

Moving a Mountain: An Update on The Task of Shifting a Market

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ABSTRACT

In 2022, the Sponsors of Mass Save® redesigned and expanded their support for electrification with heat pumps, with the aim of transforming residential and commercial markets for space conditioning and water heating. This substantial and growing initiative is evaluated annually to track market progress, with the goal of eventually quantifying market effects. The first two evaluations studies provided early evidence that increased support for heat pumps has affected these markets. This paper builds on these results with those of the most recent annual evaluation and of the first annual companion cost study to track trends in residential heat pump equipment and installation costs over time. The companion cost study used invoices from program-supported heat pump installations and web-scraped heat pump prices to establish typical proportions of equipment, labor and other costs by equipment type. The newest studies provide evidence of (1) increased residential and commercial heat pump adoption from 2022 to 2023 and (2) attribution to the Sponsors' efforts to encourage customers to adopt heat pumps. This shows the approach was effective for the period examined. The studies also found that the total costs of program-supported residential heat pump systems installed in Massachusetts increased at a greater rate than inflation from roughly 2019 to 2023, driven by equipment costs, but there was no evidence of a relationship between program activities and these higher costs. The study also found that, while heat pump market shares expanded over the research period, installer confidence in heat pumps among more experienced residential heat pump contractors declined. The paper examines sources of these trends.

Introduction

In 2022, the Sponsors of Mass Save,¹ a collaborative of Massachusetts' electric and natural gas utilities and energy-efficiency service providers, redesigned and expanded their support for electrification with the aim of transforming markets for heat pumps for space conditioning and water heating in homes and businesses. This market transformation effort is substantial and continues to grow, particularly for residential-type equipment. For example, the number of program-supported residential air source heat pump systems installed with Sponsor support more than doubled between 2021 and 2023, from about 18,000 to 39,000 per year. The programs also support heat pumps and other electrification efforts for commercial and industrial customers, though at a smaller scale than for residential customers. Collectively, the electrification efforts make up a substantial portion of the \$4.5 billion slated for the state's energy-efficiency expenditures between 2025 and 2027.

Since 2022, NMR Group, Inc. (NMR) and DNV have been conducting annual evaluations of Mass Save heat pump support with the objectives of assessing heat pump market shares and program penetration, market progress, and qualitative evidence for attribution over time, and, eventually, of quantifying market effects from the programs. A 2024 ACEEE Summer Study conference paper (Nevius, et al. 2024) described the long-term evaluation approach, which combines theory-based evaluation and cross-sectional analysis with time series data and requires hard-to-obtain sales data to calculate the market share of qualifying equipment. It also described key findings of the first two studies: (1) a baseline study for PY2021 that sized and characterized the Massachusetts heat pump markets and established initial values of key market progress indicators, and (2) a PY2022 study that sized the markets for 2022 and assessed changes since the baseline for selected indicators (NMR Group, Inc. and DNV 2024). This paper refers to these as the "Baseline" and "Interim" studies, respectively. Since then, a third

¹ Mass Save offers a wide range of services, rebates, incentives, trainings, and information to empower residents, businesses, and communities to make energy-efficiency upgrades. The Sponsors of Mass Save comprise Berkshire Gas, Cape Light Compact, Eversource, Liberty, National Grid, and Unitil.

annual study (the “PY2023/2024” study) has sized the markets for 2023 and estimated changes in market progress indicators through 2023 or 2024 (NMR Group, Inc., and DNV 2025). NMR has also completed the first of a series of companion studies to track trends in heat pump equipment and installation costs (the “HP invoice” study) (NMR 2024).

This paper draws on the results from all four studies to describe key changes in the Massachusetts space conditioning and water heating equipment markets and presents customer and installer perceptions of heat pumps from 2021 through 2023 or 2024. Because the Massachusetts markets for residential heat pumps have progressed more quickly than the markets for C&I heat pumps, the paper focuses more on trends in markets for and barriers to the adoption of residential heat pumps than C&I.

Research Focus and Approach

Baseline, Interim, and PY2023/2024 studies. To meet the research objectives of the Baseline, Interim, and PY2023/2024 studies, the evaluation team reviewed the program theory, logic models, and proposed indicators of market effects or market progress (“MPIs”) to identify appropriate approaches to assessing market progress and attribution and ultimately to estimating net savings. This included operationalizing and measuring MPIs, sizing the Massachusetts markets for space conditioning and water heating in existing buildings using secondary data, assessing market shares and program penetration of qualifying equipment, and identifying and collecting data needed to quantify market effects at a future date. Table 1 shows the types of data the studies collected and the data sources. Table 2 shows the year of focus, data source, data collection method, sampling approach, and completed sample size of the primary data collection activities undertaken in each study.

