Multifamily Heat Pump Barriers Study

(MA21R35-E-MFHPB)

Final Report

Provided to:

The Electric and Gas Program Administrators of Massachusetts

Part of the Residential Evaluation Program Area

Provided by:

Guidehouse Inc.
1375 Walnut Street
Suite 100
Boulder, CO 80302

303.728.2500

March 25, 2022

Executive Summary

Heat pumps (HPs) are an essential measure for the Program Administrators (PAs) in their goal to meet the ambitious climate targets set by the state of Massachusetts. While the PAs have helped heat pumps, especially ductless models, make inroads amongst customers in single-family homes, the multifamily (MF) sector has not seen a similar uptake in heat pump adoption.

To that end, the PAs and the Energy Efficiency Advisory Council (EEAC) consultants, launched the **Multifamily Heat Pump Barriers Study** with the goal of developing a deeper understanding of the barriers to ducted and ductless heat pump adoption in existing market rate multifamily buildings in Massachusetts, as well as the opportunities to overcome those barriers. This study focused on heat pump technologies that provide space heating and cooling (primary or secondary); it did not explore heat pump water heaters or other heat pump applications.

Typically, the PAs define multifamily programmatically as buildings with five or more units. However, for the purposes of this study, the PAs requested that the evaluation team also include "triple-deckers" and four-unit residential buildings under a broader definition of multifamily.

Evaluation Activities

Task 1 | Program Stakeholders Interviews (n=8)
The evaluation team interviewed each PA's implementation manager and vendor to gain insight into program managers' experience promoting heat pumps to multifamily customers, their perspective on perceived barriers, and to determine the missing market intelligence they need to improve future program delivery.

Task 2 | Literature Review
Our team reviewed available literature on previously identified barriers preventing adoption of heat pumps in multifamily buildings. We also investigated strategies that other programs have used to address barriers and considered their relevance and applicability for Massachusetts.

Task 3 | Market Actor Interviews (n=32) and Decision Maker Surveys (n=108)
Understanding market actors' current perspective on heat pumps adoption in multifamily buildings was central to this study. To obtain this information, we interviewed 32 supply-side stakeholders (contractors, distributors, etc.) and surveyed 108 building decision-makers (building owners, property managers, condo unit owners and renters). Collectively, these interviews and surveys provided our team with insight into existing barriers for specific groups and potential solutions to effectively accelerate heat pumps adoption in multifamily buildings.

Key Findings

Barriers

Our research revealed eight key barriers, which we have organized in three tiers, that reflect in descending order the barriers' relevant significance in preventing heat pump adoption.

Tier 1 Barriers

Greater complexity of multifamily installations. Contractors and distributors universally noted that installing heat pumps—central or ductless—is more challenging than traditional HVAC systems, particularly in MF retrofit scenarios due to limited/less space to locate compressors or the need to use a lift. According to contractors, "additional complexity" means "additional installation time" (i.e., higher labor cost) and a greater risk that something goes wrong (which they protect themselves against via a higher bid). Collectively, these factors result in a higher price that may not be acceptable to the customer or compares negatively to another contractor offering a traditional HVAC solution, both of which could lead to losing business.

Contractors are still uncomfortable with heat pumps. Most contractors we interviewed admitted that they remain generally uncomfortable with heat pump technology, installation, performance, and applicability. They shared that the complexity of multifamily properties only heightens their underlying discomfort with the technology. Contractors' general discomfort with heat pumps colors their interactions with multifamily decision-makers, who clearly indicated they lean on the advice of their contractor and leads contractors to recommend HVAC equipment that they are more comfortable with.

Current heat pump incentives are not enough for multifamily buildings. The barriers discussed above—complexity of multifamily installations and general discomfort with heat pumps—culminate in higher pricing for heat pumps, beyond just the higher equipment costs. According to supply-side stakeholders, the custom rebates for MF properties are not enough to overcome the incremental cost of heat pumps relative to traditional multifamily HVAC equipment. Additionally, building decision-makers signaled greater rebates as one of the top responses that would make them more likely to adopt heat pumps in their multifamily properties.

Tier 2 Barriers

MF heat pump projects are based on custom rebates. Several distributors felt that the necessity of going through the PAs' custom rebate process for multifamily (does not apply for 3–4-unit MF buildings, which can access prescriptive rebates) buildings slowed heat pump adoption and discouraged them (and, in their opinion, contractors) from promoting and installing heat pumps. The lack of straightforward, prescriptive rebates in multifamily buildings, coupled with the Tier 1 barriers noted above, further reduces supply-side market actors' interest in actively promoting heat pumps to their multifamily clients.

Building decision makers are not familiar with heat pumps. Two-thirds of the multifamily decision-makers survey respondents said they are either *slightly* or *not at all* familiar with heat pumps. Contractors confirmed that decision-makers are generally unfamiliar with heat pumps, that they do not frequently ask about them, and acknowledged the need to educate customers on the technology. Pending the mitigation of the supply-side barriers listed above, demand-side decision-makers need to be the catalyst for driving greater multifamily heat pump adoption.

Tier 3 Barriers

No rebates for natural gas. Contractors said the lack of rebates for replacing natural gas heating systems prevented greater heat pump adoption in multifamily buildings, as the PAs' current enhanced rebates are only for replacing existing oil, propane, or electric systems. They argue that with the low price of natural gas, installing heat pumps makes no economic sense without rebates.

Aesthetic concerns. Supply-side stakeholders said heat pump equipment aesthetics are a major barrier preventing greater adoption. Multifamily building decision-makers were less adamant, and rated aesthetics concerns as a mid-level barrier to for heat pump adoption.

