New York State Energy Research and Development Authority (NYSERDA)

Clean Heating and Cooling: Heat Pumps and Solar Thermal Market Evaluation (formerly Renewable Heating & Cooling)

Final Report

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1 INTRODUCTION

1.1 Program Description and Background

The New York State Energy Research and Development Authority (NYSERDA) filed the Renewable Heating and Cooling (RH&C) chapter[1] under the Clean Energy Fund (CEF) on May 8, 2017. The RH&C chapter included the Ground Source Heat Pump (GSHP) and Air Source Heat Pump (ASHP) initiatives which targeted general soft cost reduction strategies for all renewable heating and cooling technologies. On May 15, 2020, NYSERDA revised the name of the chapter from Renewable Heating and Cooling to Clean Heating and Cooling and significantly modified the chapter sub-initiatives to include NYS Clean Heat, a partnership between NYSERDA and the utilities focused on growing the heat pump market in NYS. This evaluation addresses the GSHP and ASHP activities prior to the transition to Clean Heating and Cooling and the addition of the NYS Clean Heat sub-initiative.

The GSHP initiative included a rebate and targeted cost-shared technical assistance offer for larger projects to address the higher pre-development costs. GSHPs are the most efficient RH&C technology and present a near-term opportunity for increased focus to help increase customer awareness and acceptance of RH&C technologies more generally. Therefore, this initiative offered incentives to offset the cost of installation of GSHP systems. Solar Heating and Cooling technologies were not evaluated in this period.

Initiatives evaluated in this study address the multi-pronged market support strategy to encourage greater adoption of GSHPs and high efficiency ASHPs. The GSHP initiative is comprised of several components: community campaigns targeting residential and business adoption of all four RH&C technologies (Community), activities encouraging large-scale and multi-building sites, universities, and state buildings adoption of RH&C technology (Campus), and rebates financially assisting the adoption of RH&C technologies (Rebate). The initiative targeted educating contractors and designers by developing a streamlined, reduced cost Measurement and Verification (M&V) protocol as well as best practice documentation to increase the standardization and predictable performance of GSHP installations. This evaluation study for heat pumps addresses the market research required to measure end user and installer awareness, confidence in, and/or training in high efficiency heat pumps. This data will be used to track

[1] https://www.nyserda.ny.gov/-/media/Files/About/Clean-Energy-Fund/cef-renewable-heating-and-cooling-chapter.pdf

metrics in the Renewable Heating and Cooling Investment Plan (now Clean Heating and Cooling), and other related heat pump initiatives. The 2018-2019 market evaluation period included the assessment of:

- Direct incentives to GSHP and ASHP contractors and distributors to encourage wider adoption of these technologies[2]
- Marketing to GSHP and ASHP contractors to build awareness of the Initiative incentives which includes webinars, email notifications, web banner ads, ads in HVAC industry magazines, and phone calls to key Initiative trade allies when there are key changes in Initiative offerings or requirements.
- Convening an advisory group of GSHP professionals which included manufacturers, representatives from trade association groups such as New York Geothermal Energy Organization (GEO) and the International Ground Source Heat Pump Association (IGSHPA), architects/designers, and engineers.
- A co-op marketing effort where NYSERDA will pay up to 50% of the installer's marketing costs as well as the costs of any marketing or technical training they may offer.
- The Geothermal Clean Energy Challenge which is jointly administered by NYSERDA and the New York Power Authority (NYPA). The Challenge is targeting eight local government buildings (e.g., educational and healthcare facilities) for geothermal projects.

This evaluation commenced in 2018 and addresses the RH&C program offering during the period of 2017 and 2019, prior to the introduction of NYS Clean Heat. Since this research commenced, NYSERDA revised the RH&C offerings significantly. A major change in this offering is the transition of incentive-based payments of heat pump technology installations from NYSERDA to the New York utilities (2020). This development resulted in changes to the planned evaluation of RH&C: Heat Pumps and Solar Thermal. Specifically, to allow for coordinated market evaluations with the utilities in the future, NYSERDA cancelled the participant and nonparticipant end user surveys planned in this research effort.

The testable hypotheses of this initiative and addressed in this market evaluation include:

1. If NYSERDA improves access to reliable information on RH&C solutions, then awareness and confidence will increase, system costs will decrease, and installations will increase.

[2] While both Initiatives passed incentives directly to the installers, the ASHP Initiative did require the installers to in turn pass along these incentives to the end use customer and sign the rebate application form. The GSHP Initiative did not require the installers to pass along these incentives.

2. If NYSERDA supports the development of a customer targeting tool, customer acquisition time and cost will decrease.

3. If NYSERDA supports local clustering of installations, customer acquisition, contractor mobilization and installation costs will decrease.

4. If NYSERDA provides cost-shared technical assistance to large systems, pre-development costs will decrease, and system performance and customer confidence will increase.

5. If NYSERDA develops standardized contracts, data protocols and requirements, and quality assurance processes, soft costs will decrease, confidence in performance will increase and market conditions enabling more private sector investment will be created.

1.2 Summary of Evaluation Objectives

Table 1-1 shows the evaluation objectives as described in the Heat Pump and Solar Thermal evaluation plan along with descriptions of the purposes and methods. While the evaluation plan mentioned solar thermal technologies, it also observed that the RH&C program had not started the Solar Heating and Cooling initiative at the time the evaluation plan had been developed in 2017. [3] Therefore, the evaluation focused primarily on heat pumps although it did ask heat pump installers whether they installed solar thermal technology and about their perceptions of consumer awareness of solar technology.

As noted in the previous section, due to significant changes in the design of the NYSERDA heat pump Initiatives in 2020, NYSERDA decided to defer some participating and non-participating end user surveys to allow for collaboration with the utilities in the future. Therefore, this study was unable to address some of the evaluation objectives which appear in Table 1-1.

[3] "The Heat Pump and Solar Thermal evaluation plan reads "The first initiative to deploy is GSHP through a rebate and targeted cost-shared technical assistance for larger projects to address the higher pre-development costs. GSHPs are the most efficient RH&C technology and present a near-term opportunity for increased focus to help increase customer awareness and acceptance of RH&C technologies more generally. Therefore, this initiative will provide rebates to offset the cost of installation of GSHP systems. Solar Heating and Cooling will be added to the Renewable Heating & Cooling Chapter in a future amendment."

Table 1-1: Evaluation Objectives

Objective	Evaluation Questions	Data Source and Analytic Method(s)
Determine the increase in community awareness of RH&C technologies because of NYSERDA's initiative	- What RH&C technologies are consumers aware of, including heat pumps (HP) and solar thermal (ST)? - What is their depth of knowledge? - Are they aware of community/incentive programs pertaining to RH&C technologies?	Participating and non-participating community members via a self-reporting phone interview or web survey[4]
Measure the reduction in customer acquisition time and cost for RH&C installers in the program (community campaigns and large-scale and multi-building sites)	What is the current average customer acquisition time and cost for RH&C installers?	Participating and non-participating installers via a self-reporting phone interview or web survey
Measure the reduction in cost per installed system in an appropriate sample of communities that do not have community campaigns	- What is the current average cost of an installed system? What is the current average cost for the consumer per install? - What is the current average cost for NYSERDA per install, if applicable?	Participating and non-participating installers via a self-reporting phone interview or web survey Secondary data analysis of project costs provided by sample communities
Measure the energy savings and private investment in the market that resulted in projects outside of, but influenced by, the program	- Were they aware of NYSERDA's program / incentives? Did they install using other sources of funding? What were other sources of funding used? - What was the total cost of the project? - How much of the total cost of the project was covered by incentives, and how much was paid for by the end user?	Participating and non-participating community members and large-scale and multi-building sites via a self-reporting phone interview or web survey

[4] As noted in the previous section, NYSERDA decided to forego these surveys due to a significant change in the heat pump Initiative designs that occurred in 2020.

