increase in demand.

The Market Evaluation Team asked the participating RHNY installers what sorts of sales tactics had been most effective for selling the high-efficiency, low-emission residential pellet stoves. Half the participants surveyed mentioned that they rely mostly on advertising to drive sales. Advertising platforms mentioned by the respondents included social media (e.g., Facebook), store website, newspapers, billboards, newsletters, radio, and, in one case, a booth at the Empire Farm Days fair. One respondent noted they simply mention the RHNY incentive when the customers are in the store. Two participating RHNY installers said that there was no need to advertise for these types of products since their business model is the exclusive sale of high-efficiency low-emission residential pellet stoves.

When the nonparticipating installers were asked about effective sales pitches for selling the high-efficiency, low-emission residential pellet stoves, multiple respondents mentioned a long-term reduction in their energy bill (n=4), the amount of energy saved (n=2), the improvement of indoor air quality (n=2), and a reduction in operation and maintenance of the system (n=2). Other sales tactics, each mentioned by a single respondent, included promoting green technology and emphasizing the quality of the high-efficiency, low-emissions models.

The interviewers also asked the installers what factors might make it difficult for them to sell/install high-efficiency, low-emission heating systems. Five of the participating RHNY installers mentioned the high first cost of the systems as the primary barrier and one respondent noted that only wealthy customers are interested in the systems. Seven of the nonparticipating installers interviewed also mentioned the high initial cost of the equipment as a barrier to market adoption and installations. Other barriers that the nonparticipating installers mentioned included limited demand of the product (n=4), the customer waiting for an old system to fail (n=1), the difficulty of building the system to meet the emissions requirements (n=1), and the low availability of manufacturing materials (n=1).

The Market Evaluation Team summarized the current RHNY incentives for the respondents and then asked the participating RHNY installers if they thought these incentives were adequate to move customers to the high-efficiency, low-emission models. Nine of the participating RHNY respondents (75%) believed that the current incentive levels were adequate. Two of the remaining three respondents believe the incentive for low-income customers should be increased as they are not able to afford these systems even with the current higher incentive (low-income participants currently receive a \$2,000 incentive vs. a \$1,500 incentive for other residential market-rate participants). The last respondent suggested a more robust trade-in program to prolong the incentive program. When the interviewers summarized the RHNY incentives for the nonparticipating installers, all of them said the incentive levels were adequate.

The interviewers also asked the participating RHNY installers how influential the program incentives were in their ability to sell these high-efficiency low-emission models. The interviewers provided the installers with a five-point scale where five meant “very influential” and one meant “not influential at all.” The average influence score was 4.4.

The Market Evaluation Team asked the installers whether they could make any generalizations about the customers who purchased their high-efficiency, low-emission residential pellet stoves. Ten of the twelve participating installers (83%) were willing to do so. The most common generalizations provided by the respondents is that customers were typically looking to upgrade their system, install something easier to operate, or looking to save money. Other generalizations included customers from a low-income household and those being environmentally motivated. Three of the eight nonparticipating installers who responded to this question were able to make some generalization about the customers purchasing these types of heating systems. These generalizations included homes in rural locations, middle class households, older families, and people interested in reducing their energy bill.

2.4.4 Program Satisfaction

The Market Evaluation Team asked the participating RHNY installers about their levels of satisfaction with various aspects of RHNY as well as with the program overall. The interviewers asked the participating RHNY installers to use a five-point satisfaction scale where five indicated “very satisfied” and one indicated “very dissatisfied.”⁹

The question about satisfaction with the program paperwork was only addressed to installers who had indicated in response to an earlier question that they sometimes filled out the program incentive application forms on behalf of their customers. All five participating RHNY installers who had reported filling out program paperwork mentioned that they were very satisfied (satisfaction rating of 5) with the program application forms.

When asked about their satisfaction with the program website, the average satisfaction rating of participating RHNY installers was high (4.6). However, two of the participating RHNY installers had suggestions for website improvements. One supplier who gave a satisfaction rating of 3 said that it was difficult to find the RHNY page on the NYSERDA website. Another respondent, though otherwise very satisfied with the website, mentioned that the website does not provide an option to remember the user to facilitate future logins.

Program marketing efforts received an average satisfaction rating of 4 from the participating RHNY installers with two respondents being less-than-satisfied with the efforts. The least-satisfied respondent (satisfaction rating of 1) said that he was completely unaware of RHNY marketing efforts outside of the program website. Another respondent, who gave a satisfaction rating of 3, said his company only sold one high-efficiency, low-emission biomass heating system in the past three years that could be attributed to the program marketing efforts.