Local regulations and building guidelines. Distributors and permitting offices mentioned local regulations can be a barrier to siting and installing heat pumps in certain multifamily applications. In some jurisdictions, heat pumps fall under the category of noise-making equipment despite technological improvements in the last decade that have resulted in lower operating decibel levels. Stakeholders also referred to the existence of building guidelines that might not allow for compressors to hang on the exterior wall as another barrier.

Considerations

The evaluation team identified several potential solutions for the PAs to consider in support of their goal of overcoming the identified barriers.

Considerations
Additional contractor training and workshops. We know the PAs already provide training and technical support for contractors. However, contractors' tepid response when asked about heat pumps suggests the need to further diversify, customize, and/or ramp up heat pump and multifamily-specific training elements. Further training should focus how to overcome common MF installation hurdles or technical challenges so that contractors can handle the incremental complexity of heat pumps without the need to protect themselves through higher bid pricing.
Wider range of financing options for MF properties. Two-thirds of building decision makers would be more likely to adopt heat pumps if they were aware of and had access to more substantial financing options. Therefore, we suggest the PAs consider extending the Expanded 2-4 Family loan to small or mid-sized multifamily buildings (i.e., 5-20 units) and increasing visibility of commercial financing options to help large multifamily buildings (20+ units).
Create a simplified rebate structure for multifamily heat pumps. A simplified rebates structure, such as a $/ton structure, but maintaining the custom savings analysis to account for the high degree of variability in site-specific savings, would encourage more supply-side market actors to deploy heat pumps in 5+ unit MF buildings by easing the time and effort currently required by the custom project participation pathways.
Include gas as an eligible pre-existing heating system for replacement rebates. To increase heat pump saturation, we suggest including natural gas as a qualified pre-existing heating type on whole-home rebates to make heat pumps more competitive against this type of fuel.
Increase building decision makers familiarity with heat pumps. Specifically, we suggest developing case studies of and providing information about multifamily buildings retrofitted with heat pump and creating a "climate champions" campaign, where buildings (as part of case study or separately) can serve as heat pump showcases and advocate for multifamily heat pump retrofits. Participants could receive public recognition for their contribution to achieving state climate goals.

Concurrent Planning Efforts

Importantly, the PAs developed their Three-Year Energy Efficiency Plan for 2022-2024 at the same time our team completed this study. In response to the new greenhouse gas (GHG) emission targets, the first programmatic priority identified in the Plan is **electrification**. Given the prioritization of electrification, it's not surprising that heat pumps are featured prominently, and it's also not surprising that some of the barriers and potential solutions in this report are also mentioned in the three-year Plan. Overlap between evaluation and planning efforts is not uncommon, particularly when the PAs are entering a new implementation cycle.

For the benefit of readers, particularly those involved in the three-year planning process, our team wanted to acknowledge the concurrence of these efforts. We recognize that the PAs have already detailed their intention to take actions (e.g., creating a Heat Pump Installer Network, and possibly prescriptive rebates for multifamily) that are consistent with several of our proposed solutions. The similarity between this study and PAs stated intentions for the next cycle should be viewed positively: the alignment indicates a sound and shared understanding of the state of heat pump adoption in Massachusetts. This multifamily-focused study provides additional market intelligence that will enable the PAs to effectively deploy a greater number of heat pumps in this traditionally harder-to-serve residential customer segment.

Table of Contents

1. Introduction 2
1.1 Report Terminology 2
1.2 Concurrent PA Planning Efforts 3
1.3 Research Questions 4
1.4 Current Heat Pump Rebates & Financing Mechanisms 6
2. Methodology 8
3. About the Multifamily Market in Massachusetts 9
3.1 Multifamily Building Stock 9
3.2 Current Heat Pump Saturation 10
3.3 MF Market Actor Ecosystem 11
4. Key Findings 12
4.1 Tier 1 Barriers 14
4.2 Tier 2 Barriers 17
4.3 Tier 3 Barriers 19
5. Additional Findings 21
5.1 Multifamily Respondents with a Heat Pump 21
5.2 MF Respondents without a Heat Pump 25
5.3 All Multifamily Respondents 28
Appendix A. Surveyed Multifamily Stakeholders 29
A.1 All Multifamily Respondents 29
A.2 Respondents with heat pumps 30
A.3 Respondents without heat pumps 31

1. Introduction

Heat pumps (HP), particularly ductless models, have become an increasingly critical part of the Massachusetts Program Administrators' (PAs) residential energy efficiency portfolio. With the significant decarbonization goals for the state and the recent reorientation of program performance metrics around greenhouse gas emissions, the importance of heat pumps in the PAs' portfolio has intensified.

This report focuses on barriers to heat pump adoption in **retrofit scenarios** in **market rate multifamily buildings** with three or more units.

However, much of the increased heat pump adoption to date has happened in single family homes. Multifamily housing, which is programmatically defined by PAs as five or more units but, for the purpose of this study we also included three- and four-unit residential buildings, has not experienced a similar uptick in heat pump adoption.

Relevant heat pump technologies: air source HP (central system - ducted), ductless mini-split HP, VRF, packaged terminal HP (PTHP), ground source HP, and water source HP (WSHP)

To that end, the PAs' launched the Multifamily Heat Pump Barriers Study with the goal of developing a deeper understanding of the barriers to ducted and ductless heat pump adoption in existing market rate[1] multifamily buildings in Massachusetts, as well as opportunities to overcome those barriers. This study focused on heat pumps that provide primary or secondary space heating and cooling; it did not explore heat pump water heaters or other applications of heat pump technology.

The Massachusetts Residential Retrofit Research Area team led by Guidehouse and Cadeo (referred to as "the team" throughout this document) completed this study on behalf of the PAs and Energy Efficiency Advisory Council (EEAC) consultants. Cadeo led this specific study, including all primary data collection, analysis, and reporting.