Table 1. Types and Sources of Data Collected

Types of Data Collected and Sources of Each							
Sources: D (distributors), M (manufacturers), I (installers), PC (participant customers), GC (General Residential Customers), PT/I (program tracking data & invoices), S (secondary data)							
	D	M	I	PC	GC	PT/I	S
Sales of HVAC equipment by count and by heating capacity at 47°F and 5°F and of water heaters by count and capacity in gallons	✓						
YOY percentage changes in sales	✓						
Equipment stocking practices	✓						
Heat pump purchase & installation costs			✓			✓	
Heat pump market trends	✓	✓					
Installation sizing practices			✓				
Attitudes towards heat pumps & their efficacy			✓	✓	✓		
Awareness of heat pumps					✓		
Market progress indicators	✓	✓	✓	✓	✓		
Program penetration						✓	✓

Table 2. Primary Data Collection by Study and Year of Focus or Participation

Study	Focus Year(s)	Group	Method	Sampling Approach	Completed Sample
Baseline	2021	Manufacturers	Phone interview	Census attempt	10
Baseline	2021	Participant distributors	Phone interview	Census attempt	15
Baseline	2021	Participant installers: C&I	Phone interview	Census attempt	20
Baseline	2021	Participant customers: C&I	Mixed mode	SRS	95
Baseline	2021–22	Participant installers: Res	Web survey	PPS	43
Baseline	2021	Participant customers: Res	Web survey	SRS	798
Baseline	2023	General customers: Res*	Web survey	SRS	5,555
Interim	2022	Participant customers: Res	Web survey	SRS	716
PY2023/ 2024	2023	Participant distributors	Phone interview	Census attempt	15
PY2023/ 2024	2023–24	Participant installers: Res	Web survey	PPS	57
PY2023/ 2024	2023	Participant customers: C&I	Mixed mode	SRS	90

* Fielded as add-on questions to a survey of general residential conducted as part of the Massachusetts Residential Building Use and Equipment study (Guidehouse 2023).

While the Baseline, Interim, and PY2023/2024 studies focused on heat pumps for use in existing homes and C&I buildings, they also collected data on non-heat pump equipment for context, as listed below.

- Air source heat pumps (ASHPs): air-to-air ducted and ductless systems (split or packaged) and variable refrigerant flow (VRF) systems. Each compressor represents one system, with capacities under 5.4 tons deemed residential-duty and capacities over 5.4 tons deemed commercial-duty. For these studies, the team considered all VRFs to be commercial-duty, regardless of capacity. The market effects indicator studies used cold-climate status as a proxy for ASHPs that would qualify for Mass Save support.
- Heat pump water heaters (HPWHs).
- Central air conditioning systems (CAC): residential-duty non-heat pump split or unitary systems and commercial-duty non-heat pump, split or unitary systems using direct expansion (DX) cooling, excluding chillers.
- Fossil fuel-fired heating systems: furnaces, boilers, and combination boilers.
- Fossil fuel-fired and electric resistance water heaters: residential- and commercial-duty storage and instantaneous, excluding indirect water heaters.

Heat pump invoice study data collection. In the HP invoice study, which focused only on program-supported residential heat pumps,² NMR examined invoices from a sample of centrally ducted ASHPs, mini-split air-source heat pumps (MSHP), and HPWHs supported by Sponsor programs and installed primarily in existing homes between 2021 and 2022 (Table 3). NMR supplemented this invoice sample with data for ASHP, MSHP, and ground source heat pump (GSHP) projects from between 2019 and 2021 from databases published by the Massachusetts Clean Energy Center (MassCEC) and with heat pump equipment prices scraped from distributor and retailer websites in the summer of 2020 and fall of 2023. With this data, NMR developed estimates of wholesale

² These comprised residential-duty HPWHs and central ducted ASHPs and ducted or multi-split MSHPs meeting cold climate specifications for air source heat pumps. The HP invoice study also analyzed ground source heat pump costs, but these are not reported here.

equipment prices and total installed costs of program-supported equipment in constant dollars (January 2024 USD).

Table 3. Heat Pump Invoice Data Sample Summary

Source	Vintage	ASHP	Ducted/Mixed MSHP	Ductless MSHP	HPWH	GSHP
Mass Save	2021–2022	227	76	414	69	7
MassCEC	2019–2021	11	2,212		–	186

Research Limitations and Sources of Uncertainty

- The market indicator studies’ findings are based on data from participating distributors and installers only; therefore, they may not represent the entire residential or C&I equipment markets. However, the studies found that nearly all the HVAC and water heating distributors serving Massachusetts participated.
- As the studies could not identify the entire population of market actors, the authors had to rely on some assumptions subject to uncertainty to extrapolate the findings to the full populations.
- The information gathered from market actors was self-reported, and thus subject to errors such as socially desirable responding or faulty recall.
- Not every market actor sold or installed every equipment type. The variation in the types and volumes of equipment sold or installed across market actors makes it difficult, if not impossible, to achieve a sample that is consistently representative across all equipment types.
- There was no industry standard definition for cold-climate ASHPs in 2021, making the estimates of 2021 cold-climate heat pump market share especially uncertain.

Massachusetts Heat Pump Market Insights

This section presents estimates of heat pump market shares (i.e., the percentages of space conditioning and water heating sales that heat pumps comprise), equipment prices and installation costs, and progress toward market outcomes – first for residential and then for commercial equipment. It also presents installers’ residential ASHP sizing practices and perceptions of residential heat pumps.

Here, the term “program” refers to the Sponsors’ support for heat pump measures offered through various Mass Save initiatives. A “unit” refers to a system or piece of equipment, with ASHP systems counted by the number of compressors. Note that, since distributors do not know where equipment was ultimately installed, they reported data based on equipment type rather than customer type.