RHNY received very high satisfaction ratings from participating RHNY installers for the timeliness of incentive delivery, interactions with program staff, and for the overall program, as Table 1-5 shows. The eight participating RHNY installers who did interact with program staff all said that they were very

⁹ As discussed in the methodology section, three installers which the sample design had identified as nonparticipants were later revealed by the interviews to be participating installers. Since the battery of program satisfaction questions only appeared in the participating installer interview guide, these three installers were not asked the program satisfaction questions.

helpful and followed through with their requests, whether these involved helping with out of with the incentive application forms or providing other customer needs.

Table 1-5: Average Program Satisfaction Ratings from Participating Installers

Program Attribute	Participating Installers (n=9)*
Program website	4.6
Marketing efforts	4.0
Timeliness of incentive delivery	5.0
Interactions with programs staff	5.0
NYSERDA RHNY program	4.6

*The sample size for the interactions with program staff was only eight because one participant reported no interaction with the program staff.

Source: Q2 2019 Market Evaluation Team interviews with biomass heating system installers/stores

At the end of the interviews, the interviewer asked participating installers for suggestions on how to improve the design and delivery of RHNY. The following are their suggestions (with the parentheses indicating the number of installers who made the suggestion):

- Increase the level of program marketing and outreach (3);
- Provide information on the future duration of the program on the program website (e.g., so installers will know when program incentives are likely to go away) (3);
- Provide a larger incentive for income-qualified customers (2);
- Allow EPA-certified wood stoves to be program-qualifying (2);
- Provide opportunities for financing through third party sources, such as Energy Finance Solutions (1);
- Conduct more program outreach to senior citizens (1);
- Create a list of qualified distributors of high-efficiency, low-emission heating systems (1); and
- Improve the quality of the program’s facsimile communications (the fax line is very slow and sometimes crashes when an application form is only partially submitted) (1)

Lastly, one participating RHNY installer said that when the program began, it was difficult to use, noting the program implementation improved greatly and would like to see to this improvement continue.

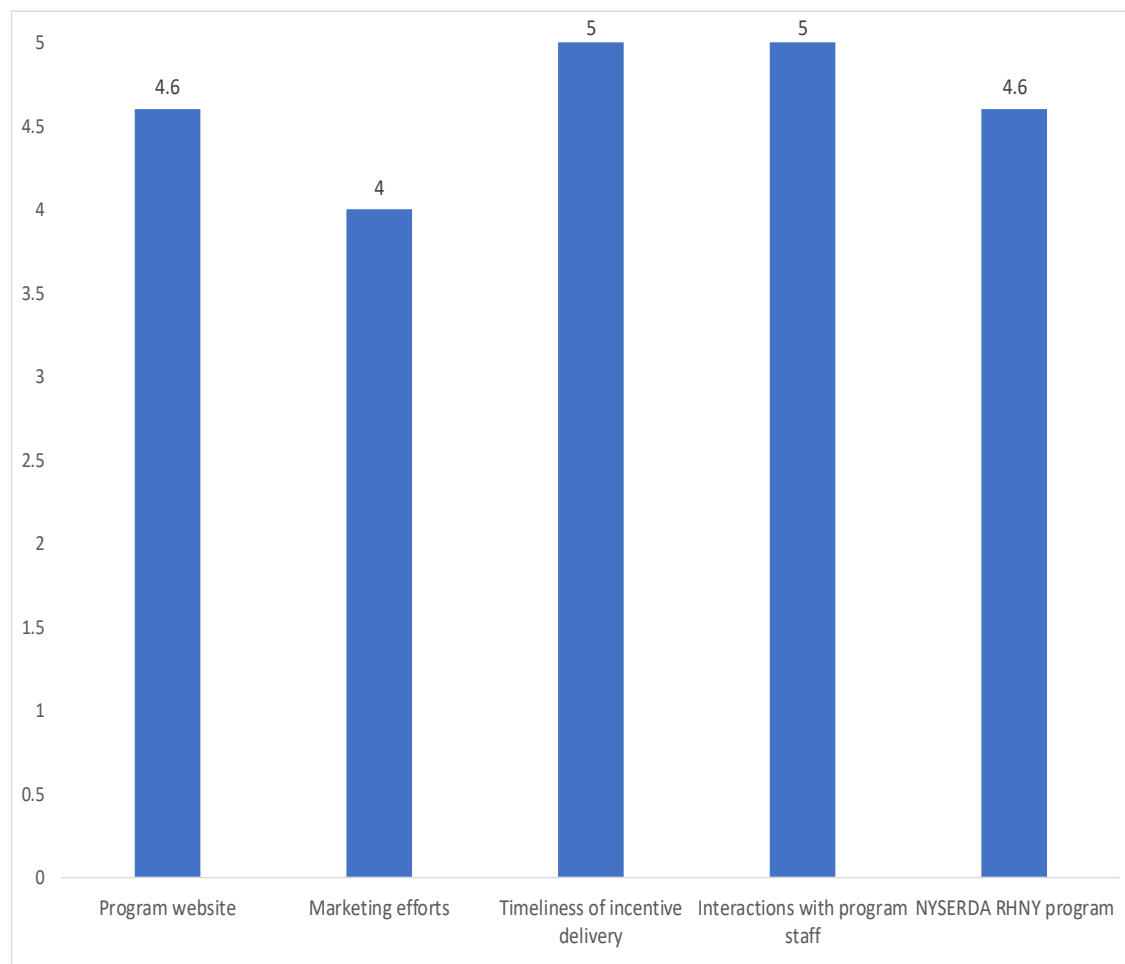
2.4.5 Key Findings and Recommendations from the Biomass Heating System Installers