Objective	Evaluation Questions	Data Source and Analytic Method(s)
Validate the reasons for the increase of customer confidence as demonstrated through increased conversion rate and assess non-participant attitudes toward the benefits of RH&C installations	- What factors/assumptions led the implementer to adopt the technology? - Do consumers believe investing in RH&C technology will result in savings and a positive return on investment (ROI)? - Do consumers believe that they will have a positive experience with RH&C contractors? - Do consumers believe RH&C technologies will perform at or above their expectations/will perform as advertised?	Participating and non-participating community members and large-scale and multi-building sites via a self-reporting phone interview or web survey
Determine if there is an increase in installer confidence in RH&C technologies as a revenue stream	What is the total number of RH&C installers who have installed at least 3 systems in the last 12 months in NYS? Have they increased their line of services/products to include RH&C technologies or include new RH&C technologies? What percentage of their sales are of RH&C technologies? Have they increased their sales of RH&C?	Participating and non-participating installers via a self-reporting phone interview or web survey Secondary data analysis of participating contractors in GSHP Initiatives
Determine level of customer understanding about 1) RH&C value propositions, 2) value of warranties, and 3) effective weatherization for RH&C sizing and design	What value propositions do customers desire and understand? Do customers recognize the importance of post-work warranty protection by qualified, full-service contractors?	Participating and non-participating community members; participating and non-participating installers

1.3 Executive Summary

This section contains a high-level summary of the key findings and recommendations that are described in more detail in the body of the report. These findings are based on in-depth interviews with:

- *Heat pump installers:* During Q4 2019 the evaluation team completed interviews with 23 heat pump installers. All these contractors installed Ground Source Heat Pumps (GSHPs) and 13 of them also installed Air source Heat Pumps (ASHPs). The interviewees included mostly installers participating in the NYSERDA GSHP Initiative along with a few nonparticipants.[5]

- *Heat pump trade association representatives:* In October 2019 the evaluation team also completed interviews with two trade associations that represent installers of GSHP and ASHP technologies servicing New York and other trade professionals.

Some key findings from these interviews with heat pump installers and heat pump trade association representatives include:

- *The NYSERDA Initiative appears to be having a positive impact on the GSHP market in NY:* Two thirds of the 15 participating GSHP installers reported seeing an increase in their sales since joining the Initiative. In addition, one of the two trade association representatives reported market growth in GSHP adoption and installations in areas where the GSHP rebate programs are operating heavily. In addition to the effects of the Initiative incentives, one trade association said that NYSERDA's sponsorship of the Initiative acts as a "seal of approval" which validates the GSHP technology for wary or unfamiliar customers.

- *The GSHP industry in NY is generally profitable:* The average reported profit margin for all installers was 15.9%. The non-participants reported higher average profitability (22.5%) than GSHP Initiative participants (13.9%). The report discusses several possible explanations for this difference including the fact that the participating installers were, on average, larger (allowing them to make up for lower per-project margins via project volume), ambiguities about whether participating installers were reporting net margins (including the impacts of the incentives) or gross margins (without the incentives), Initiative administrative costs possibly reducing margins for participants, and the small number of nonparticipating installers reporting profit margins (n=4) leading to higher variance in estimates.

[5] The Market Evaluation Team completed interviews with 15 of the 82 installers participating in the NYSERDA GSHP Initiative (an 18% response rate). It also completed interviews with eight other GSHP installers who were not listed as GSHP Initiative participants even though six of the eight claimed to have had some recent program activity.

- *The average cost of residential GSHP systems:* The Market Evaluation team asked the installers about the average cost of a smaller GSHP system installed at a residence with smaller defined as 10 tons or less. The installers estimated an average cost of $35,700 (n=20). They cited several variables that could influence the project costs including the size of the house, existence of ductwork or amount of ductwork needed, whether the system had a horizontal or vertical loop, and whether system was a standard water-to-air or a less common water-to-water system.

- *The solar thermal market in NY appears undeveloped:* Of the 15 participating GSHP installers surveyed, four installers reported installing solar thermal systems. Additionally, of the eight nonparticipating GSHP installers surveyed, one reported installing solar thermal systems. When asked why they did not install solar thermal, most GSHP installers surveyed cited a lack of consumer demand for this technology. Only 9 of the 23 installers thought that end user customers were even aware of solar thermal technology.

- *The GSHP industry market actors are generally satisfied with the level of NYSERDA Initiative incentives:* The 15 participating GSHP installers gave the Initiative's incentives an average satisfaction rating of 4.6, using a five-point satisfaction scale where five indicated "very satisfied" and one indicated "very dissatisfied." The heat pump trade association representatives also gave the Initiative incentive a good satisfaction rating (3.9 average rating). However, one installer did claim that the NYSERDA incentives were lower than those offered by the New York utilities at that time.

- *The NY GSHP industry is dissatisfied with the paperwork and permitting requirements for the NYSERDA Initiative.* The 15 participating GSHP installers gave the Initiative's paperwork requirements its lowest satisfaction rating of 2.4. One installer stated it can take 10-12 hours to complete the paperwork for one project and another reported devoting one day per week to paperwork. One trade association representative also claimed that resources needed to complete Initiative paperwork added a substantial cost to GSHP projects.

  Two of the trade association representatives and three of the participating installers also objected to NYSERDA's requirements that incentivized GSHP projects obtain permits. These respondents claimed that many local governments do not require a permit. In these cases, the installers must get these local governments to notify NYSERDA that a permit is not needed. The trade association representatives indicated that because local compliance offers typically spend only a small percentage of their week on permitting, getting these permitting waivers can take a long time.

- *The GSHP industry would like NYSERDA to conduct more marketing of the Initiative in NY:* The 15 participating GSHP installers gave the Initiative's marketing activities its second-lowest satisfaction rating of 3.0 using a five-point satisfaction scale where five indicated "very satisfied" and one indicated "very dissatisfied." Two installers located in the Finger Lakes region said they were dissatisfied because they had not seen any Initiative marketing efforts in their area. One trade association representative gave a satisfaction rating of 4.0 for the Initiatives' marketing to installers but only a 1.0 satisfaction rating for the Initiative's marketing to end use customers.

- *Future evaluations should clarify whether GSHP profitability is net vs. gross:* One possible reason why the installers participating in the GSHP Initiative reported a lower average level of profitability than the nonparticipating installers was that the survey questions did not distinguish between net profitability (including the impacts of rebates) and gross profitability (excluding rebate effects). The Market Evaluation Team recommends that future evaluations and survey instruments are designed to distinguish between the gross and net profit margins of heat pump installers to assure more precise estimates of profit margins.

1.4 Detailed Report Findings

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 Heat Pump and Solar Thermal evaluation plan. It then examines whether this market baseline evaluation can verify any of the RH&C Initiatives' performance metrics which are also in the evaluation plan. This is followed by the evaluation findings from interviews with 23 heat pump installers. Finally, this section presents the findings from interviews with representatives of two heat pump trade associations.

1.4.1 Testing Hypotheses of Program Effects

One of the evaluation objectives was to test the five hypotheses of program effects mentioned in Section 1.2. The original scope of this evaluation was to conduct a market baseline evaluation to establish initial heat pump market conditions in New York followed by two years of follow-up studies to measure trends in key market indicators over time. Because the Initiative was significantly changed, 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 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	Relevant Evidence from the Study
1. If NYSERDA improves access to reliable information on RH&C solutions, then awareness and confidence will increase, system costs will decrease, and installations will increase.	• *Increasing awareness and confidence of RH&C solutions:* The study evidence for this was mixed. o While the study never surveyed customers to measure their awareness of RH&C technologies, it did ask the heat pump installers which of the RH&C technologies they thought the "average" customer was aware of. Seventeen of the 23 respondents said average customers were aware of GSHPs, 16 said that they were aware of ASHPs, nine said they were aware of solar thermal technology; and one said they were of biomass systems. o The representative of one heat pump trade association was satisfied with the information that NYSERDA provided about its heat pump incentives (4 satisfaction rating where 5=very satisfied) and with NYSERDA's marketing efforts. (4 satisfaction rating) o The representatives of the other heat pump trade association were satisfied with the program information that NYSERDA provided to installers (4 satisfaction rating) and with NYSERDA's marketing efforts to installers. (4 satisfaction rating). However, they were very dissatisfied with the program information provided to end use customers (1