1.1 Report Terminology

As part of this study, we collected the perspective of a variety of individuals associated with multifamily properties in Massachusetts, namely property owners, property managers, condo owners, and renters. Throughout this report, we collectively refer to these individuals as multifamily customers, multifamily clients and/or building decision makers. To differentiate between insights provided by each respondent types, we use the following terminology consistently throughout the report.

[1] While this study focused on market-rate multifamily housing, the PAs' income eligible efforts and, more generally, LEAN, have significant experience promoting and installing heat pump in buildings with 3+ units. Our team did not speak to LEAN as part of this effort since LEAN wasn't identified as an interview target in the Stage 3 plan. However, we strongly encourage the evaluation team that leads the upcoming income eligible process and impact evaluations (for single and MF) to investigate their experience with heat pumps in multi-unit buildings and combine that information with the insights from this study.

Term	Brief Description
Property owner	Owner of at least one multifamily property, including owning all units within property. This does not refer to individual condo owners or condo owners who own multiple units within a property.
Property manager	Third-party individual or company hired to manage a multifamily property.
Condo unit owner	Individual unit owner within a condo property. This person may own multiple units within a property.
Renter	Tenant within a multifamily property who rents at least one unit from property owner, property management company or a condo owner.
Other important terms	
Respondent	Stakeholder (property owner, property manager, condo owner or renter) who responded to the survey as part of this study

1.2 Concurrent PA Planning Efforts

It is important to note that the PAs developed their Three-Year Energy Efficiency Plan for 2022-2024[2] at the same time our team completed this study. The plan, which was a joint effort between the PAs and the Energy Efficiency Advisory Council (EEAC) consultants, outlines their collective vision, planned strategic interventions, and programmatic priorities for the impending three-year implementation cycle.

In response to the PAs' new greenhouse gas (GHG) emission targets, **electrification** is the first priority listed in the Plan. Given the prioritization of electrification and focus on GHG, it's not surprising that heat pumps are featured prominently throughout in the 2022-2024 plan. In fact, the words "heat pump" show up more than 400 times in the Plan.

It's also not surprising that some of the barriers we identified in this report, as well as many of the potential solutions, are mentioned in the three-year Plan. Overlap in evaluation and planning efforts is not uncommon, particularly when the PAs are entering a new implementation cycle.

For the benefit of readers, particularly those involved in the three-year planning process, our team wanted to acknowledge the concurrence of these efforts and recognize that the PAs have already detailed their intentions to take actions (e.g., the creation of a Heat Pump Installer Network, and possibly prescriptive rebates for multifamily) that are consistent with several of our proposed solutions. The similarity between the findings and proposed solutions in this report and the PAs' stated intentions for the next cycle should be viewed positively. This alignment between both efforts indicates a sound and shared understanding of the state of heat pump adoption in Massachusetts in general. This multifamily-focused study provides additional market intelligence that will enable the PAs to effectively deploy a greater number of heat pumps in this traditionally harder-to-serve residential customer segment.

[2] https://ma-eeac.org/wp-content/uploads/Exhibit-1-Three-Year-Plan-2022-2024-11-1-21-w-App-1.pdf

1.3 Research Questions

The Stage 3 evaluation plan for this study included more than a dozen specific research questions related to heat pumps, the ecosystem of market actors that sell, install, and service them, multifamily buildings in Massachusetts, and the wide range of PA customers that own, manage, and live in those buildings. However, each question was in service to a broader research goal:

To better understand and identify how to overcome the barriers preventing greater heat pump adoption in multifamily buildings.

Collectively, the individual questions, which we have listed below, helped our team probe for meaningful differences in barriers between building occupancy types, ownership scenarios, and management structures. The questions also directed our team to explore issues related to contractor acceptance of the technology, equipment availability, heat pump related electrical infrastructure upgrades, building codes, and preferences of multifamily building decision makers.

Research Themes and Questions
#1. What are the main barriers for heat pump adoption in MF properties?
How significant is upfront cost as a barrier to adoption? How does this vary depending on the displacement scenario or event type (i.e., early retirement vs. replace-on-failure)?
Is shifting heating costs from landlord to tenant a barrier? How is the tenant being compensated? How impactful are split incentives when considering a heat pump adoption?
How do building guidelines help or hinder the adoption of these technologies?
Is existing panel ampacity/configuration a barrier?
How significant are space requirements constraints for siting outdoor units, which can also encroach on other tenants outdoor living space, as well as locating indoor heads?
#2. What is the perception of stakeholders in the HP market in MA?
What role is the contractor's reticence for adoption or lack of knowledge contributing to end user adoption?
Are customers or contractors reticent to install heat pumps due to concerns about "lukewarm" output air relative to the fossil fuel furnaces, or the perception that heat pumps alone may be insufficient on cold days?
How significant is the perception that indoor and outdoor equipment is unattractive, takes up a lot of space and can be noisy?
How reluctant are building owners/managers, as well as contractors, to fully displace existing heating systems?
Are heat pumps installed primarily for cooling or heating needs? How do heat pump's ability to also provide cooling—where it did not exist before or was provided via less effective window or wall units—factor into building owner/managers decision-making process?
What do MF building owners/managers know about variable refrigerant flow (VRF) systems? What do they think about VRF, especially as it relates to heat pumps?[3]
Have the MF building owners/managers considered other more complex technologies, such as radiant hydronic systems?[4]
Are indoor air quality impacts a factor/considered?
#3. What other market factors might affect HP adoption in MF properties?
How do these barriers differ by building size/configuration, ownership scenario, management structure, or occupant type?
How impactful is regional product availability?
How large of a barrier is contractor and customer inertia (replacing like with like) and greater familiarity with traditional heating and cooling options?
What role do controls play in the decision-making process for partial displacement scenarios?