To estimate market shares, the evaluation team first sized the Massachusetts space conditioning and water heating markets, estimating market sales of equipment installed in residential and in commercial settings based on data obtained from multiple secondary sources. The approaches for sizing the 2021 markets in the Baseline study are described in the ACEEE paper “Electrifying Changes: Assessing Effects of Program Support on Massachusetts Heat Pump Markets” (Nevius et al., 2024). The PY2023/2024 study used the same approaches to size the 2022 and 2023 residential and commercial markets. The team then integrated 2024 sales estimates from participating distributors with the market-level data to develop 2024 Massachusetts market share estimates.

The share of heating equipment in the market was estimated using three metrics: 1) units sold, 2) heating capacity at 47°F, and 3) heating capacity at 5°F. While unit estimates provide insights into the volume of new equipment entering the market, capacity estimates offer additional context on how much of the heating load is met by each equipment type. Because premises served by space conditioning equipment other than heat pumps typically have one central heating or cooling system, while the same space could be served by multiple heat pump compressors, relying solely on unit shares can be misleading, particularly when evaluating displacement of fossil fuel heating by heat pumps. Thus, shares of units are not a direct indicator of shares of space served.

Residential heat pump market shares. From 2021 to 2023, heat pump shares of the Massachusetts residential-duty heating and cooling equipment markets increased substantially. In 2023, heat pumps comprised more than one-third (36%) of the residential-duty heating equipment units sold in Massachusetts – up from 25% in 2021 – and almost half of the residential-duty cooling equipment units (49%) – up from 33% in 2021 (Figure 1). As predicted by the program theory, this arose from the displacement of fossil fuel heating equipment and traditional central air conditioners. In terms of heating capacity at 47°F, heat pump heating shares are estimated to have increased from 12% in 2021 to 19% in 2023; at 5°F, they are estimated to have increased from 10% to 17% (Figure 2). While the heat pump share of the residential water heating market also increased, heat pumps still account for a much smaller share of the market for water heating than space conditioning (4% in 2023, up from 2% in 2021).

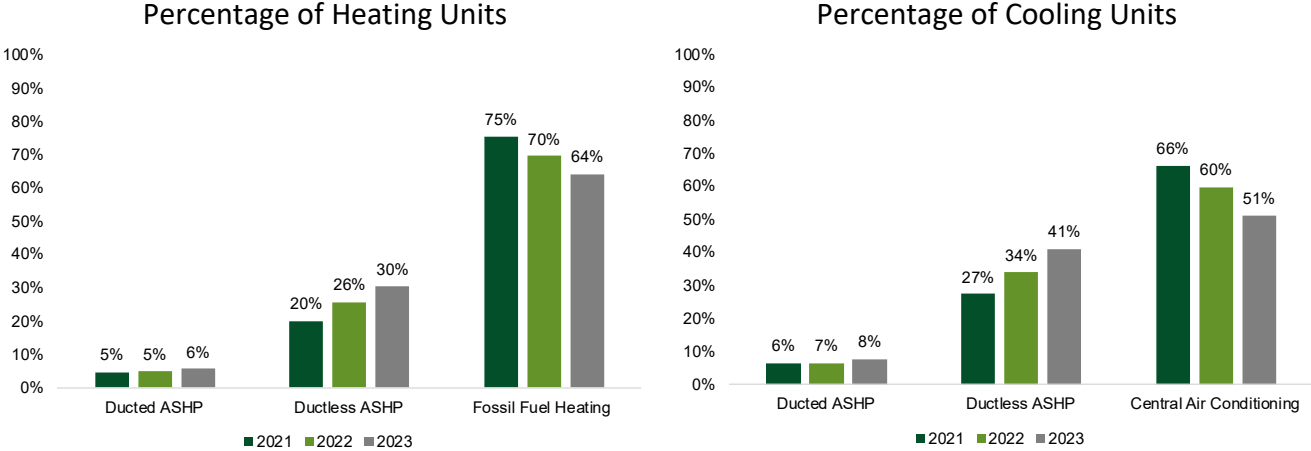


Figure 1: Estimated Massachusetts residential heating and cooling market shares, 2021 to 2023