Hypotheses of Program Effects	Relevant Evidence from the Study
	satisfaction rating) and the marketing to end use customers (1 satisfaction rating). o The 15 participating installers gave the GSHP Initiative's marketing efforts their second-lowest average satisfaction score (3.0). • *RH&C system costs will decrease:* While the Market Evaluation Team did not have access to a multiyear project cost trend data, it did compare average project costs reported by the 15 installers participating in the GSHP Initiative with average project cost estimates from the eight nonparticipating installers. The average GSHP costs were similar ($36,000 for participants and $34,600 for nonparticipants). • *RH&C system installations will increase:* There was some evidence of the Initiative encouraging increased heat pump sales including: o Two thirds of the 15 participating GSHP installers reported seeing an increase in their sales since joining the Initiative. o One heat pump trade association representative noticed market growth in adoption and installations where the heat pump rebate programs are operating heavily. o The 15 participating installers reported installing an average of 48 GSHP systems per year compared to 35 systems for the nonparticipants. However, in the Market Evaluation Team's experience, rebate programs tend to attract larger and more sophisticated contractors and the participating installers were larger on average (21 employees) than the

Hypotheses of Program Effects	Relevant Evidence from the Study
	nonparticipating installers (6 employees). Therefore, it is unclear whether the higher volume of system installation for the participating installers was due to these "self-selection" effects or due to GSHP Initiative rebates driving the higher volumes.
2. If NYSERDA supports the development of a customer targeting tool, customer acquisition time and cost will decrease.	The customer targeting tool was not fully developed or implemented at the time of this evaluation and therefore the hypothesis that the targeting tool will reduce customer acquisition time and costs was not evaluated.
3. If NYSERDA supports local clustering of installations, customer acquisition, contractor mobilization and installation costs will decrease.	As mentioned above for Hypothesis 1, the participating installers were installing more GSHP projects, on average, than the nonparticipating installers, but this may be due to self-selection effects. As also noted for Hypothesis 1, the average GSHP project costs of the participating and nonparticipating installers were very similar.
4. If NYSERDA provides cost-shared technical assistance to large systems, pre-development costs will decrease, and system performance and customer confidence will increase.	Not evaluated. NYSERDA decided that the Market Evaluation Team should not interview the campuses that had been targeted for large GSHP projects with NYSERDA technical assistance due to concerns that project development was in early stages and that an evaluation effort might confuse the candidate participants.
5. If NYSERDA develops standardized contracts, data protocols and requirements,	• The Market Evaluation Team asked the 15 participating installers to rate their satisfaction with the information about the GSHP Initiative as well as the Initiative's paperwork requirements. Using a five-

Hypotheses of Program Effects	Relevant Evidence from the Study
and quality assurance processes, soft costs will decrease, confidence in performance will increase and market conditions enabling more private sector investment will be created.	point scale where five equaled very satisfied and one indicated very dissatisfied, the participating installers gave the Initiative information a 3.6 average satisfaction rating, the amount of paperwork needed for Initiative participation a 2.4 average rating, and the application process a 3.7 average rating. • When the Market Evaluation Team's interviewed the three RH&C Initiative managers and the RH&C program manager, they indicated that they had developed some draft EM&V protocols for GSHP projects but they had not yet made them public and would issue them "at the appropriate time." Therefore, the Market Evaluation Team did not make these protocols a focus of the installer interviews. • The participating installers surveyed reported a shorter average project length (5 weeks) than the nonparticipants (7 weeks) which could be due to a reduction in "soft costs." However, is important to note that only three of the eight nonparticipants provided an estimate of average project duration and such small samples have high variances.

1.4.2 Initiative Performance Metrics

The Market Evaluation Team also examined whether its research could assess whether the RH&C Initiative was making progress towards its performance metrics listed in the Heat Pump and Solar Thermal evaluation plan. The following table lists the RH&C Initiative 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). The table shows that these performance metrics could not be verified due to the removal of customer surveys and follow-up installer interviews from the evaluation scope. However, the heat pump installer interviews in the baseline year did provide some information on average project costs and installer perceptions of trends in GSHP energy efficiency.

Table 1-3: Examining RH&C Initiative Progress Towards Performance Metrics

Output/ Outcomes	RH&C Initiative Component	Indicators	Evidence from the Evaluation
Increased awareness of RH&C technologies in communities with campaigns	Community	Increased awareness of RH&C technologies in communities with campaigns (%)	Performance metric could not be verified because NYSERDA chose not to launch the community survey due to changes in program design
Acquisition time and costs decrease in community campaigns for college and university large-scale and multi-building sites	All	• Acquisition time in community campaigns and for college and university large-scale and multi-building sites • Costs in community campaigns and for college and university large-scale and multi-building sites	Performance metric could not be verified because the community and campus survey were not fielded for previously stated reasons. In addition, the installer interviews were only conducted for the baseline year and so no data were available on long-term changes in their project costs. Average GSHP project costs for participating and nonparticipating installers in the baseline year were similar ($36,000 for participants vs. $34,600 for nonparticipants)
System performance and customer confidence increase	All	Customer confidence	Performance metric could not be verified because the community and campus surveys were not fielded for previously stated reasons. The market baseline evaluation did ask the 15 participating installers if they observed any changes to the efficiency of GSHP systems since participating in the Initiative. Seven of them said they had noticed no change in efficiency levels, three said they had noticed an increase in efficiency, and the remaining five either did not know or did not provide an answer.
Cost reduction ($ per ton) in installed systems	Community	Cost ($ per ton) in installed systems in community campaigns and for	Performance metric could not be verified because the community and campus survey were not

Output/ Outcomes	RH&C Initiative Component	Indicators	Evidence from the Evaluation
in community campaigns and for college and university large-scale and multi-building sites		college/university large-scale and multi-building sites reduced (%)	fielded for previously stated reasons. In addition, the installer interviews were only conducted for the baseline year and so no data were available on long-term changes in their project costs. Average GSHP project costs for participating and nonparticipating installers in the baseline year were similar ($36,000 for participants vs. $34,600 for nonparticipants)

1.4.3 Interviews with Heat Pump Installers

One important objective of the NYSERDA GSHP and ASHP Initiatives was to encourage wider adoption of these energy-efficient technologies by providing financial incentives to GSHP and ASHP installers to reduce project costs. These Initiatives also provided technology-specific training opportunities for GSHP and ASHP installers in NY.

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 completed interviews with 23 heat pump installers, including GSHP and ASHP technologies. The interviewees included mostly installers participating in the NYSERDA GSHP Initiative along with a small number of nonparticipants.[6] The Team spoke primarily with senior ranking employees within the participating GSHP and ASHP installer businesses including 12 business owners, one vice president, one director of marketing, and one office manager. For

[6] This data collection effort focused on GSHP installers because in 2019 the New York ASHP installers were being interviewed by two other New York evaluation efforts and NYSERDA was concerned about a third evaluation team contacting this same market actor group. In the sample design phase, the Team had predetermined eight of the installers to be nonparticipants based on information in the Initiative tracking data. However, in the interviews six of the eight identified themselves as active participants. Because the Initiative did not identify these six installers as Initiative participants, for the purposes of this report the Team has chosen to keep their original designation as Initiative nonparticipants although this ambiguity does complicate the interpretation of their interview responses.

nonparticipating GSHP and ASHP installer businesses, the Team spoke with three business owners, three general/operations managers and one sales associate. The interviews covered the following topics:

- *Company characteristics:* The interviews covered the size of the companies, services they offer, types of markets they serve, number of systems they recently installed, and their perceptions of customer awareness of GSHP systems and other energy-efficient or renewable heating and cooling systems.
- *GSHP projects characteristics:* The Team asked the installers about the average costs, sizes, profit margins, and duration of installation of their GSHP projects.
- *Initiative impacts and participant satisfaction:* The Team asked the participating installers whether they noticed any impacts of the NYSERDA Initiatives on sales of GSHP systems or the average energy efficiency of these systems. It also asked them to rate their level of satisfaction with the Initiative (overall and with specific elements such as information, incentives, paperwork, etc.) and their reasons for any dissatisfaction.
- *Familiarity with other NYSERDA programs:* The Team asked the participating installers about their familiarity with three other NYSERDA programs; the Geothermal Energy Challenge, the ASHP Initiative, and Renewable Heat New York.