[3] According to supply side stakeholders, VRFs are uncommon for retrofit scenarios and mainly relevant for new construction, which is outside of the scope of this study.

[4] None of the interviews building owners/managers provided insight into radiant hydronic systems.

1.4 Current Heat Pump Rebates & Financing Mechanisms

In this section we list the PAs' current heat pump offers for in MF properties, which as previously noted includes 3- & 4-unit buildings, as well as buildings with 5+ units. As shown below, the offers vary by building type and ownership status (i.e., condo unit owners versus building owners).

It is important to note that the PAs' are actively revisiting their heat pump offers in response to the 2022-2024 Energy Efficiency Plan[5] and that more up-to-date rebate amounts may exist on MassSave.com. Since our team conducted our research in 2021, the findings reflect supply and demand stakeholders' perspective towards the PA's 2021 heat pump offerings, which, again are subject to change in the future.

Rebate Type	Rebate Amount	Brief Description	Available to
Whole-home	Air source & Water source $10,000 Ground source $15,000	To access this rebate the heat pump/s must be sized to cover whole-home heating needs, and customers must either disconnect or remove the pre-existing heating system, or only use it in case of an emergency.	3-4-units buildings All building decision makers
Partial-home	Air source $1,250 per ton or up to $10,000.	Accessible to customers who adopt air source heat pumps for a specific area of the house or to supplement their existing heating system. Installing an integrated control in this case is necessary to access the rebate.	3-4-unit buildings All building decision makers
Vendor guided incentive approach	Mini-splits - extra 5% off	PAs vendor's make similar heat pump offers to condo unit owners. Customers take the requirement list to contractors and then back to PA vendor for approval. A minimum number of customers in the MF property must agree to participate in order to obtain this rebate.	3+ units Condo unit owners
Custom	All heat pump types. The amount will depend on $/ton and savings.	Multifamily properties can access this rebate by requesting a complementary Multifamily Energy Assessment. The Energy Specialist will identify and recommend energy-savings improvements, which includes HVAC systems.	5+ units Building owners, condo buildings, and property managers

[5] The table below represents the latest information available. However, we anticipate PAs may continue to make updates. For the latest information visit https://www.masssave.com/en/saving/residential-rebates/heat-pump

In addition to rebates, PAs offer a few financing options to support heat pump adoption. The HEAT Loan is an interest-free financing option providing up to $25,000 for energy-efficient home upgrades with a maximum term of 84 months. This is available to individual condo unit owners and 3- to 4-unit buildings in the MF sector (as addressed in this study). There is one additional option for 3- to 4-unit buildings, which is the Expanded 2-4-Family Loan. This loan provides financing for project beyond $25,000 and up to $50,000.

The PAs do not currently offer any financing programs specifically designed for MF buildings. Some PAs partner with a third-party capital provider to offer low interest rate financing for large commercial and industrial buildings, which, technically larger MF buildings owners/managers are eligible apply for. However, our team heard, anecdotally, that few MF buildings do. Also, starting in July 2020, MassDevelopment and the Massachusetts Department of Energy Resources started offering the Property Assessed Clean Energy (PACE) program for energy improvements and is available for 5+ unit MF buildings. PACE offers local government financing with a term of up to 20 years, that is tied to the property and not to the owner.

2. Methodology

To identify the barriers to heat pump adoption in multifamily buildings and provide the PAs with insights into how to mitigate them, the evaluation team completed the following three tasks.

Task 1 | Program Stakeholders Interviews (n=8)

Our team began by interviewing PA program managers and their multifamily implementation vendors. Our team used these initial interviews to gain insight into program managers' experience promoting heat pumps to multifamily customers, their perspective on perceived barriers, and to identify the market intelligence they need to improve future program delivery and overcome those barriers. We spoke with representatives from each PA, as well as two implementation vendors (CLEAResult and RISE Engineering).

Task 2 | Literature Review

As noted in the Introduction, our team conducted a literature review of the relevant Massachusetts-specific, regional, and national resources related to heat pumps in multifamily buildings. We used the review to leverage existing information, identify information gaps, and help focus our team's line of questioning for the subsequent interviews and surveys. The Introduction contains an initial multifamily heat pump market characterization (i.e., building stock details, heat pump saturation, relevant market actors, and previously identified barriers).

Task 3 | Market Actor Interviews (n=32) & Decision Maker Surveys (n=108)

Understanding market actors' perspectives on heat pumps adoption in multifamily buildings was central to this study. To obtain this information, we interviewed 32 supply-side stakeholders (contractors, distributors, etc.) through zoom meetings in the summer of 2021. We obtained the sample through NTG (net-to-gross) HVAC participants, commercial heat pump and HVAC initiative Mass Save distributor list and web searches. We also surveyed 108 demand-side building decision-makers (owners, managers, etc.) in the fall of 2021 through an online survey, using sample from RES 43. We provided a $100 dollar incentive to all respondents to encourage participation. We used the collective insights from these interviews and surveys as the primary basis for the findings and potential solutions offered in this report. We have provided more information about the multifamily decision-makers we surveyed, as well as their buildings, familiarity with heat pumps, and experience with PA programs in Appendix A.

3. About the Multifamily Market in Massachusetts

The evaluation team assessed the broader multifamily landscape in Massachusetts before investigating the barriers to heat pumps in these buildings. To gain insight into the existing landscape, our team performed a literature review of available secondary information sources.