- **General market awareness of high-efficiency, low-emission biomass systems was high, but awareness of the Renewable Heat NY (RHNY) program was lower.** All nonparticipating biomass system installers reported being aware of high-efficiency, low-emission residential wood pellet stoves and all of them rated their familiarity with the technology as either somewhat familiar or very familiar. However, only half of the nonparticipating installers were aware of RHNY and its incentives. One of the twelve New York Code Enforcement Officers (CEOs) surveyed reported being aware of the RHNY program. In addition, when asked about his level of program familiarity using a five-point scale where five meant “Very familiar” and one meant “Not familiar at all,” the respondent reported a familiarity rating of two.
- **Awareness of the RHNY trainings was high among participating RHNY installers but participation was low, likely due to alternative training options. However, there was interest in RHNY trainings among nonparticipating installers.** Two thirds of the participating installers surveyed indicated they were aware of the RHNY training offered but only two respondents reported to have taken some form of the trainings available through RHNY. However, 83% of the participating RHNY installers and 56% of the nonparticipating installers said they had participated in non-NYSERDA trainings on high-efficiency, low-emission biomass heating systems. Most respondents said they received trainings on such systems from their manufacturer/supplier. Although, none of the nonparticipating installers were aware of the RHNY training opportunities, most of the respondents were interested in this training.
- **Nonparticipating installers reported installing high-efficiency, low-emission biomass systems, but at a lower rate than participating installers. RHNY is capturing two-thirds of the qualifying equipment sales of participating installers.** The nonparticipating installers reported that about 60% of their sales of residential pellet stoves in New York in the past year (2018) were high-efficiency, low-emission models. In contrast, the participating RHNY installers said that 75% of their biomass heating systems sold in New York were RHNY-qualifying units.¹⁰ The participating RHNY installers reported that 67% of their program-qualifying systems sold in New York in the past year received program incentives. When asked why they did not sell all their program-qualifying systems through

¹⁰ Because the Market Evaluation Team assumed that many of the nonparticipating installers would be unfamiliar with RHNY, it could not use terms like “program-qualifying” in the interview questions. Therefore, there is some uncertainty as to comparability between the program-qualifying systems reported by the participating installers and the high-efficiency, low-emission systems reported by the nonparticipating installers.

RHNY, participating installers reported factors such as burdensome paperwork, unfamiliarity with the program, and some of these sales predating their program participation.

- ***Both participating and nonparticipating RHNY installers reported that the profit margins are higher for the high-efficiency, low-emission biomass systems than for the standard systems.*** The participating RHNY installers reported an average profit margin of 34% for the high-efficiency, low-emission biomass systems compared to 26% for the standard biomass systems. The nonparticipating installers reported an average profit margin of 27% for the high-efficiency, low-emission biomass systems compared to 25% for the standard biomass systems.
- ***Participating installers are very satisfied with RHNY.*** The Market Evaluation Team asked the participating RHNY installers about their levels of satisfaction with various aspects of RHNY and the program overall. The interviewers asked the participating RHNY biomass installers to use a five-point satisfaction scale where five indicated “very satisfied” and one indicated “very dissatisfied.” Figure 1-1 shows that the participating installers were very satisfied with RHNY with the lowest average satisfaction rate (for RHNY’s marketing efforts) being 4.0.

Figure 1-3: Participating Installer Satisfaction with RHNY

- The participating RHNY installers had several suggestions for improving RHNY:*** Suggestions made by multiple respondents included increasing the level of program marketing and outreach, providing information on the future duration of the program on the program website, providing a larger incentive for income-qualified customers, and allowing EPA-certified wood stoves to be program-qualifying. Suggestions which were each made by a single respondent included providing opportunities for financing through third party sources, doing more program outreach to senior citizens, and creating a list of qualified distributors of high-efficiency, low-emission heating systems.
- Future evaluations should clarify whether project costs include the impacts of incentives:*** As discussed in the body of the report, an unexpected finding was participating RHNY installers reporting the average costs of standard biomass heating systems to be *higher* than the average costs they reported for high-efficiency low-emission systems. This was surprising because the nonparticipating installers reported standard systems being less expensive and the incentives which

the RHNY program offers are intended to mitigate presumed higher incremental costs for the high-efficiency low emission systems. The Market Evaluation Team suspects some of the participating installers interviewed may have reported the costs of for high-efficiency, low-emission systems after the buydown effects of the RHNY incentives. Future evaluations should clarify this.