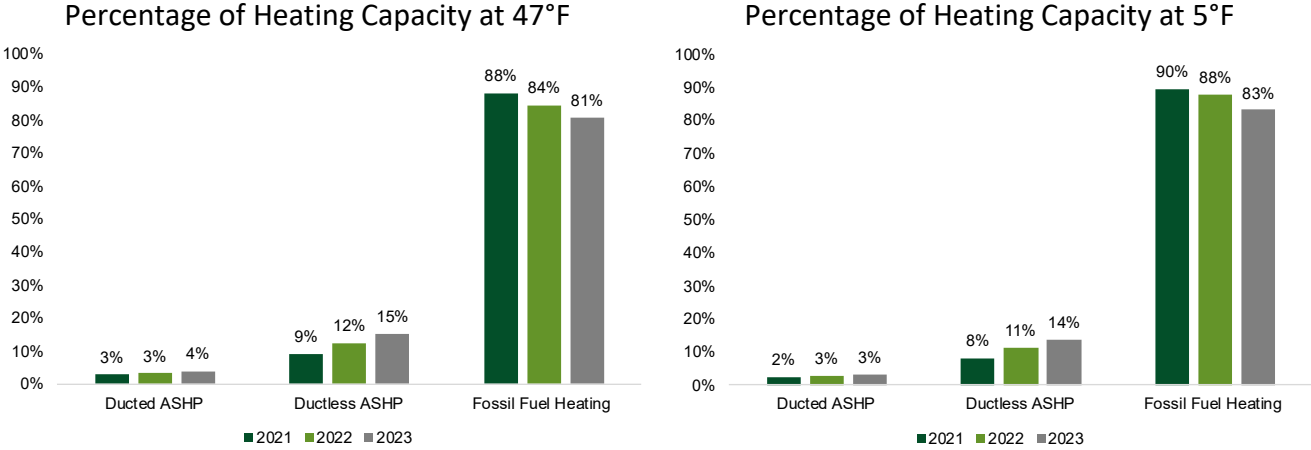


Figure 2: Estimated Massachusetts residential heating market shares by capacity, 2021 to 2023

Residential heat pump equipment prices and installation costs. The HP Invoice study examined changes in the costs of program-supported heat pump installations from 2019 to roughly 2022–2023. It found that the fraction of project costs attributed to equipment prices for common space-conditioning heat pump types increased in this period (Figure 3). This shift is correlated with changes in the national and northeast consumer price indices (CPI) and the HVAC industry producer price index (PPI). In general, one would expect equipment costs to decrease as the scale of adoption increases and manufacturing techniques improve. However, numerous factors in recent years, such as shipping disruptions in the Suez and Panama canals (2021 and 2023–2024 respectively) and other supply chain constraints have served to drive up prices. It is also possible that contractors’ changes in equipment mark-up practices have contributed to this trend. Given these confounding factors, as well as inconsistencies

across related equipment categories in our sample, there was no evidence of a relationship between program incentives and higher heat pump project costs.

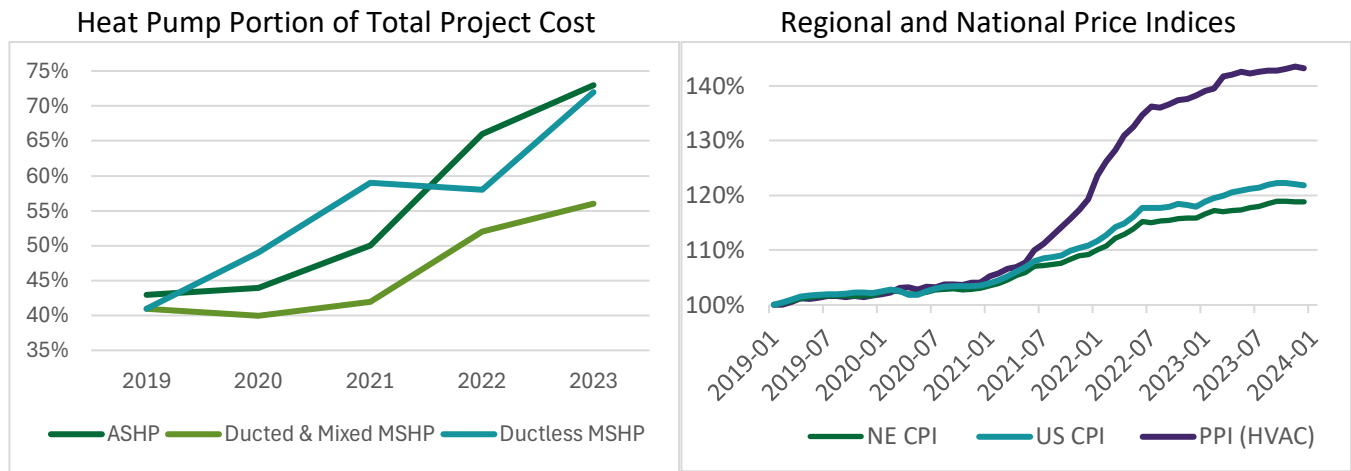


Figure 3: Equipment cost proportion of heat pump installation costs and price indices, 2019 to 2023

By contrast, trends in overall project costs are mixed; these included labor, miscellaneous materials, and equipment costs.³ Inflation-adjusted costs for ductless mini-split projects increased slightly over the period, while those for ducted projects decreased slightly, but there were no statistically significant trends in total project costs. Table 3 presents the change from 2022 to 2023 in equipment and total project costs for MSHP and ASHP in January 2024 dollars from program invoices sampled by the study. The study also found evidence that HPWH heater costs had increased over time but could not estimate the percentage increase, due to small sample sizes and a clustering of projects within a narrow window.

Table 3. Change in Equipment and Total Costs of Sampled Program Invoices from 2022 to 2023, in January 2024 \$

Heat Pump Type	Heat Pump			Project		
	Change	n (2022)	n (2023)	Change	n (2022)	n (2023)
Ductless MSHP	38%	49	2	3%	172	10
Ducted & Mixed MSHP	29%	7	4	18%	32	4
Ducted ASHP	35%	22	7	-2%	106	15

The installer survey conducted as part of the PY2023/2024 study corroborated these findings, with installers reporting increases in wholesale residential ASHP prices of 23% on average between 2022 and 2023 – substantially more than the rate of inflation and more than other types of heating equipment. The installers also reported increases in installation labor costs that were similar for heat pump and non-heat pump equipment. Water heating installers reported that wholesale prices for HPWHs had increased at a greater rate than for other types of water heaters, but they were not asked to estimate the percentage increase.