1.4.3.1 Company Characteristics

Of the 23 GSHP installers who the Team interviewed, 20 said they directly installed GSHPs while two said they supported drilling operations for GSHP loop systems and one reported being mainly a distributor of heat pump systems to other Central New York installers. The Market Evaluation Team posed a series of questions to the installers about the size of their companies, the services they offer, and the characteristics of their GSHP system Table 1-4 summarizes these responses broken down by whether or not the installers were participating in the GSHP Initiative.[7] Due to small sample sizes, the results presented may not be representative.

[7] 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).

Table 1-4: Company and Project Characteristics of NY GSHP Installers

Question Topic	Participants** (n 15)	Non participants** (n 8)
Average full-time employees	13-21*	6
Install Air Source Heat Pumps (ASHPs)	9	4
Install Solar Thermal Systems	4	1
Primarily focused on GSHP Installations (>49%)	13	6
Average amount of GSHP Installations per year	48	35
Primarily focused on Residential GSHP Installations (>49%)	8	3
Existing Building GSHP Installation	74%	65%
New Construction GSHP Installation	37%	46%
Average Cost of Small Residential System (<10 tons)	$36,000	$34,600
Average Installation Time, in weeks	5	7

*The participants had one large company with 140 employees. Thirteen is the mean number of employees when this outlier is removed. Twenty-one is the mean number of employees when the outlier is included.
** Due to small sample sizes, the results presented may not be representative.

Additional information which the installers provided on their companies and services beyond that summarized in Table 1-4 included:

- *HVAC equipment installed:* Eleven of the 13 installers who reported installing ASHPs indicated they install systems that are designed for a cold climate. Four non-participants and two participants also said they install other HVAC equipment such as traditional furnaces.

  When asked why they did not install solar thermal or biomass systems, most participating and non-participating installers interviewed cited a lack of consumer demand for these technologies while also stating that there was plenty of market demand for the GSHP, which is the main focus of their business. Other interviewees cited a lack of training or the need to hire new staff if they were to install solar thermal or biomass systems. Some installers interviewed also said that acquiring the specialized GSHP expertise was so demanding that it left little time to gain expertise with non-heat

pump HVAC equipment. Three participating installers said they focused solely on GSHP installations as the reason for not installing solar thermal or biomass systems.

The installers also mentioned other reasons for focusing on GSHPs vs. other HVAC equipment alternatives (besides solar thermal technology). Two of the participating installers cited greater competition within the ASHP market as a reason for focusing more on GSHPs. s. Finally, two participating installers said they chose to focus on GSHPs because they believed the environmental impacts of GSHPs were much less than traditional HVAC options.

- *Installer perceptions of customer awareness of clean or renewable heating technologies:* The Market Evaluation Team asked the installers about their perceptions of the "average customer's" awareness of RH&C technologies. Sixteen of the 23 respondents said average customers were aware of ASHPs and 17 reported that average customers were aware of GSHPs. In contrast, only nine of the installers surveyed reported average customers were aware of solar thermal technology and one respondent reported average customer awareness of biomass systems. Since these installers are more likely to interact with customers who are interested in the GSHP and ASHP technologies, their perceptions of the levels of customer awareness of these technologies are likely somewhat exaggerated.

- *Number of GSHP installations:* The Market Evaluation Team calculated the number of GSHP installations by the sampled installers by first asking the total number of HVAC installations completed by each installer regardless of equipment and then asked a percentage breakdown of ground and air source heat pumps, biomass and solar thermal HVAC installations. Participants reported an average of 48 GSHP installations over the course of the year with a minimum of 1 and maximum of 130 installations. Seven installers were focused solely on GSHP installations. Nonparticipants reported an average of 35 GSHP installations over the course of the year, with a minimum of 1 and a maximum of 115.

- *Target markets:* The installers surveyed reported focusing mostly on the residential GSHP market rather than on commercial, government or multifamily customers. Twelve participant and six non-participant installers surveyed indicated that over 90% of their installations were with residential customers. The installers surveyed also reported focusing much more on existing residential buildings than on new construction with 17 of the interviewees saying that they mainly targeted existing buildings. The Initiative tracking data did not distinguish between retrofits of existing GSHPs (such as installing a new loop system) and new installations at an existing building.

1.4.3.2 GSHP Project Characteristics

The Market Evaluation Team also asked both the participating and nonparticipating installers about the characteristics of their GSHP projects including costs, profit margins, and project duration.

- *GSHP project costs:* The Market Evaluation team asked the installers about the average cost of a smaller GSHP system installed at a residence with smaller defined as 10 tons or less. They estimated an average cost of $35,700 (n=20, rounded to the nearest hundred dollars) with a range of $24,000 to $50,000.

  Installers surveyed identified several factors that would cause the cost a GSHP system to differ from the average system design. The most common factor was the size of the house which would affect the needed system capacity. Five of the 20 participating and nonparticipating installers who provided project cost estimates cited the need for new or upgraded ductwork as a significant factor in increasing costs of a typical GSHP project. Two of these installers said the decision to install a horizontal or vertical loop could affect the price although neither stated which would be the more expensive option. One installer stated that their water-to-water systems could be $15,000-20,000 more expensive than the standard water-to-air systems. Another installer identified a $1,000 easement cost for lake loop installations.

- *GSHP profit margins:* The average reported profit margin for non-participants (n=4) was higher at 22.5% than participants (n=13) margin of 13.9%. Four installers indicated that they did not know their profit margin while one participant said they have a negative profit margin on GSHP installations. This installer cited the increased costs of ductwork in recent years as the main contributor to this negative margin.

  The higher average profit margin for the nonparticipating installers was an unexpected result because, in theory, the NYSERDA Initiative incentives should reduce the cost of the project, whether the incentives are kept by the installers or the customers. There are several possible explanations for this difference. First, the sample of nonparticipating installers reporting their profitability was very small (n=4) and smaller samples have inherently higher variance. Second, the interview guide did not ask the installers to distinguish between net margin (including the impacts of the incentives) or gross margins (without the incentives). While some participating installers reported both their net and gross profit margins, Table 1-4 only shows the average gross margin for the participating installers to allow for better comparability with the nonparticipants (who only have gross margins). Future evaluations

and survey design could ask installers to distinguish between their gross and net profit margins to assure accurate reporting.

Surveyed participating installers also reported a higher average number of yearly GSHP installations (48) than the nonparticipants (35). This may also explain the difference in average profit margin since they could use a higher volume of sales to make up for the lower margin per project. It is also possible that Initiative participation increased project administrative costs (which would negatively impact margin) due to permitting and paperwork requirements (see discussion in next section). Finally, as mentioned earlier, it is possible that some installers who the Team identified as nonparticipants were actually Initiative participants.

- *Project duration:* The participating installers surveyed reported a shorter average project length (5 weeks) than the nonparticipants (7 weeks). However, is important to note that only three of the eight nonparticipants provided an estimate of average project duration and such small samples have high variances.[8]

1.4.3.3 Initiative Impacts and Participant Satisfaction

The Market Evaluation Team asked the participating installers about the impacts of NYSERDA's GSHP Initiative on their business and their overall satisfaction with the Initiative. Ten participating installers (n=15) reported seeing an increase in sales since they began to participate in the Initiative. Of the five participating installers who reported they did not see an increase, one installer said sales remained flat while another said an increase in calls was not translating to sales due to the requirements of higher capacity systems and Initiative participation. Another installer who did not report increased sales due to a lack of Initiative participation and compared NYSERDA's incentives unfavorably to local utility incentives. According to the interviewee, other utilities offered $2,000/ton and no cap compared to NYSERDA's $1,500/ton and 10-ton cap. Two installers surveyed also noted that the NYSERDA incentive could be bundled with the federal tax credit to further buy down the project cost.