2.5 Interviews with Code Enforcement Officers

The Market Evaluation Team completed interviews with 12 New York code enforcement officers in the first and second quarters of 2019. Of the 12 interviews conducted with code enforcement officials, six were county code enforcement officers and six local (e.g., town/village/city) code enforcement officers.

2.5.1 Characterizing NY County and Local Building Code Offices

The interviewers asked the code enforcement officers a series of questions to characterize their building code offices. These included questions about their involvement with building code development, updating, and enforcement. The interviewers also asked about the sizes of these building code offices.

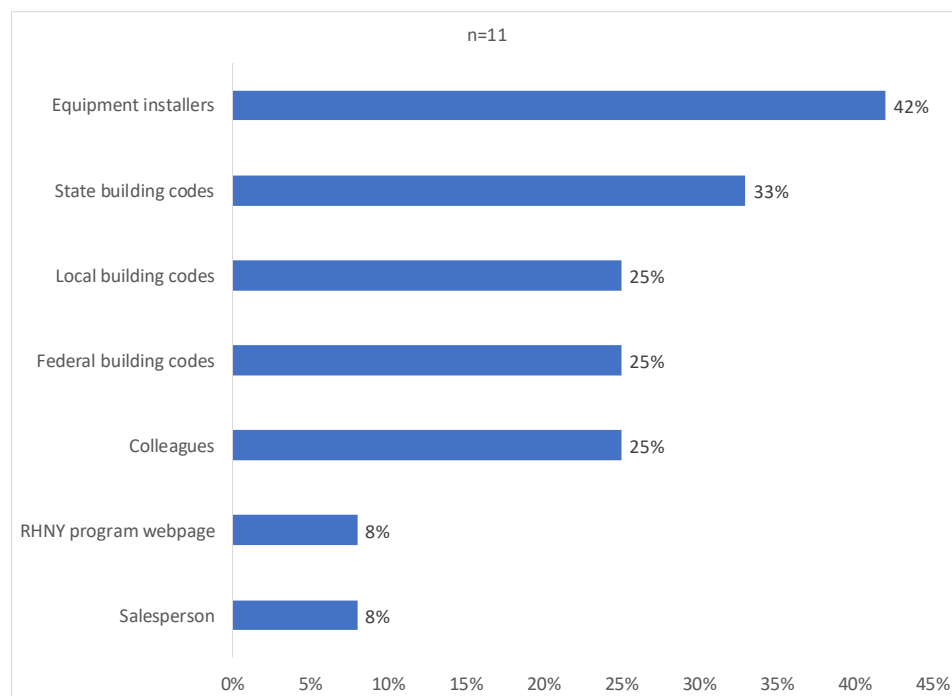
All respondents reported being responsible for, or involved in, monitoring the updates of building codes in their jurisdiction. Of the five county-level respondents, four stated they were responsible for both residential and commercial and industrial (C&I) code enforcement. The other county-level respondent reporting solely being responsible for residential code enforcement. All the local code enforcement officers reported being responsible for code enforcement of residential and C&I sectors.

The county code enforcement officers reported an average of 2.8 code enforcement officers in their offices with a high of eight. All the local code enforcement officers said they were the only code enforcement officer in their offices with one exception (that office had two code enforcement officers).

2.5.2 How Code Officials Learn About Biomass Heating Equipment

The interviewer asked the code enforcement officers where they look for information about biomass heating equipment applicable to New York. Figure 1-4 shows that most code enforcement officer respondents reported obtaining this information from equipment installers. The second-most-frequently reported source of information was existing state codes, closely followed by local/city codes and federal codes.

Figure 1-4. Sources of Information for Biomass Heating Equipment Codes and Standards used by New York State Code Enforcement Officers



Note: Total exceeds 100% because multiple answers were accepted.

Source: Q2 2019 Market Evaluation Team interviews with New York State Code Enforcement Officers

One respondent further explained, “We normally rely on executive law / Department of Environmental Standards for installation of solid fuel appliances. This includes things like the amount of smoke/emissions, and times for restricted use (for example, in the summer).” There were some differences in information sources between the county and local code enforcement officers. The county code enforcement officers were more likely to rely on state building codes than the local code enforcement officers. Not surprisingly, reliance on the local building codes was exclusive to the local code enforcement officers.