The literature review focused on:

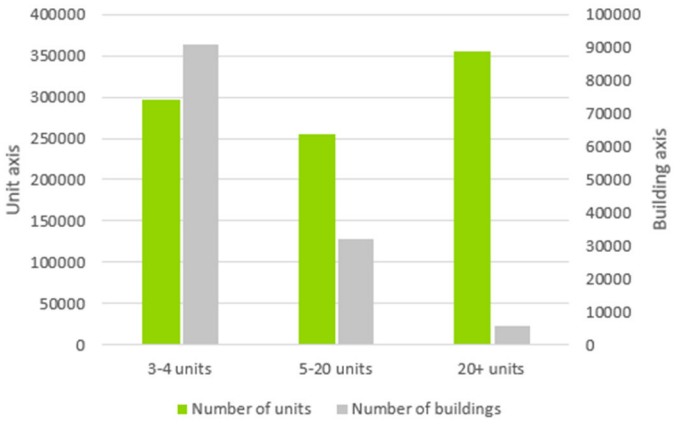
- Characterizing the multifamily building stock in Massachusetts,
- Assessing current heat pump saturation, and
- Identifying the complete ecosystem of supply-side market actors that enable heat pump adoption, as well as the demand-side building-level decision makers that ultimately determine what HVAC technologies are installed in multifamily buildings.

To provide readers with the context for remainder of this report, we have provided a summary of our findings below.

3.1 Multifamily Building Stock

Regarding the existing multifamily building stock, our research found:

- There are 128,797 multifamily buildings (including 3- and 4-unit buildings) in Massachusetts (7% of total buildings in MA); collectively, these buildings represent 907,495 units (33% of total units in MA).[6]



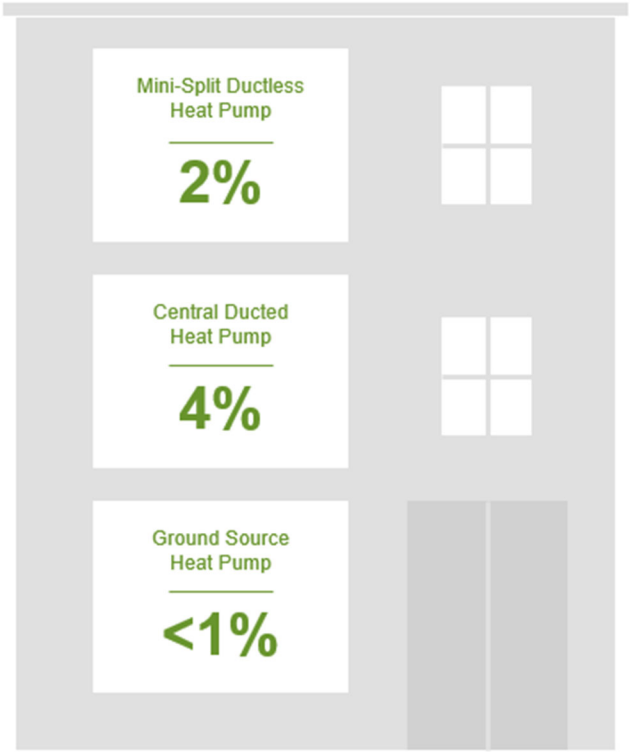
- Of these nearly 130,000 buildings, the vast majority (90%) are occupied by market rate (i.e., not income-eligible customers).
- Almost two-thirds (61%) of the multifamily buildings in-state have 5-9 individual tenant units.[7]
- In general, an inverse relationship exists between the total number of units and the total number of buildings. In the extreme case, the 50+ units category accounts for only 5% of the state's buildings but comprises 40% of total multifamily units in the state.[8]
- Condominiums (individually owned units) make up roughly a quarter of the multifamily units with a known ownership type; the remainder are apartments.[9]

[6] Navigant, 2018. Census of Massachusetts Multifamily Buildings (RES 43). https://ma-eeac.org/wp-content/uploads/RES43-Final-Report-2019-05-31.pdf
[7] Ibid
[8] Ibid
[9] Ibid

3.2 Current Heat Pump Saturation

Our team found there was relatively little readily available information on heat pump saturation. We found that the PAs' own Massachusetts Residential Building Use and Equipment Characterization Study (previously known as the Residential Baseline Study) was the best source of information. Our findings show:

- Heat pump saturation differs by building type with 7% for 5+ unit multifamily buildings, 6% for 2- to 4-unit buildings and 11% for single family.
- The most common type of heat pump also varies by building type, with central ducted systems being the most common in 5+ unit multifamily buildings accounting for 4% saturation, whereas mini-splits are the predominant technology in single family and 2- to 4-unit buildings, accounting for 10% and 4% of saturation respectively.[10]
- There was an increase in heat pump saturation levels across all residential sectors from 2018 to 2019.[11]
- Most heat pumps installed in multifamily new construction between 2015 – 2020 were air source models (70%).[12]



[10] Guidehouse, 2020. Massachusetts residential baseline study https://ma-eeac.org/wp-content/uploads/RES-1-Residential-Baseline-Study-Ph4-Comprehensive-Report-2020-04-02.pdf Statewide Saturation Results https://ma-eeac.org/wp-content/uploads/Appendix-B-3-MA-Statewide-Saturation-Results-2020-03-31.xlsx