Progress toward anticipated residential market outcomes. The Baseline, Interim, and PY2023/2024 studies assessed progress towards market outcomes expected from the programs, as summarized in Appendix B of NMR Group, Inc., and DNV (2025). If the direction of changes in market effects indicator values over time is generally consistent with the expected direction per the program theory, this can serve as supporting evidence that the changes in the market are at least in part driven by Sponsors’ support for heat pumps. The studies have established indicator baselines for all 20 residential market outcomes predicted by the program theory and logic model, with between one and four progress indicators for each outcome, and measured changes from the baseline for 16 of

³ Miscellaneous costs include permitting, disposal of old equipment, etc. Labor costs in some projects covers electrical upgrades or ductwork.

these outcomes. Taken together, the results across the studies show evidence of initial or ongoing change in the direction predicted by the program theory and logic model for 12 of the 16 outcomes, with some mixed findings for two others. Other evidence of attribution includes:

- Market actors indicated that the program was partially responsible for the growth in residential heat pump sales from 2021 to 2022. Distributors most frequently cited Mass Save support as reasons for both the growth in their sales of cold-climate ASHPs and decreases in their sales of fossil-fuel fired boilers, furnaces, and central air conditioning from 2022 to 2023.
- Distributors indicated that, since 2021, they had increased supply chain resources devoted to residential heat pump markets partially due to the programs.
- Manufacturers and distributors indicated that the number of heat pump trainings they offered, and attendance at manufacturer-offered trainings, increased from 2021 to 2022, partially due to the program. They also indicated that the programs influenced the training topics.
- Market actors' estimates of the percentage growth in unit sales of residential ASHPs from 2022 to 2023 were exceeded by the percentage growth in program-supported residential ASHPs during the same period, and market actors' estimates of the percentage growth in HPWH sales over the period were close to the growth in program-supported HPWH sales. This suggests that the programs have been driving equipment sales growth.

These findings and additional qualitative evidence reported in the studies suggest the Sponsors' support for heat pumps contributed substantially to the changes in the markets from 2021 to 2023. They also provide evidence of the effectiveness of the program changes that began in 2022.

ASHP sizing practices. Both the Baseline and PY2023/2024 studies surveyed participating residential HVAC installers. In 2023 the former study surveyed installers who participated in 2021, and in 2024 the latter study surveyed installers who had participated in 2023. While many more installers participated in 2023 than in 2021, some installers participated in both years and were eligible for both surveys. The surveys showed installers expressing high levels of confidence in their technicians' ability to install residential ASHPs correctly in both years, indicating that the ASHP sizing practices of participating installers had improved from 2023 to 2024. In this period, participating HVAC installers made increasing use of the ASHP system sizing practices the Sponsors promote, with majorities reporting that in 2024 they adhered to Mass Save sizing guidance on three of four sizing practices.⁴ Specifically, in 2024,

- Almost two-thirds (63%) of installers reported their company always uses Manual J for sizing whole home systems, up from 25% in 2023, a statistically significant difference.⁵
- More than three-quarters of installers (77%, up from 44% in 2023) reported they select systems as close as possible to Manual J load calculations, a best practice.
- Nearly all installers (95%) reported their company primarily uses Manual J, S, or D calculations to determine the heating capacity of ASHP systems (nominally higher but not statistically different from 84% in 2023).

Confidence in ASHP performance. As with 2023, in 2024 the majority (two-thirds or more) of participating HVAC installers reported they often or always recommend heat pumps for heating, not just cooling, in situations where it would be appropriate. The percentage of installers reporting they often or always recommend ductless ASHPs for heating increased significantly from 2023 (71%) to 2024 (94%). More than nine out of ten installers (92%) reported being "somewhat" or "very" satisfied with the overall performance of ASHPs in 2024.

⁴ The exception was the rate at which respondents reported their companies gathered very detailed information for Manual J load calculations (i.e., a rating of 9 or 10 on a scale of 1 to 10) (24% in 2023 and 25% in 2024).

⁵ All statistically significant differences are at the 90% confidence level.

Perception of ASHPs as full heating solutions. Despite this and the increase in residential ASHP market share noted earlier, participating installers remain somewhat skeptical of using ASHPs as total replacements for oil, propane, and gas heating systems. Specifically:

- The rate at which HVAC installers “somewhat” or “strongly” agree that cold-climate heat pumps can fully replace oil, propane, and gas heating systems dropped significantly from 2023 to 2024 (from 50% in 2023 to 24% in 2024), suggesting that in 2024 HVAC installers have less faith in cold-climate ASHPs as complete replacements for oil, propane, and gas heating systems than in 2023.
- There was no improvement in the rate at which HVAC installers “somewhat” or “strongly” agreed that in cold climates, ductless ASHPs should be used for cooling only (62% in 2023 versus 52% in 2024, not a statistically significant difference)
- While installers reported high levels of satisfaction with most aspects of ASHPs in 2024, they reported the lowest level of satisfaction (53% in 2024 versus 62% in 2023) and the highest level of dissatisfaction (44% in 2024 versus 16% in 2023) with the ability of cold-climate ASHPs to meet customer space heating needs even on the coldest days.