2.5.3 Program Awareness

The Market Evaluation Team asked the code enforcement officers about their awareness of RHNY. Only one of the twelve respondents – a local code enforcement officer – reported being aware of the program. This one program-aware code enforcement officer said they first heard about RHNY from the NYSERDA-RHNY webpage. When asked about his level of program familiarity using a five-point scale

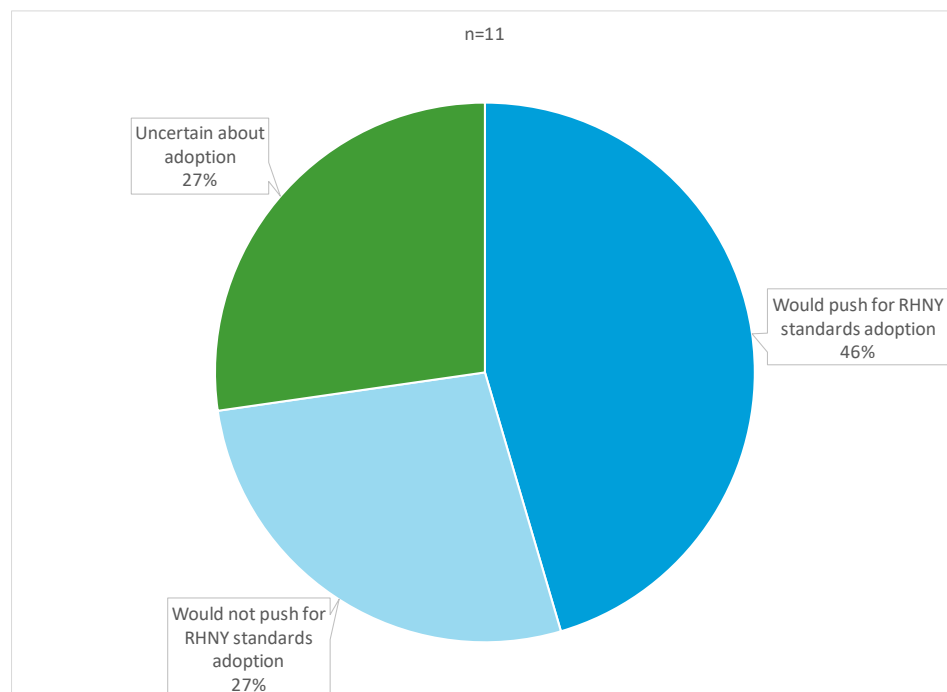
where five meant “Very familiar” and one meant “Not familiar at all,” the respondent gave a familiarity rating of two. The respondent explained that residents within the jurisdiction do not use this equipment technology. Two other code enforcement officers, one county-based and one locally based, said they were uncertain whether they had previously heard about the program.

2.5.4 Support for Adoption of RHNY Standards

After informing all code enforcement officer respondents of the RHNY’s program’s objectives, the interviewers asked whether they would encourage the adoption of RHNY standards within their jurisdictions. Figure 1-5 shows that slightly less than half (45%) of the code enforcement officers interviewed would support adoption with about a quarter opposing adoption and about a quarter uncertain about adoption. Those code enforcement officers who opposed adoption cited factors including this technology being not very prevalent in their jurisdictions and the level of effort involved in adoption being a strain on limited staff resources. Those code enforcement officers who were uncertain about adoption said that NY State Uniform Fire Prevention & Building codes and other federal/state regulations were the primary sources for their codes and standards or that they might consider adoption after further research.

The local code enforcement officers were more willing to support adoption of the RHNY standards than the county code enforcement officers. Information that NYSERDA provided on RHNY training attendees also showed the only code enforcement officers that took the training were local code enforcement officers. The fact that local code enforcement officers were predominantly the sole decisionmakers in their offices may give them more autonomy to make these kinds of decisions. Another factor may be the wider prevalence of biomass heating systems in the localities, as described below.

Figure 1-5: Whether Code Officials Would Support Adoption of RHNH Standards



2.5.5 Prevalence of Biomass Heating Systems

The interviewers asked the code enforcement officers to rate how prevalent biomass heating systems, such as wood pellet stoves, were in their jurisdiction. The respondents were instructed to use a five-point scale where five meant “very prevalent” and one meant “not prevalent at all”. The average score reported by county code enforcement officers was 1.8, with local code enforcement officers reporting a higher prevalence with an average score of 2.6.

2.5.6 Training Opportunities

Finally, the interviewers asked the code enforcement officers about the best ways to train them on new technologies for high-efficiency, low-emission wood heating stoves and boilers. Four of the county code enforcement officers and four of the municipal-level code enforcement officers interviewed stated that they would prefer online training. One county code enforcement officer and one local code enforcement officer said they did not have a preference. “Online or onsite training would probably be best, but time of year is crucial,” the final respondent remarked. “The best time is winter or early spring for code officials, especially for onsite training, because summer months in the northern counties are buildings months with

limited time for additional training.” With the current COVID-19 pandemic it is likely that online training will be even more the preferred option going forward.