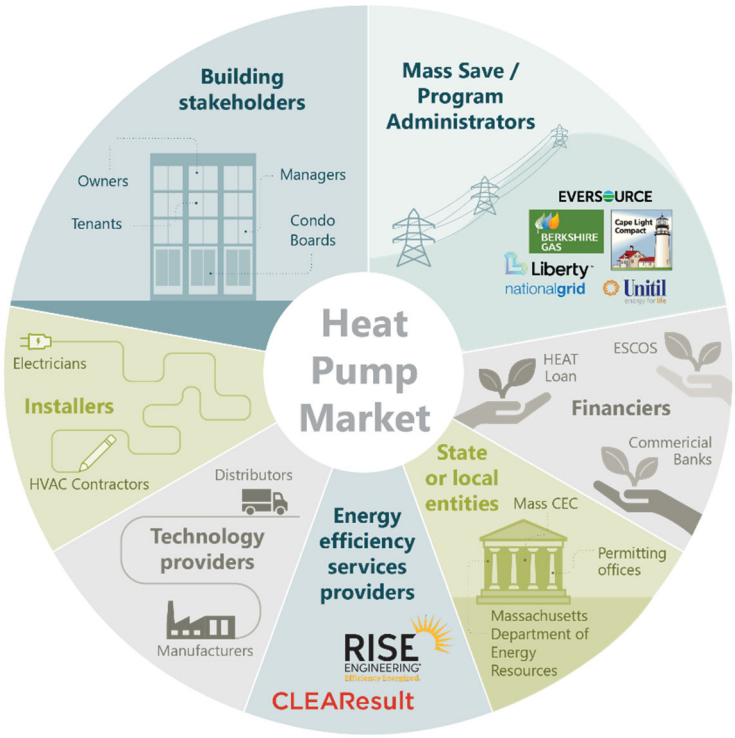
[11] Ibid

[12] United States Census Bureau https://www.census.gov/construction/chars/

3.3 MF Market Actor Ecosystem

Through literature review and with support of primary research results, we found:

- There are no heat pump manufacturers with production facilities located in the state.
- Distributors actively stock heat pumps and are amongst the most informed about the technology. Some distributors are manufacturer-specific, while others carry a variety of manufacturer models. Distributors also directly work with large multifamily and commercial customers in a plan-spec and design-build role.



- HVAC contractors are obviously the key player of the heat pump market and HVAC market more generally. They drive supply-side adoption by providing trusted advice to building-decision makers and either encouraging—or discouraging—heat pumps to their clients.
- Independent multifamily maintenance providers do not typically service HVAC systems. These all-purpose multifamily maintenance providers tend to focus on less technical aspects of multifamily properties, leaving the maintenance and replacement of HVAC equipment and other mechanical systems to specialized contractors and/or technicians.

4. Key Findings

Our research identified eight different barriers to the adoption of heat pumps in market rate multifamily buildings, which, for the purpose of this report, we have organized into three tiers reflecting their relevant significance.

- **Tier 1 Barriers** were most frequently mentioned by interviewees and survey respondents and, in the opinion of our team, are most important to overcome to encourage greater heat pump adoption.
- **Tier 2 Barriers** were mentioned by multiple market actors and decision-makers, but less frequently than Tier 1. These barriers are also important to the PAs' goal of increasing heat pump saturation, but less essential to overcome than Tier 1 barriers.
- **Tier 3 Barriers** were noted by more than one respondent, which implies the barrier was not unique to that individual and/or building. For that reason—and for the sake of comprehensiveness, we have documented it for consideration in this report. However, the relative infrequency with which market actors and decision makers highlighted the barrier also implies it is not a first order or high priority barrier for the PAs to address.

Below is a list of the eight barriers we identified, organized by tier.

Tier 1 Barriers
Greater complexity of multifamily installations
Contractors are still uncomfortable with heat pumps
Current heat pump incentives are not enough for multifamily
Tier 2 Barriers
MF heat pumps projects are based on custom rebates
Building decision makers are not familiar with heat pumps
Tier 3 Barriers
No rebates to replace natural gas
Aesthetic Concerns
Local regulations and building guidelines

In this section of the report, our team provides the following information for each barrier listed above:

- A brief description of the barrier
- A summary of supporting information and/or market intelligence that led us to identify the barrier
- The market implications of the unmitigated barrier
- Whether the barrier is technical, economic, or achievable in nature
    - *Technical*: Barriers related to technical aspects of heat pumps or incompatibilities between heat pumps and the building infrastructure.
    - *Economic:* Barriers associated with costs incurred to adopt, install, operate, or maintain heat pumps.
    - *Achievable:* Regulatory, behavioral, or programmatic market barriers that prevent or slow heat pump adoption.
- Some considerations to overcome the barrier
- An icon indicating whether the barrier is primary related to supply-side or demand-side issues

Please note that we provide more detail below for Tier 1 and 2 barriers than Tier 3 barriers, which reflects the lesser importance of that tier.

4.1 Tier 1 Barriers

Greater complexity of multifamily installations

What We Heard

Contractors and distributors universally noted that installing heat pumps—central or ductless—is more challenging than traditional HVAC systems. They typically went on to say that, in general, the more challenging nature of heat pumps is exacerbated in MF retrofit scenarios.

Supporting Details

In support, contractors cited:

- Limited and/or less space to locate heat pump equipment at MF properties
- Locating compressors often only possible in difficult-to-access regions (i.e., requires a lift), which makes installation and maintenance more expensive
- Greater challenges accessing, modifying, or installing MF ductwork

Implications

The logic is straightforward: Because of the greater complexity associated with heat pumps, contractors are not naturally motivated to install them, particularly in MF settings. The issue is not that contractors cannot handle complex installs. Rather, in a contractor's world, "additional complexity" equates to "additional time" (higher labor cost), as well as greater risk that something goes wrong (which they protect themselves against via a higher bid).

Collectively, these factors result in a higher price that may not be acceptable to the customer or compares negatively to another contractor offering a more traditional HVAC solution. This means contractors are less likely to proactively recommend a heat pump to a potential customer or to encourage an existing customer, that inquiries generally about heat pumps, to select the technology.