[8] The larger average size of the participating installers (13-21 employees depending on whether the outlier company is included) compared to the nonparticipating installers (6 employees) might also explain their shorter project length. However, the impacts of the higher average number of employees for the participating installers would be reduced by the fact that the participating installers are also doing a larger number of GSHP installations than their nonparticipant counterparts (48 vs. 35 on average).

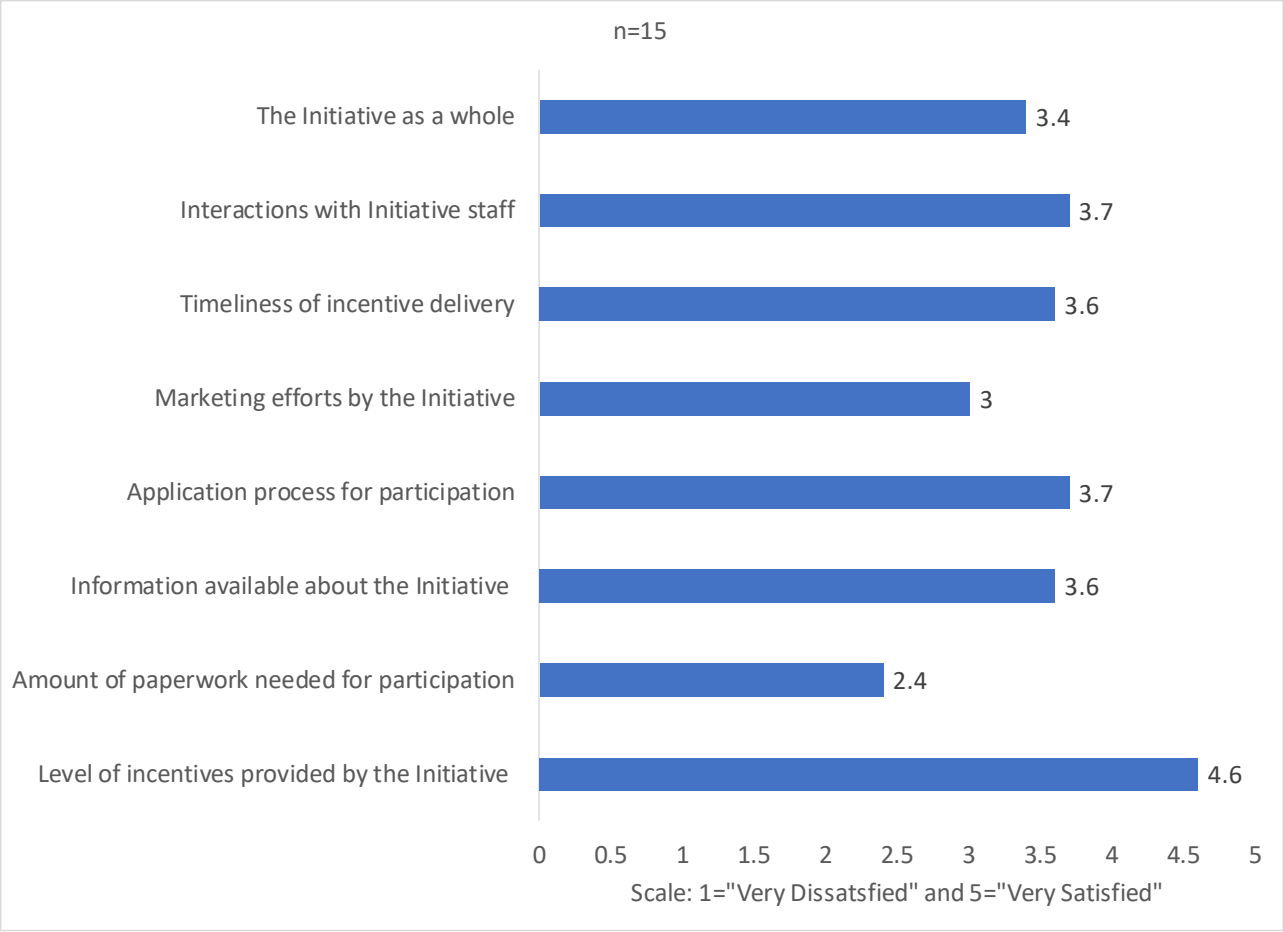
To be eligible for NYSERDA rebates, GSHP systems must meet certain energy efficiency and performance requirements.[9] Therefore, one of the expected program outcomes mentioned in the evaluation plan is "system performance and customer confidence increase."

Since the original scope of this evaluation was to conduct two years of follow-up surveys after this initial market baseline evaluation, the Market Evaluation Team would normally have measured this performance metric by observing trends in installer self-reports of the frequency of high efficiency/performance GSHP systems in New York over this three year period. However, the Team tried to capture an early indicator of this increased performance metric in the market baseline evaluation by asking the 15 participating installers: "Have you noticed any changes in the energy efficiency levels of the ground source heat pumps since participating in this NYSERDA Ground Source Heat Program?" Seven of the surveyed participating installers said they did not notice a change in efficiency levels since joining the Initiative while three installers did notice an increase in efficiency. One installer did not know, and four installers did not provide an answer.

All 15 participating installers provided feedback on the Initiative impacts and satisfaction. The Market Evaluation Team asked these installers to use a five-point satisfaction scale where five indicated "very satisfied" and one indicated "very dissatisfied." Figure 1-1 shows their average satisfaction scores rounded to the nearest tenth. Installers were most satisfied with the level of incentives provided by the Initiative with an average score of 4.6. Installers were neutral to somewhat satisfied with other aspects of the Initiative including the information available about the Initiative, the application process, marketing efforts, timeliness of incentive delivery, interactions with Initiative staff, and Initiative as a whole.

Figure 1-1: GSHP Initiative Satisfaction Scores

[9] These include either being ENERGY STAR listed, or if not ENERGY STAR listed, having certain Air-Conditioning, Heating and Refrigeration (AHRI) ratings and meeting certain minimum Coefficients of Performance (COPs) and Energy Efficient Ratings (EERs).



The Initiative aspect that received the lowest satisfaction score from the surveyed participant installers was the GSHP Initiative paperwork process. Three of the 15 surveyed participant installers cited the building permit requirement as burdensome with one stating it can affect the timeliness of the incentive delivery. Two of these 15 installers cited the amount of time they spend on paperwork as the reason for their low satisfaction score. Specifically, one installer stated it can take 10-12 hours to complete per home and another reported they devote one day per week to paperwork. Another installer cited the Initiative QA spreadsheet as cumbersome. When asked about the Initiative application process, one installer said the requirements were too strict while another said that Salesforce interface can be difficult to navigate. While the paperwork requirements were the largest source of dissatisfaction with the Initiative, two participating installers located in the Finger Lakes region were also dissatisfied because they had not seen any Initiative marketing efforts in their area.