2.5.7 Key Findings and Conclusions from the Code Enforcement Officers

- *Code enforcement officers surveyed were divided as to their willingness to adopt RHNY standards into building codes.* Slightly less than half (45%) of the code enforcement officers surveyed said they would support adoption of these standards with 27% opposing adoption and another 27% uncertain about adoption. Those code enforcement officers who opposed adoption of standards cited factors including this technology being not very prevalent in their jurisdictions and the level of effort involved in adoption being a strain on limited staff resources. Those code enforcement officers who were uncertain about adoption of standards said that NY State Uniform Fire Prevention & Building codes and other federal/state regulations were the primary sources for their codes and standards or that they might consider adoption after further research.

3 Methodology

This section describes how the Market Evaluation Team developed the sample frames for the three types of market actors it interviewed (biomass heating system manufacturers, installers of such systems who participated in the RHNY program, nonparticipating installers, and code enforcement officers).

3.1.1 The Biomass Heating System Manufacturers

To develop the sample frame for the biomass heating system manufacturers, the Market Evaluation Team consulted with NYSERDA staff, reviewed the InfoGroup database, and conducted web searches. NYSERDA was most interested in biomass heating system production in New York but only a few of the manufacturers had New York-based production and some had all their production in Europe. Since these European-based manufacturers did have product sales in New York, the Market Evaluation Team included them in the sample frame by interviewing representatives of the companies that served as their United States sales partner or “official United States importer.” For the sake of simplicity, this report will refer to all these interviewees as “manufacturer representatives.” To try to further increase the manufacturer sample frame, the Market Evaluation Team also contacted manufacturers of wood pellets to find out whether they also produce wood pellet stoves. However, none of the pellet manufacturers produced their own biomass heating systems. The final sample frame included 12 biomass heating

systems and the Market Evaluation Team was able to complete interviews with seven of these manufacturers.

3.1.2 Biomass Heating System Installers

The starting point for the participating RHNY biomass heating system installer sample frame were three lists of NYSERDA-approved pellet stove or pellet boiler installers (file names: Pellet-Stove-Participating-Contractors.pdf, qualified-installers-boiler-pellets.pdf, and RHNY Data Evaluation.xls). These lists provided no information about the relative size of the participating companies such as the number of employees or annual revenue. It is the Market Evaluation Team’s standard practice to sort the remaining companies into large, medium, and small company size strata. This company size stratification is important because smaller companies are most numerous, and therefore a simple random sample would result in primarily smaller companies being surveyed.

To estimate company size, the Market Evaluation Team first searched for the biomass heating system installers on the InfoGroup commercial database which NYSERDA provided. InfoGroup provides company employee counts which are good measures of company size. Table 3-1 shows the primary SIC and NAICs codes included in this dataset.

Table 3-1: SIC/NAICS Codes Included in the InfoGroup New York HVAC Installer Dataset

Primary SIC Codes	Primary NAICs Codes
<ul style="list-style-type: none"> • 171101 – Heating Specialties • 171102 – Heating Installers • 171103 – Sheet Metal Work Installers • 171104 – Pipe Thawing • 171105 – Plumbing Installers • 171110 – Furnaces – Repairing & Cleaning • 171111 – Solar Heating Installers • 171112 – Heat Pumps • 171115 – Humidifying Apparatus • 171116 - Air Pollution Control • 171117 – Air Conditioning Installers & Systems • 171118 – Boilers, Repairing & Cleaning • 171119 – Cooling Towers • 171120 – Ventilating Installers • 171124 – Duct systems – Air Conditioning & Heating 	<ul style="list-style-type: none"> • 23822001, 23822002 – Plumbing Htg & Air-Conditioning Installers

<ul style="list-style-type: none"> • 171129 – Heating Systems – Cleaning & Repairing • 171130 – Air Balancing • 171131 – Energy Management Systems & Products • 171133 – Leak Detecting Service • 171135 – Radiant Heat & Cooling Systems • 171139 – Boilers • 171141 – Plumbing Installers Referral Service • 171144 – Solar Heating Systems • 171146 – Steam Fitters • 171152 – Sewer & Drain Cleaning-Service/Repair • 171159 – Air Duct Sealing • 171165 – Fire Sprinkler Systems Installation • 171198 – Plumbing Heating & Air Conditioning • 179603 – Blowers & Blower Systems • 179613 – Clothes-Dryer-Venting-Installation-Coml • 769996 – Instruments-Industrial-Repairing 	
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A standard approach for picking a nonparticipant comparison group for installers is to take the SIC/NAICS codes from the participating RHNY installers and use these codes to find similar companies in a commercial general population database such as InfoGroup. However, when the Market Evaluation Team took NYSERDA’s list of participating RHNY biomass heating system installers and tried to find these installers on s New York HVAC installer InfoGroup list provided by NYSERDA, it only found matches for a small minority of the installers. A closer look at the company names of the participating RHNY installers revealed a variety of company types that were not traditional HVAC installers such as chimney stores, fireplace/stove stores, and farming equipment. Therefore, the Market Evaluation Team requested that NYSERDA provide another New York InfoGroup list with additional SIC/NAICS codes. Table 3-2 shows these additional SIC/NAICS codes.