Relevant to:

- **Contractors**
- **Distributors**
- **Electricians**
- Building Decision Makers
- Occupants

Considerations

Some possible strategies to mitigate this barrier include:

- **MF-Specific Installation Workshops for each heat pump technology**. Develop technology-specific workshops, ideally coupled with onsite training, assistance, and oversight, that is oriented around MF heat pump installations- including how to overcome common MF installation hurdles or technical challenges that can help contractors handle the incremental complexity of heat pumps without the need to protect themselves through higher bid pricing.
- **Leverage Distributor Support.** Unlike contractors, distributors have natural motivation to sell heat pumps since the equipment cost is typically higher. Many distributors, often in partnership with their manufacturer representatives, offer training, resources, or other support for priority products. The distributors we spoke with were more familiar with commercial and large MF heat pump retrofit projects. The PAs could leverage this experience, market motivations and ancillary support services to provide contractors with even more technical support for the installation of heat pumps in MF buildings.

Type

Technical

Economic

Achievable

Contractors are still uncomfortable with heat pumps

What We Heard

Most contractors we interviewed admitted that they remain generally uncomfortable with heat pump technology, installation, performance, and applicability. They shared that the complexity of MF properties only heightens their underlying discomfort with the technology.

Supporting Details

Some comments exemplifying this issue included:

- A few distributors signaled the lack of education of some contractors when it comes to design-built type projects and HP technology in general
- One distributor shared with us that while some manufacturers have mandatory product training for contractors, the passing score is sometimes as low as a 30% correct response rate, which they considered an astonishing low bar
- Many contractors said bad installations by "other contractors" hurt the heat pump market; they noted it was not uncommon to find refrigerant leaks on ductless heat pumps
- Despite existence of and education related to cold climate models, some contractors are still concerned about HP performance in cold weather
- Many contractors admitted to struggling to keep up with changes in the HP market, which they see still maturing (i.e., manufacturers are constantly bringing new models to the market), which makes it hard to stay in the loop

Implications

Surveyed MF building decision makers said contractors were the most trusted source of information when they consider installing a HP at their properties. Therefore, it's imperative that contractors are comfortable with the technology and can confidently recommend it to their MF clients. However, this is currently not happening. Contractors' general discomfort with heat pumps colors their interactions and leads them to recommend HVAC equipment that they are more comfortable with.

Relevant to:

- **Contractors**
- Distributors
- Electricians
- Building Decision Makers
- Occupants

Considerations

Some possible strategies to mitigate this barrier include:

- **Contractor Training on HP Technology and technical design**. We know that the PAs already provide some training and technical support for contractors. However, contractors' tepid response when asked about heat pumps suggests the need to diversify, customize, and/or ramp up heat pump and multifamily-specific training elements. Further training should focus on familiarizing contractors with the range of HP technologies, models characteristics and efficiencies, and which models are best suited for various MF scenarios. Additionally, offering training on project technical design would help overcome any MF-specific challenges, these HP-centric efforts will also empower contractors to promote and install HPs for their single-family clients too.

Type

Technical

Economic

Achievable

Current heat pump incentives are not enough for multifamily

What We Heard

The barriers discussed above—complexity of multifamily installations and general discomfort with heat pumps—culminate in higher pricing for heat pumps, beyond just the higher equipment costs relative to more traditional HVAC options. According to supply-side stakeholders and building-decision makers, the existing heat pump rebates offered by the PAs are not enough to overcome the incremental cost of heat pumps.

Supporting Details

Supply-side market actors and building-decision makers alike commented that:

- From their perspective, the PAs' current incentives were insufficient to cover the incremental equipment and labor cost associated with heat pumps in multifamily applications
- Electrical infrastructure upgrades are sometimes required to support a heat pump, therefore creating a further financial disincentive
- Access to, or awareness of, financing options to cover higher costs of heat pumps in multifamily buildings is low

Implications

Multifamily properties have higher upfront costs than single family homes, given the larger equipment size and/or the amount of equipment required. Additionally, installing HP in MF buildings is more labor intensive and time consuming for the contractor, which translates into higher costs for the property owner. These problems are compounded when the heat pump requires upgrades to the existing electrical system.

Relevant to:

- Contractors
- Distributors
- Electricians
- **Building Decision Makers**
- Occupants

Considerations

Our research shows that two-thirds of building decision makers would be more likely to adopt heat pumps if they were aware of and had access to more substantial financing options. We suggest:

- **Extend the Expanded 2-4 Family Loan offer to small or mid-sized multifamily buildings.** Making the additional $25,000 in loan value (on top of the HEAT loan's usual $25,000 limit) available to small and mid-sized (i.e., 5-20 units) would increase the likelihood of heat pumps adoption for this key multifamily segment.
- **Increasing visibility of commercial financing options to help large multifamily buildings (20+ units).** Larger properties will need more than the HEAT loan. Ensuring decision-makers at larger properties understand the extent of financial support available to them will be essential for overcoming this traditional monetary barrier.

Type

Technical

Economic

Achievable

4.2 Tier 2 Barriers

MF heat pump projects are based on custom rebates

What We Heard

Several distributors felt that the necessity of going through the PAs' custom rebate process for multifamily buildings slowed heat pump adoption and discouraged them (and, in their opinion, contractors) from promoting and installing heat pumps. Interestingly, we primarily heard this concern from distributors, not contractors.

Supporting Details

Some distributors mentioned that:

- The heat pump custom rebate process for multifamily is complex and time consuming.
- The large amount of paperwork to fill out and the lack of clarity of the process makes it hard to capture all savings.

Implications

The lack of a straightforward prescriptive building level rebates in 5+ unit multifamily properties, when coupled with the complexity of heat pump installations in multifamily properties, further reduces supply-side market actors' interest in actively promoting heat pumps to their multifamily clients. While the custom requirement is not as critical of a barrier as the previous Tier 1 barriers, it adds to the body of reasons why supply-side market actors might lean away from recommending heat pumps in multifamily scenarios.