In addition, the results suggest that the relative frequency of callbacks for ASHPs increased more than non-heat pump equipment from 2022 to 2023. Two in five installers (40%) reported getting more callbacks for ASHPs in 2023 than 2022.

To better understand the reasons behind these findings, the team examined the relationship between participating installers’ perceptions of ASHPs in 2024 and the relative length of their experience installing them, as well as firm size. We grouped installers by “experienced” versus “newer” and firms by small, medium, and large size. We defined an installer as “newer” if they (1) belonged to the stratum of firms that joined the Mass Save Heat Pump Installer Network (HPIN)⁶ in 2023 and were not associated with any records in the 2022 program data, or (2) if they reported that they started to install ASHPs in 2022 or 2023. We defined “experienced” installers as all those that did not qualify as “newer” installers.⁷ We grouped installers into large versus medium and small firms based on the number of incentives recorded for each firm in 2022.

The team’s analysis of participating installers’ confidence in ASHPs and satisfaction with them revealed that, in 2024, experienced installers had more negative perceptions of ASHPs as full heating solutions than newer installers, and that large, experienced installers had more negative perceptions of ASHPs as full heating solutions than small and medium experienced installers. Specifically:

- Experienced installers have less confidence than newer installers in cold-climate ASHPs as full replacements for fossil fuel heating systems. Larger experienced installers reported less confidence in heat pumps as full replacements than the experienced small and medium installers. Almost two-thirds (63%) of experienced ASHP installers somewhat or strongly disagreed that these heat pumps are suitable full replacements for fossil fuel heating, but only 20% of newer installers shared this view. This difference is statistically significant. Three percent of experienced large ASHP installers somewhat or strongly agree that heat pumps are suitable replacements versus 39% of experienced small and medium ASHP installers.
- Experienced large installers agreed that in cold climates, ductless ASHPs should be used for cooling only at significantly higher rates than experienced small and medium installers. More than half of experienced large installers somewhat or strongly agree that ductless heat pumps should be used for cooling only in cold climates (53%), compared to only 8% of experienced small and medium installers. This difference is statistically significant.
- In 2024, both newer and experienced installers were less satisfied with the rate of callbacks for ducted heat pumps than for ductless heat pumps. However, experienced ASHP installers reported lower levels of

⁶ Installers that participate in the HPIN have provided proof of EPA certification and insurance in the state of Massachusetts and have completed heat pump installation training.

⁷ The explosive growth in the number of residential installers participating in the HPIN from 2022 to 2024 could result in major differences in the composition of the participating installer base over time, potentially complicating trend analysis.

satisfaction with rates of overall performance and customer callbacks for ductless heat pumps than newer installers. Specifically, 76% of experienced installers said they were somewhat or very satisfied with the rate of customer callbacks for ductless systems, compared to 95% of newer installers. Additionally, 87% of experienced installers reported they were somewhat or very satisfied with the overall performance of these systems, compared to 100% of newer installers. These differences are statistically significant.

We traced at least some of the negative sentiment of experienced installers toward ASHPs as full heating solutions to increased callbacks for ASHPs. Installers who somewhat or strongly disagreed that cold-climate ASHPs are good full replacements for oil, propane, and gas heating systems were slightly more likely to report dissatisfaction with the rate of customer callbacks with ASHPs (a low correlation, not statistically significant) and somewhat more likely to say that between 2022 and 2023 the rate of customer callbacks increased more for ASHPs than for other types of non-heat pump equipment (a moderate correlation, statistically significant at the 90% confidence level). These correlations suggest that the increased rate of callbacks may influence a negative opinion of heat pumps as full displacement for some heat pump installers.

In an open-ended question in the 2024 survey, when asked how market conditions had changed for residential ASHPs since January 2023, three heat pump installers offered anecdotal evidence that customers were less likely to opt for full displacement because of the requirement added in 2024 to either disable or remove existing heating equipment to qualify for the whole home rebate.

Participating residential installers' attitudes toward HPWHs. There was a statistically significant drop in the rate at which participating water heating installers agree that their company regularly recommends HPWHs, from 68% in 2023 to 45% in 2024. Coupled with a lack of change in other measurements of water heating installers' perceptions of HPWHs, this suggests that installers may be growing somewhat skeptical of HPWHs' ability to meet their customers' residential water heating needs. To better understand the reasons, the team examined the relationship between installers' perceptions of HPWHs in 2024 and how long they have been installing them, grouping HPWH installers into "experienced" versus "newer."

As with the ASHP installers, we found that experienced installers' attitudes towards HPWHs were more negative than the newer installers'. Because the survey asked fewer questions about HPWHs than ASHPs, we could not trace the source of this difference. In 2024, experienced HPWH installers reported significantly lower rates of agreement than newer installers that HPWHs are good replacements for fossil fuel and electric resistance water heaters (33% versus 76% newer) and that their company regularly recommends HPWHs (34% versus 72%). However, there was no significant difference between experienced and newer installers in the rates at which they would recommend HPWHs in appropriate situations.