Table 3-2: Additional InfoGroup Dataset Requested by the Market Evaluation Team

Target Participant Installer Group	Additional SIC/NAICS Codes Requested by the Market Evaluation Team
Biomass Heating System Installers	<i>Chimney Stores:</i> (SIC: 7349-16, 1741-01, and 1741-07; NAICS: 23899055, 23814006 and 23814002)
	<i>Fireplace/Stove Stores:</i> (SIC: 5719-33; NAICS: 44229929)
	<i>Farm Equipment:</i> (SIC: 5083-10, 3523-04; NAICS: 42382005 and 33311103)

Because the name of a given company can often vary in spelling and level of detail from one database to another, the Market Evaluation Team also used street addresses and phone numbers to identify matches of the NYSERDA-approved installers in the InfoGroup data. Despite these additional matching efforts and the expanded InfoGroup database, the team could only find about a fifth of the approved biomass heating system installers in the InfoGroup data. This was inadequate coverage to allow the use of employee counts from the InfoGroup data to sort the installers by size.

Therefore, as a backup solution, the Market Evaluation Team chose to use the number of participating projects in the NYSERDA program tracking database (RHNY Data Evaluation.xls) as a proxy for company size. This database provides the installers used for each program-rebated wood heating project. The Market Evaluation Team sorted the participating RHNY installers based on their number of completed program projects from highest to lowest and then assigned them to four strata (Large, Medium, Small, and Inactive). This was conducted so that the number of completed projects was as equally divided as possible between the Large, Medium, and Small strata.

Because traditional HVAC installers could participate in both the Renewable Heat and the Heat Pump and Solar Thermal GSHP programs, the Market Evaluation Team compared the participating RHNY installer lists for both programs for any potential overlap. Due to concerns about respondent fatigue, the Market Evaluation Team wanted to avoid, if possible, interviewing installers twice (e.g., once for each program). Luckily, this process identified only two installers who appeared on the participant lists for both programs, RHNY and it randomly allocated these two installer types to each of the program sample frames.

In order to create the nonparticipating installer sample frames for both the Renewable Heat and Heat Pump and Solar Thermal – GSHP program evaluations, the Market Evaluation Team had already removed the participating installers from each program’s respective nonparticipating installer frames.

However, there was still a possibility of cross-program duplication between participating and nonparticipating installers. For example, an installer who was a nonparticipant in the Renewable Heat Program might be a participant in the Heat Pump and Solar Thermal – GSHP program. Therefore, the Market Evaluation Team conducted an additional cross-program check for duplication. As an extra measure of caution, the Market Evaluation Team also compared these lists and reassigned any duplications.

Since two other New York evaluation efforts were interviewing traditional HVAC installers in the state at the same time, the Market Evaluation Team conducted a second round of sample filtering at the end of Q1 2019, when these evaluation efforts were concluded. For example, NYSERDA provided the Market Evaluation Team with a list of the traditional HVAC installers that one of the other evaluation teams was sending advanced letters. The Market Evaluation Team removed these installers from its own participating RHNY installer frame, which significantly reduced the size of the available sample.

Table 3-3 and Table 3-4 show the original sample designs for the participating pellet stove and biomass boiler installers (before the number of companies in the sample frame was significantly reduced due to the overlap with other evaluation efforts discussed above). While it could be argued that the inactive installers were not technically “participating” installers, the Market Evaluation Team believed it was important to interview these inactive installers/stores to learn about program design issues or market barriers which may be keeping them from being active in the program.

Table 3-3: Original Sample Design for Participating Pellet Stove Installers

Company Size	Number of Companies	Target # of Completed Interviews
Large	2	2
Medium	3	3
Small	19	11
Inactive	30	6
Total	54	22

Table 3-4: Original Sample Design for Participating Biomass Installers

Company Size	Number of Companies	Target # of Completed Interviews
Large	1	1
Medium	2	2
Small	6	3

Inactive	8	2
Total	17	8

Table 3-5 shows the original sample design for the nonparticipating RHNY installers. As was the case with the participating RHNY installer sample frame, NYSERDA directed the Market Evaluation Team to remove from the sample frame Traditional HVAC contractors which were being surveyed by another NYSERDA evaluation contractor for a separate evaluation. This significantly reduced the number of Traditional HVAC companies available for contact.