1.4.3.4 Familiarity with Other NYSERDA Programs

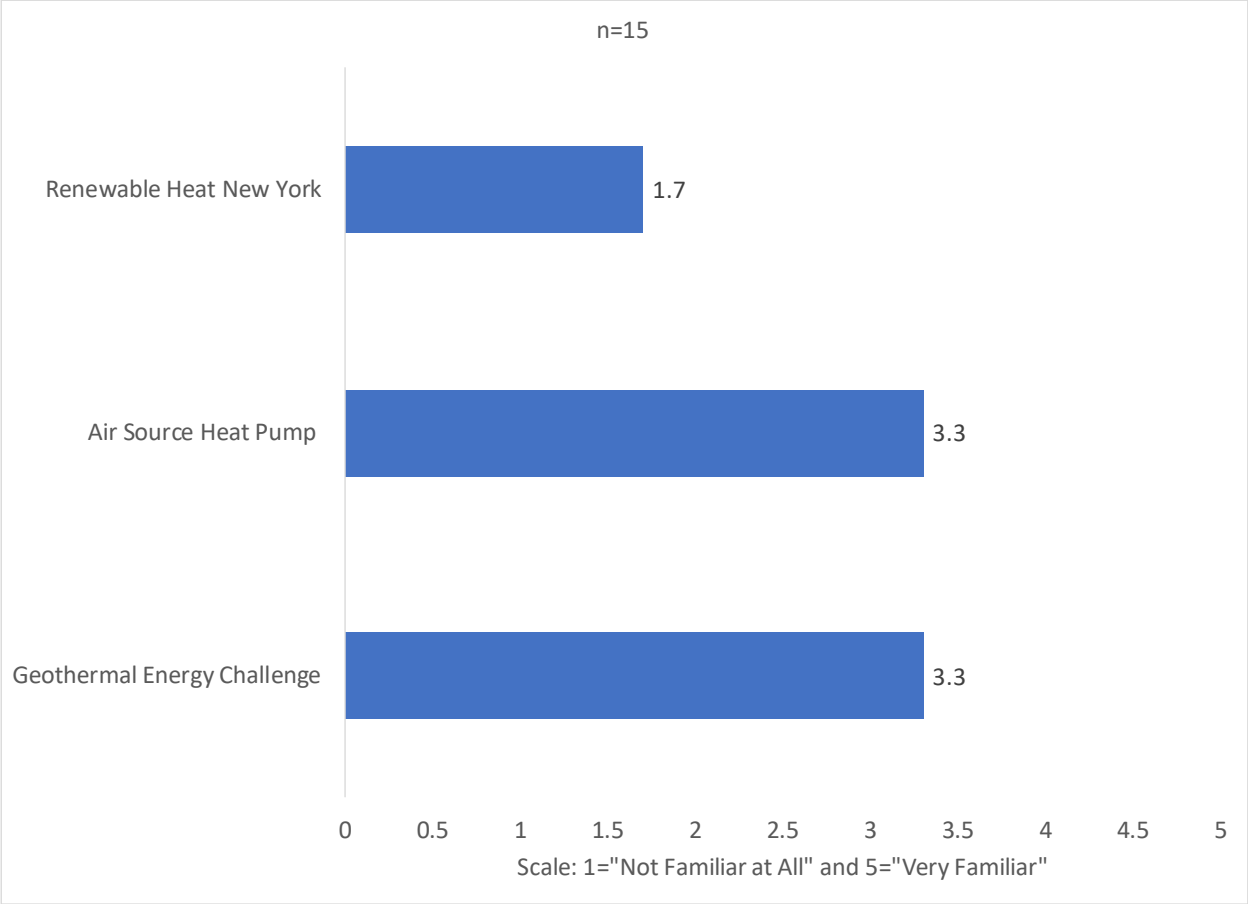
The Market Evaluation Team asked the 15 participating installers about their familiarity with three other NYSERDA programs; the Geothermal Energy Challenge, the Air Source Heat Pump Initiative, and the Renewable Heat New York program.[10] The Team asked the installers to rate their familiarity on a 5-point scale with 5 being "very familiar" and 1 being "not familiar at all." **Error! Reference source not found.** shows the average program familiarity scores. Participating installers said they were either very familiar (n=6) or not familiar at all (n=4) with the Geothermal Energy Challenge resulting in an average score of 3.3.

Six installers who said they installed air source heat pumps reported being familiar or very familiar (score=4 or 5) with the Air Source Heat Pump Rebate Initiative. However, three other installers who installed ASHPs were not familiar with the Initiative. Of the six ASHP installers who were familiar with the air source heat pump program, only two said they submitted rebates through the Initiative.

The surveyed participating installers indicated they were least familiar with the Renewable Heat New York Program with an average familiarity score of only 1.7. Six of the 15 installers surveyed gave a familiarity score of only 1.0. However, only one of the 15 installers surveyed reported installing biomass systems, which likely explains this lack of familiarity.

[10] On May 15, 2020, NYSERDA revised the name of the chapter from Renewable Heating and Cooling to Clean Heating and Cooling

Figure 1-2: Participating Installer Familiarity with Other NYSERDA Programs



1.4.3.5 Key Findings and Recommendations from the Heat Pump Installers

Some key findings and recommendations from these interviews with heat pump installers and heat pump trade association representatives include:

- *The NYSERDA Initiative appears to be having a positive impact on the GSHP market in NY:* Two thirds of the 15 participating GSHP installers reported seeing an increase in their sales since joining the Initiative.

- *The GSHP industry in NY is generally profitable:* The average reported profit margin for all installers was 15.9%. The non-participants reported higher average profitability (22.5%) than GSHP Initiative participants (13.9%). Possible explanations for this difference include the fact that the participating contractors were, on average, larger (allowing them to make up for lower per-project margins via

project volume), ambiguities about whether participating installers were reporting net margins (including the impacts of the incentives) or gross margins (without the incentives), Initiative administrative costs possibly reducing margins for participants, and the small number of nonparticipating installers reporting profit margins (n=4) leading to higher variance in estimates.

- *The average cost of residential GSHP systems:* The Market Evaluation team asked the installers about the average cost of a smaller GSHP system installed at a residence with smaller defined as 10 tons or less. The installers estimated an average cost of $35,700 (n=20). They cited several variables that could influence the project costs including the size of the house, existence of ductwork or amount of ductwork needed, whether the system had a horizontal or vertical loop, and whether system was a standard water-to-air or a less common water-to-water system.

- *The solar thermal market in NY appears undeveloped:* Of the 15 participating GSHP installers surveyed, four installers reported installing solar thermal systems. Additionally, of the eight nonparticipating GSHP installers surveyed, only one reported installing solar thermal systems. When asked why they did not install solar thermal, most GSHP installers surveyed cited a lack of consumer demand for this technology. Only 9 of the 23 installers thought that end user customers were even aware of solar thermal technology.

- *GSHP installers are generally satisfied with the level of NYSERDA Initiative incentives:* The 15 participating GSHP installers gave the Initiative's incentives an average satisfaction rating of 4.6, using a five-point satisfaction scale where five indicated "very satisfied" and one indicated "very dissatisfied." However, one installer did claim that the NYSERDA incentives were lower than those offered by the New York utilities.

- *GSHP installers are dissatisfied with the paperwork requirements for the NYSERDA Initiative.* The 15 participating GSHP installers gave the Initiative's paperwork requirements its lowest satisfaction rating of 2.4. One installer stated it can take 10-12 hours to complete the paperwork for one project and another reported devoting one day per week to paperwork.

- *GSHP installers would like NYSERDA to do more marketing of the Initiative in NY:* The 15 participating GSHP installers gave the Initiative's marketing activities its second-lowest satisfaction rating of 3.0 using a five-point satisfaction scale where five indicated "very satisfied" and one

indicated "very dissatisfied." Two installers located in the Finger Lakes region said they were dissatisfied because they had not seen any Initiative marketing efforts in their area.

- *Future evaluations should clarify whether GSHP profitability is net vs. gross:* One possible reason why the installers participating in the GSHP Initiative reported a lower average level of profitability than the nonparticipating installers was that the survey questions did not distinguish between net profitability (including the impacts of rebates) and gross profitability (excluding rebate effects). The Market Evaluation Team recommends that future evaluations and survey instruments are designed to distinguish between the gross and net profit margins of heat pump installers to assure more precise estimates of profit margins.

1.4.4 Interviews with Heat Pump Trade Association Representatives

Interviewing trade association representatives is a useful way of understanding the heat pump market because such representatives have a broad understanding of market trends, barriers, and dynamics that individual installers cannot provide. At the onset of program development, NYSERDA engaged with trade association representatives for GSHP technologies to be part of its Advisory Group. The Market Evaluation Team completed two interviews with ground source heat pump trade associations (referred to as "associations" henceforth) in October 2019.[11] To maintain anonymity, the report refers to the individual associations as TA1 and TA2.

The main purpose of the interviews is to understand how NYSERDA's GSHP and ASHP Initiatives are impacting the market for renewable heating and cooling systems in New York and how these Initiatives may be improved. A secondary objective of these interviews is to better understand the New York heat pump market, generally, and identify barriers to the wider adoption of energy-efficient heat pump technologies in New York.