C&I heat pump market shares. As Figure 3 shows, heat pumps remained a relatively small portion of the commercial heating market from 2021 to 2023. While most commercial heat pumps sold in this period were VRFs, in 2023 they represented only 5.2% of total commercial heating capacity sold. Compared to other commercial heat pump equipment, VRF adoption appears to have grown the most (27%) from 2022 to 2023. At 5°F ambient temperature, the heat pump market shares are smaller than at 47°F. This is because at 5°F ambient temperature heat pump equipment heating capacity decreases while fossil fuel equipment heating capacity remains the same. Heat pump market share increased for cooling equipment as well (Figure 4). For cooling, the study looked at heat pump equipment, direct expansion systems, and conventional split and packaged air conditioners.⁸VRFs also represented the largest share of commercial heat pump cooling capacity sold from 2021 to 2023, and grew from 8.6% of cooling capacity sales amongst the surveyed technologies in 2021 to 17.1% in 2023. In 2023, VRFs comprised the largest heat pump share of the C&I cooling market across all heat pump types (17%) – however, there was essentially no change in the heat pump share of the water heating market (from 1.3% in 2021 to 1.6% in 2023).

⁸ We excluded chillers from the analysis since heat pumps are less likely installed to replace them.

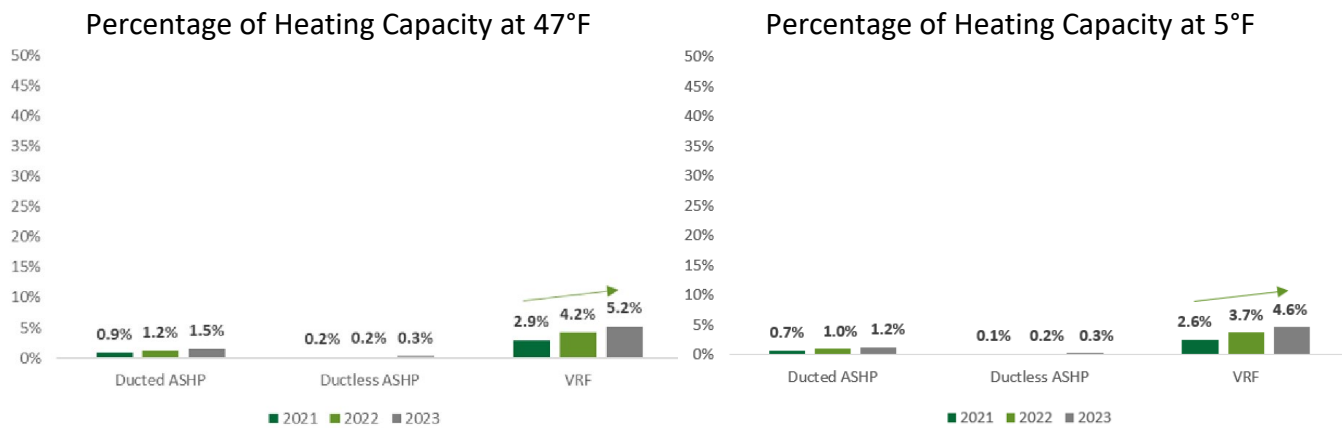


Figure 3: Estimated Massachusetts C&I heating market shares, 2021 to 2023

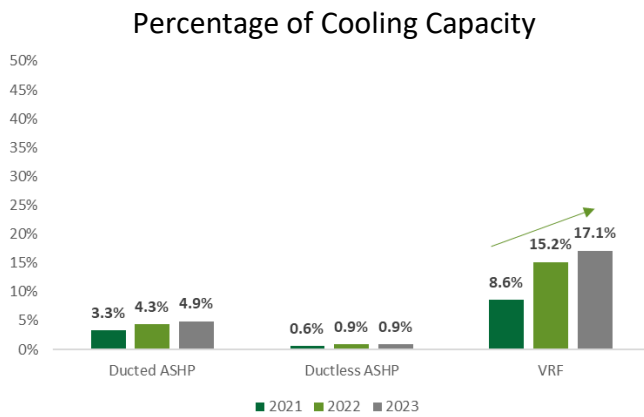


Figure 4: Estimated Massachusetts C&I cooling market shares, 2021 to 2023

Changes in C&I heat pump costs from 2021 to 2023. Based on limited data, as in 2021 C&I customers that installed a heat pump system in 2023 reported paying, on average, more than those who installed fossil-fuel-fired equipment for space heating. The limited 2021 and 2023 data suggest that installation costs for commercial-duty fossil-fueled equipment were notably lower than for heat pumps, and that heat pump installation costs increased by roughly 50% from the baseline year of 2021. This was substantially higher than the general inflation rate of 17% from January 2021 to December 2023, as measured by the Consumer Price Index (CPI). This finding aligns with the residential heat pump pricing trends discussed earlier in the memo.