The Market Evaluation Team's strategy for determining the number of completed interviews was based on several considerations. When the underlying populations were large enough (e.g., Traditional HVAC, Chimney Stores), the evaluators attempted to achieve a rough balance in target completed interviews across the different company size strata. However, the Market Evaluation Team deviated from this practice when the underlying populations were very small (e.g., Fireplace/Stove Stores). The Market Evaluation Team did analyze data from the Farm Equipment company type but decided not to include these companies in the nonparticipant sample frame because this company type was least represented in the participant sample frame and the Team was concerned that companies which sold a broad range of farm equipment types were less likely to be very knowledgeable about a single product that represented a very small percentage of the products they sell.

Table 3-5: Original Sample Design for Biomass Heating System Installers

Company Type	Company Size	Number of Companies	Target # of Completed Interviews
Traditional HVAC	Large (25+ employees)	142	4
	Medium (6-24 employees)	863	4
	Small (1-5 employees)	1,867	5
Chimney Stores	Large (8+ employees)	62	4
	Medium (3-7 employees)	252	4
	Small (1-2 employees)	391	4
Fireplace/Stove Stores	Large (10+ employees)	2	1
	Medium (4-5 employees)	7	2
	Small (1-3 employees)	8	2
		Total	30

The Market Evaluation Team encountered several formidable challenges in completing in-depth interviews with installers of high-efficiency low-emission biomass heating systems. The primary

challenge in completing in-depth interviews with the traditional HVAC contractors, as noted, was that another NYSERDA evaluation team was already interviewing New York HVAC contractors in Q1 2019, most of these contractors were not available to the RHNY evaluation due to concerns about respondent fatigue.

Another challenge was that biomass heating technologies are much less commonly sold than other heating technologies. Therefore, the Market Evaluation Team's interviewers screened through a lot of installers to find those who sold this technology.

Table 3-6 shows the revised installer sample frame after the removal of the unavailable traditional HVAC contractors and the ineligible companies. It also shows the number of complete interviews by company type and participation status. Comparing Table 3-6 with Table 3-5 shows the significant impact of these removals on the sample frames. The vast majority (>80%) of the ineligible companies were ineligible because they did not sell biomass heating systems. Other reasons for ineligibility include bad phone numbers, closed businesses, and duplicated listings (e.g., the same company listed multiple times due to spelling variations).

Table 3-6: Revised Installer Sample Frame and Disposition

Company Type	Participating RH Installers		Nonparticipating RH Installers	
	Eligible Companies	Completed Interviews	Eligible Companies	Completed Interviews
HVAC	10	1	648	8
Non-HVAC*	62	12	62	3
Total	72	13	710	11

*Includes chimney and fireplace/stove stores.

In addition, to these significant reductions in the size of the installer sample frames discussed above, response rates for installers was low, as shown in Table 3-7. The interviewers reported that the biggest obstacle was that most of the small to medium-sized HVAC contractors are out in the field most of the day and have only limited and unpredictable in-office hours. When out in the field, many of the smaller contractors use answering services to respond to phone calls which lack the knowledge or inclination to respond to a survey. The response rates were likely higher for the non-HVAC contractors because most of these were store locations where somebody was available to answer the phone.

Table 3-7: Response Rates by Sub-Sample

Company Name	Participating RH Installer	Nonparticipating RH Installer
HVAC	10%	1%
Non-HVAC*	18%	13%
Total	17%	2%

*Includes chimney and fireplace/stove stores.

One participating RHHY installer who had initially agreed to an interview discontinued after the firmographic section when it was learned that they had only joined the program when considering buying a fireplace store that ultimately did not occur. As discussed elsewhere in the report, three of the non-HVAC participants were originally a part of the nonparticipant list and were thus not asked certain RHHY participant installer questions (e.g., program satisfaction). For nonparticipants, some respondents were short on time as they were small businesses that could not afford to spend much time on the phone.

3.1.3 Code Enforcement Officers

The code enforcement officer sample frame was developed in a two-stage process. The original focus of the interviews was on New York county code enforcement officers since this group had been emphasized most prominently in the RHHY evaluation plan. NYSERDA staff developed the list of county code enforcement officer contacts based on information available on county websites and telephone calls to county offices. However, when the Market Evaluation Team began contacting the county code enforcement officer, it discovered that only 32 of the 62 counties in the sample enforced code at the county-level. The remaining jurisdictions reported enforcing code at the local level (e.g., city, town, city, community).

For those counties that relied on local code enforcement, the Market Evaluation Team asked the county code enforcement officer if there were specific local governments, they recommended contacting for information about code enforcement practices. The local-code-enforcement counties provided a list of 114 local governments to follow up with, although they only had readily available contact information for three of them. However, NYSERDA staff was able to locate contact information for most of the remainder (97 of the 111) through a search of the local government websites. Table 3-8 shows the updated population, target number of completions, and the final number of completes.

Table 3-8. Code Enforcement Officer Sample Frame and Completed Interviews

Type of CEO	Population	Target Interview Completion	Achieved Interview Completions
County	32	6	6
Municipal	100	6	6
Total	132	12	12