1.4.4.1 Trade Association Membership and Services

To better understand how these trade associations operated, The Market Evaluation Team asked the interviewees about their roles, the membership composition of their associations, how they communicate with their members, and which technologies their associations focus on. TA1's representative was a

[11] TA1 was interviewed on October 4, 2019 and was represented by one individual. TA2 was interviewed on October 14, 2019 and was represented by two individuals.

manager of day-to-day operations for their association. Of the 1,450 domestic and international active members of TA1, 170 are active in NYS. The makeup of the active members of TA1 are primarily manufacturers, installers, distributors, utilities, drillers, contractors, architects, engineers, and designers. TA1 reaches out to these active members through digital monthly newsletters, a digital quarterly magazine, and special emails for news that is either urgent or time-sensitive and which needs to be communicated before the next round of newsletters or magazines. In addition to these targeted forms of communication, TA1 is also active on the social media platforms Facebook and LinkedIn. Membership renewals are handled via postage and direct phone calls. GSHP and ASHP technologies are the sole focus of this trade association.

TA2 was represented by the association's executive director and director of operations. There are currently 108 active members in TA2 with only about 10-15 active members outside of NYS in areas such as Canada, Western US, and Southern US. The makeup of the active members of TA2 are primarily contractors, professionals, non-profits, distributors, drillers, and manufacturers. TA2 communicates to their active members by a weekly digital newsletter delivered via email that highlights national and international industry news. TA2 stated that they only directly support and promote GSHP but typically cooperate with ASHP organizations.

The Market Evaluation Team asked the association representatives about the services they offer to their members. Both associations host conferences with TA1 hosting a biannual conference with about 250 attendees and TA2 hosting an annual conference with about 300 attendees. At both conferences, the trade associations provide workshops/exhibitions for technologies as well as conventional presenters on new matters in the industry. Unlike TA2, TA1's conference also hosts training sessions at their conference. TA2 stated that conference attendees include state officials and people who are looking at beneficial electrification of the heating sector in NYS.

Besides the biannual conference, TA1 also hosts training seminars both online and in-person, although with onset of COVID-19 these trainings have been exclusively online. These training can also be self-paced sessions where the trainer is available to answer questions and address concerns over the phone once a week. TA1 currently offers a geo-exchange designer certification course through the Association of Energy Engineers and is in the process of finishing a residential designer certification course and a geothermal inspector certification course. TA2 stated that they cooperate with other associations for certification.

Representatives of both associations said that they coordinate with other trade associations domestically and internationally. These trade organizations include cooperating partners, policy-oriented trade associations, and associations that work on designing technical manuals.

1.4.4.2 Program Awareness & Market Changes

The Market Evaluation team asked the associations about incentive program awareness, incentive program or policy changes that have impacted the market, and their association's working relationships with policymakers. The TA1 representative reported being aware of the GSHP Rebate, Central Hudson GSHP Program, and vaguely familiar with the Geo-Clean Energy Program. The TA2 representatives stated they were aware of NYSERDA's incentive program, federal tax credits, and the Heat Smart program. Both trade associations disseminate information about these programs, both general information and events, through the various communication methods described above (e.g. newsletters, magazines, etc.). Both the TA1 and TA2 representatives stated that their members are generally aware of the heat pump energy efficiency standards promoted by these programs.

The Market Evaluation team asked the respondents about charges in the market for both GSHPs and ASHPs as a result of community or incentive programs in NY. The TA1 representative noticed an increase in training programs in NYS as a result of the GSHP programs while the TA2 representatives noticed market growth in adoption and installations where the programs are operating heavily.

The Market Evaluation team asked the respondents how changes in public policy or regulations might impact the market for GSHPs or ASHPs. The TA1 representative stated that while they are not aware of any changes that have affected the GSHP market in the past year, they do actively work with other associations that have active relationships with policymakers. The working relationship involves open communication between associations about the discussions they have with the policymakers.

The TA2 representatives spoke about four different policy changes or events that have had implications on the GSHP market. The first involves developments from rate cases and the New York Public Service Commission. The TA2 representatives claimed that the trade associations have helped the Public Service Commission recognize "that … when a customer gets a geothermal heat pump, they will be paying much more on their delivery charge even though they are not adding to the demand, the peak demand that is the cause of the delivery rate. "As a result of this," said one of the TA2 representatives, "there has been a Public Service Commission move in several rate cases, as well as in the REV [NY Reforming the Energy

Vision] proceedings, ,,, where they're having utilities come up with stand-by rates that are demand-based that will be applicable and available to geothermal customers."

The second policy change is the existence of the 100-foot rule in NYS[12] that, according to the TA2 representatives, creates an unlevel playing field for electric heating customers since other rate payers are providing this service. The third policy change the TA2 representative spoke about was the Climate Leaderships and Community Protection Act that improved the way the state values global warming potential from natural gas heating services.[13] The fourth and last policy change that the TA2 representatives identified was the denial of pipelines within NYS that led to Consolidated Edison (ConEd) declaring a natural gas moratorium. Responding to this natural gas moratorium in designated areas of NYS, NYSERDA responded with greater incentives in that area. The TA2 representatives reported having a working relationship with policymakers such as the Public Service Commission and NYSERDA. The TA2 is also active in campaigns such as Renewable Heat Now and are involved with the Clean Energy Organization Collaborative which is a group that closely monitors state-level policy changes through biweekly phone calls.

1.4.4.3 Participation Drivers and Barriers

The Market Evaluation Team asked the TA1 and TA2 representatives about drivers of incentive program participation, barriers to incentive program participation, and preferred communication mediums for learning about incentive programs. Representatives of both associations stated that the program incentives are the primary drivers for members of their associations to participate in the programs. In addition to the incentives, the TA1 representative noted that a reduced energy cost for the customer is an important driver of market adoption and the TA2 representatives mentioned that acts as a "seal of approval" which validates the GSHP technology for wary or unfamiliar customers. .

In terms of barriers to program participation by active members, the TA1 representative mentioned that not everyone is aware of the program until after the project is complete. The TA2 representatives mentioned that paperwork and additional hassle added a substantial cost to the projects citing a case of roughly 25% of the incentives being dedicated to paperwork and administrative tasks. Additionally, the

[12] The 100-foot rule in NYS is a state law (16 CRR-NY 230.2) that requires gas corporations to provide a free-of-charge natural gas line service extension up to 100-feet from either (1) the centerline of the public right-of-way or (2) the main if it is closer in proximity to the customer.

[13] New York Senate Bill S6599, which Governor Andrew Cuomo signed into law in July 2019, commits New York to achieve 100% zero emission electricity by 2040 and to reduce emissions to at least 85% below 1990 levels by 2050.

TA2 representatives said that NYSERDA has included a need for local permitting for rebated installations. They stated that while there is no objection in the industry to having permits where required, many compliance officers only work on permits a very short amount of time in a week. They further observed that most local jurisdictions do not require a permit, so it is then up to the local jurisdiction to respond to NYSERDA saying a permit is not needed. Due to the work schedule of compliance officers, permitting has become a difficult task for GSHP and ASHP installers and has provided them with a bad experience.

When asked about the preferred way learning about community or incentive programs that promote energy-efficient GSHPs and ASHPs, both the TA1 and TA2 representatives said that direct email communication would work best so that they could efficiently disseminate that information via their standard ways of communicating to members. With the subsequent onset of the COVID-19 pandemic (the trade association interviews were conducted in October 2019), it is likely that some of the trade associations "standard ways" of communicating with their members (e.g., conferences, onsite trainings) will change.

1.4.4.4 Initiative Satisfaction

To conclude the interview, the Market Evaluation Team asked both trade association representatives to rate their satisfaction with various aspects of the NYSERDA GSHP and ASHP Initiatives. The representatives were told to use a five-point satisfaction scale where 5 indicated being "very satisfied" and 1 indicated being "very dissatisfied." Table 1-5 shows their satisfaction ratings with notes explaining their satisfaction ratings.[14]

[14] TA1 was asked an off-scripted question of which aspect are you most and least satisfied with as the response was a 4 for all answers applicable. The respondent did not have a response to this off-scripted question.