Progress toward anticipated C&I market outcomes. As with the residential markets, the studies assessed the direction of changes in C&I market effects indicator values against market outcome expectations, summarized in Appendix B of NMR Group, Inc., and DNV (2025). The studies established indicator baselines for all 11 C&I market outcomes predicted by the program theory and logic model, with between one and four progress indicators for each outcome, and measured changes from the baseline for 10 of these outcomes. The Baseline and Interim studies measured changes for five of 12 expected outcomes in the C&I heat pump markets, and the PY2023 study for six of the outcomes. Together, the Baseline and Interim studies found evidence of change in the theorized direction of indicators of four of the five outcomes from 2021 to 2022, with the fifth inconclusive. The PY2023 study found evidence of change in the expected direction for three of the six outcomes from 2022 to 2023; two others showed mixed results and one no change. While these findings provide some support for the attribution of C&I market changes from 2021 to 2023 to the Sponsors' support for heat pumps, the evidence is weaker than for residential. The most supportive evidence includes:

- From 2022 to 2023, the percentage increases in program-supported commercial equipment in the program tracking data were larger than the market actor-estimated percentage increases in heat pump sales for the market. This was also the case in the previous study for the period from 2021 to 2022.
- Three of the six indicator groups for which new measurements were available for 2023 showed evidence of movement in the direction predicted by the program theory and logic model, two showed mixed results, and one showed no change.
- The growth rate of C&I program-supported heat pump equipment from 2022 to 2023 was higher than the rate of growth in market-level sales of heat pump equipment. This was true for 2021 to 2022 as well.
- While data on program-induced sales for commercial ASHPs, VRFs, and HPWHs is limited, distributors indicated that the program induced close to one-third (30%) of commercial-duty ASHP and VRF sales and about half (49%) of commercial-duty HPWH sales in 2023.

Other qualitative evidence of attribution from distributors was less promising. Of the five distributors who said their sales of VRFs increased from 2022 to 2023, two attributed their increase in sales to Mass Save rebates or incentives. The assessment of the extent to which distributors had changed the types of commercial cooling or water heating equipment they keep in inventory by increasing their inventory of ASHPs was inconclusive.

Conclusions

The studies provide evidence of increased heat pump adoption during the period in question and attribution to the Mass Save Sponsors' efforts to encourage customers to adopt heat pumps, indicating the program approach was effective for the period examined. Heat pump shares of both the residential and commercial heating, cooling, and water heating markets continued to increase in 2023, as they have since 2021. This is consistent with program theory. The increase was more pronounced among residential-duty equipment, for which there has been more program support and the technology is further along. There was other evidence of attribution as well. For example, the studies showed evidence of initial or ongoing progress toward market outcomes in the direction predicted by the program theory and logic model for most of the anticipated residential market outcomes. Market actors attributed some of the growth in residential HP sales, increases in supply chain resources devoted to residential HPs, and increases in the availability of and attendance at HP trainings to Mass Save support.

As in many other states, substantial impediments remain for customers adopting heat pumps for space and water heating in Massachusetts—some ongoing and some new—including higher electricity prices compared to natural gas, the loss of Inflation Reduction Act (IRA) funding for heat pumps, and the current federal administration's stance on climate change. The results presented above identified additional impediments current at the time of the most recent studies, including rising equipment prices and continued installer skepticism of HPs as full replacements for conventional space and water heating equipment.

Rising equipment prices. From roughly 2019 to 2023, the total costs of program-supported heat pump systems installed in Massachusetts increased, driven by equipment costs. From 2022 to 2023, residential HP prices increased faster than inflation, and faster than prices of competing equipment. Possible reasons include that supply could not keep up with the rapid increase in demand, that market actors saw an opportunity to raise prices offset by incentives, or that improvements in heat pump technology and performance or higher program efficiency requirements required higher price, or some combination of these. While the HP invoice study found no evidence that program incentives had driven up residential HP prices, there was limited time-series data available to reliably assess this, and neither the HP invoice study nor the market effects studies included probing questions about the source of price increases.

Installer skepticism of heat pumps as full replacements for space and water heating. An analysis of experienced versus newer participating ASHP installers showed that, in 2024, experienced installers—especially larger ones—had more negative perceptions of ASHPs as full heating solutions than newer installers. We traced at least some of the negative perceptions of experienced installers to increased callbacks for ASHPs. We also found

that experienced installers' attitudes towards HPWHs had grown less favorable since the previous measurement, but due to survey space constraints we could not trace the source of the change.

New heat pump market effects and invoice studies currently underway delve into the causes of the additional barriers the most recent studies identified. For example, the second annual HP invoice study examines the sources of HP price changes, including the impact of incentives on heat pump prices and project costs using much larger sample sizes and better-quality price data. The fourth market effects study includes interview questions designed to elicit insights into the drivers behind changes in heat pump equipment and installation costs. The skepticism expressed by some experienced heat pump installers toward ASHPs as full heating solutions and their concerns about the requirement for full displacement warrant further examination, as installers are key market actors in the transition of the space heating market toward heat pumps. The latter study also includes probing survey questions to better understand the reasons behind shifts in installers' views of ASHPs as full replacements for oil, propane, and gas heating systems in homes and small commercial applications, and their views of HPWHs as good replacements for fossil fuel and electric resistance water heaters.

The results presented in this paper provide early evidence of effectiveness of the Massachusetts' program sponsors' market transformation efforts and illustrate the ongoing need for state and local program support for heat pumps, especially given unfolding federal policy.

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