Table 1-5: Trade Association Representative Satisfaction with the NYSERDA GSHP/ASHP Initiatives

Initiative Attribute	TA	Rating	Explanatory Notes
Level of incentives	1	4	NA
	2	3-4	NA
Amount of paperwork	1	Refused	Respondent is unfamiliar with the process.
	2	1-2	The paperwork process caused too much a hassle and costed the project roughly 25% of the provided incentive.
Information available about incentives	1	4	NA
	2	4 for industry; 1 for public	The public is generally unaware of the program which creates an unlevel playing field for GSHPs.
Application process	1	Refused	Respondent is unfamiliar with the process.
	2	4	NA
Marketing efforts	1	4	NA
	2	4 for industry; 1 for public	The public is generally unaware of the program which creates an unlevel playing field for GSHPs.
Timeliness of incentive delivery	1	Refused	Respondent is unfamiliar with the process.
	2	1	The permitting process required by NYSERDA is a major barrier to incentive delivery.
Interactions with Initiative staff	1	4	NA
	2	4-5	Respondent mentioned that this rating is given with hesitation since the permitting process has become a pain point for the association.
Initiative as a whole	1	4	NA
	2	3	NA

1.4.4.5 Key Findings from the Heat Pump Trade Association Interviews

Some key findings from the interviews with heat pump trade association representatives include:

- *The NYSERDA Initiative appears to be having a positive impact on the GSHP market in NY:* One heat pump trade association representative noticed market growth in adoption and installations where the heat pump rebate programs are operating heavily. A trade association representative also said that NYSERDA's sponsorship of the Initiative acts as a "seal of approval" which validates the GSHP technology for wary or unfamiliar customers.

- *The heat pump trade associations regard the GSHP Initiative's permitting requirements as onerous:* Two of the trade association representatives objected to NYSERDA's requirements that incentivized GSHP projects obtain permits. These respondents claimed that many local governments do not require a permit. In these cases, the contractors must get these local governments to notify NYSERDA that a permit is not needed. The trade association representatives indicated that because local compliance offers typically spend only a small percentage of their week on permitting, getting these permitting waivers can take a long time.

- *The heat pump trade associations had mixed assessments of the Initiative's marketing efforts:* The representative of one heat pump trade association was satisfied with the information that NYSERDA provided about its heat pump incentives (4 satisfaction rating where 5=very satisfied) and with NYSERDA's marketing efforts (4 satisfaction rating). However, the representatives of the other heat pump trade association were satisfied with the program information that NYSERDA provided to installers (4 satisfaction rating) and with NYSERDA's marketing efforts to installers.(4 satisfaction rating). However, they were very dissatisfied with the program information provided to end use customers (1 satisfaction rating) and the marketing to end use customers (1 satisfaction rating).

2 Methodology

This section describes how the Market Evaluation Team developed the sample frames for the GSHP installer interviews.

2.1 Sample Design for the GSHP Installers

The starting point for the participating GSHP installer sample frame was a list of 82 NYSERDA-approved GSHP contractors (file name: GSHP Approved Contractor List.xls) which NYSERDA provided. While this list had good contact information, it lacked information about the relative size of the companies. This company size stratification is important to this evaluation methodology because smaller companies are most numerous, and therefore a simple random sample would result in primarily smaller companies being surveyed.

To get estimates of company size, the Team first searched for the GSHP installers in the InfoGroup commercial database which NYSERDA provided. InfoGroup provides company employee counts which are good measures of company size. Initially NYSERDA provided a dataset of New York HVAC contractors.

Table **2-1** shows the primary SIC and NAICs codes included in this dataset.

Table 2-1: SIC/NAICS Codes included in the InfoGroup New York HVAC Contractor Dataset

Primary SIC Codes	Primary NAICs Codes
• 171101 – Heating Specialties • 171102 – Heating Contractors • 171103 – Sheet Metal Work Contractors • 171104 – Pipe Thawing • 171105 – Plumbing Contractors • 171110 – Furnaces – Repairing & Cleaning • 171111 – Solar Heating Contractors • 171112 – Heat Pumps • 171115 – Humidifying Apparatus • 171116 - Air Pollution Control • 171117 – Air Conditioning Contractors & Systems • 171118 – Boilers, Repairing & Cleaning • 171119 – Cooling Towers • 171120 – Ventilating Contractors • 171124 – Duct systems – Air Conditioning & Heating • 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 Contractors 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	• 23822001, 23822002 – Plumbing Htg & Air-Conditioning Contractors

However, when the Market Evaluation Team compared the list of participating GSHP installers provided by NYSERDA to the New York HVAC contractor InfoGroup list (which it called "Traditional HVAC"), it only found matches for a small minority of the installers. A closer look by the Market Evaluation Team at the company names of the participating installers revealed a variety of company types that were not

traditional HVAC contractors. Therefore, the Market Evaluation Team requested NYSERDA provide another New York InfoGroup list with some new SIC/NAICS codes. Table 2-2 shows these additional SIC/NAICS codes.

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

Target Nonparticipant Contractor Group	Additional SIC/NAICS Codes Requested by the Team
GSHP Installers	*Geothermal* (SIC: 1711-32, 5074-20, 5084-44 and 3433-02; NAICS: 23821031, 42362046, 42383076 and 33341404) *Wells and Drilling* (SIC: 1781-03, 1781-01 and 1711-02; NAICS: 23711009, 23711005 and 23822020)

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 try to find 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 third of the approved GSHP installers in the InfoGroup data. This was inadequate coverage to allow the Market Evaluation Team to use employee counts from the InfoGroup data to sort the GSHP installers by size.

Therefore, as a backup solution, the Market Evaluation Team chose to use the number of participating projects in the NYSERDA GSHP Initiative tracking database (GSHP Rebate Program Customer Contact List 1.xls) as a proxy for company size. The Market Evaluation Team sorted the participating GSHP installers based on their number of completed Initiative projects from highest to lowest and then assigned

them to four strata (i.e., Large, Medium, Small, and Inactive), so that the number of completed projects was as equally divided as possible between the Large, Medium, and Small strata.[15]

Table 2-3 shows the sample design for the participating GSHP installers. The Team attempted to interview the full population of Large and Medium contractors and reserved over two-thirds (22 out of 30) of the targeted interviews for companies who had some activity in the GSHP Initiative. While it could be argued that the inactive contractors were not technically "participating" contractors, the Market Evaluation Team believed it was important to interview these contractors to learn about program design issues or market barriers which may be keeping them from being active in the Initiative.

Since the Market Evaluation Team has typically found trade ally interview response rates to be in the 20% range, this goal of trying to complete 30 interviews out of a population of 82 – a 37% response rate – was ambitious. As discussed in the report, the Market Evaluation Team was only able to complete interviews with 15 of the 82 participating installers – a 18% response rate. Due to the low number of completed interviews, results presented are not statistically significant.

Table 2-3: Sample Design for GSHP Participating Installers

Company Size	Number of Companies	Target # of Completed Interviews
Large	3	**3**
Medium	5	**5**
Small	25	**14**
Inactive	49	**8**
Total	**82**	**30**

The sampling process for the nonparticipating GSHP installers began with the same InfoGroup lists mentioned above. The Market Evaluation Team first removed the names of the participating contractors from these InfoGroup lists. Then, to make these InfoGroup datasets more relevant to the target nonparticipant installer groups, The Market Evaluation Team reviewed the detailed SIC/NAICS codes to filter out non-relevant companies. It then used the InfoGroup data on the number of company employees to sort the remaining companies into large, medium, and small company size strata – with each stratum having roughly equal number of employees in total. As noted, this company size stratification is

[15] The number of projects for installers in each size stratum ranged from 51-70 projects for those in the Large stratum, 26-37 projects for those in the Medium stratum, and 1-22 projects for those in the Small stratum. Installers in the Inactive stratum had no projects in the NYSERDA GSHP Initiative tracking database even though they were listed on the NYSERDA website as an approved contractor.

important because smaller companies are most numerous, and therefore a simple random sample would result in primarily smaller companies being surveyed. Finally, The Market Evaluation Team randomized the companies within each company type/company size stratum.