Relevant to:

- **Contractors**
- **Distributors**
- Electricians
- Building Decision Makers
- Occupants

Considerations	Type
While contractors were less vocal regarding the lack of a prescriptive rebate, distributors were clear it was an issue for them. Given the substantial climate goals established for the state, we suggest: • **Create a simplified rebate structure** with a $/ton rebate structure but maintain the custom savings analysis to account for the high degree of variability in site-specific savings. • **Develop a fast and straightforward participation pathway** for critical decarbonization measures like heat pumps.	Technical Economic **Achievable**

Building decision makers are not familiar with heat pumps

What We Heard

Two-thirds of the multifamily decision-makers survey respondents said they are either *slightly* or *not at all* familiar with heat pumps. Contractors confirmed that decision-makers are generally unfamiliar with heat pumps and that they do not frequently ask about them.

Supporting Details

Results and comments that support this barrier:

- Lack of knowledge was the second largest barrier to heat pump adoption among building decision-makers
- When asked "What have you heard about HPs?", twice as many respondents selected "*HP perform poor in extremely cold weather"* vs "G*ood performance in any weather"*
- Most of the surveyed heat pump adopters kept their backup system because they don't fully trust HP performance
- Contractors mentioned that even though customers sometimes call asking for heat pump installations, the customers do not know much about the technology

Implications

As a result of the barriers mentioned above, most supply-side market actors are not proactively advocating for heat pumps at multifamily properties. Pending the mitigation of those barriers, demand-side decision-makers need to be the catalyst for driving greater multifamily heat pump adoption.

The importance of greater awareness of heat pumps amongst building-level decision-makers is further underscored by the fact that these respondents cited their multifamily colleagues and peers as the top source of information when making decisions about upgrading HVAC systems. This response implies a catch-22 paradox: for more multifamily decision-makers to opt into heat pumps, more multifamily decision-makers need to have them.

Relevant to:

- Contractors
- Distributors
- Electricians
- **Building Decision Makers**
- Occupants

Considerations	Type
Based on the results of our research, we suggest PAs: • **Develop case studies of retrofitted multifamily buildings** in high density multifamily areas. The PAs should share as much information as possible about the case study sites, including location and ideally contact information, to generate trust among decision-makers. • **Create a "climate champions" campaign**, where buildings (as part of case study or separately) can serve as showcases and advocates for multifamily heat pump retrofits. Participants could receive public recognition for their contribution to achieving state climate goals. • **Keep promoting heat pumps** by sending customers information through e-mail or mail, the top two preferred communication options. Showcasing the growing number of new buildings choosing heat pumps and their performance can help create awareness.	Technical Economic **Achievable**

4.3 Tier 3 Barriers

No rebates for natural gas

Contractor said the lack of rebates for replacing natural gas heating systems prevented greater heat pump adoption in MF buildings, the PAs' current whole-home rebates for 3-4-unit buildings are only for replacing existing oil, propane, or electric systems. They argue that with the low price of natural gas, installing heat pumps makes no economic sense without rebates. A few distributors mentioned that the only place where heat pumps can beat gas is in areas where gas pipelines are stressed and if the building wants to connect to the gas system it has to pay for the distribution infrastructure needed.

Potential Solution

According to our research results, natural gas is the most utilized fuel for space heating in MA. Given the state targets for HP adoption and natural gas low prices, we suggest including natural gas as a preexisting heating type on whole-home rebates to make HPs more competitive against this type of fuel. Additionally, locational value of HPs based in stressed gas pipelines areas could be a point to consider in new programmatic offerings.

Relevant to:

- Contractors
- Distributors

Type

Technical

Economic

Achievable

Aesthetic concerns

Supply-side stakeholders said heat pump equipment aesthetics are a major barrier that prevent greater adoption. MF building decision-makers were less adamant, and rated aesthetics concerns as a mid-level barrier to for heat pump adoption. While building decision makers signal aesthetics as a problem, they mentioned it could be overcome if environmental and economic benefits can be accrued with installation of HPs. Despite aesthetics continuing to be a problem for HP adoption, we see this barrier softening due to end users' growing acceptance and familiarity of HPs.

Potential Solution

As HPs saturation grows, end users will acclimate to HP aesthetics. Our suggestion is to keep promoting HPs through the customer-preferred methods of communication. These promotions will include images of case studies and HP installations in well-known public places or aesthetically pleasing interior or exterior designs. This will generate customer visual habituation to the technology due to repeated exposure, thus reducing or eliminating aesthetics as a barrier.

Relevant to:

- Bldg. Decision makers
- Occupants

Type

Technical

Economic

Achievable

Local regulations and building guidelines

Distributors and permitting offices mentioned local regulations, such as zoning regulation on noise, can be a barrier to citing and installing heat pumps in certain MF applications. In some jurisdictions heat pumps, like other HVAC equipment, fall under the category of noise-making equipment despite technological improvements in the last decade that have resulted in lower operating decibel levels. These stakeholders also referred to the existence of building guidelines that might not allow for compressors to hang on the exterior wall or the ASHRAE refrigerant ratio-to-room size requirement.

Potential Solution

We suggest working with municipalities, in collaboration with acoustical consultants, to amend zoning regulations on noise that may currently delay or prohibit the adoption of HPs in some jurisdictions. This amendment could be in the form of establishing level noise threshold, while manufacturers could disclose this information for each equipment. Another amendment could be exemptions to roof mounted equipment.

Relevant to:

- Contractors
- Distributors
- Building Decision makers

Type

Technical

Economic

Achievable

5. Additional Findings

In addition to the barriers discussed above, our surveys with multifamily stakeholders yielded other insights into the intersection of heat pumps and multifamily buildings. We have provided these additional findings below to aid the PAs' effort to improve existing programs or develop new ones.

We have organized these additional findings in a manner that mirrors our survey design. In addition to questions asked of all respondents, we posed different questions to respondents with a heat pump (at any of the properties they owned or managed) and to respondents that did not.

Consequently, this section of the report includes three subsections that summarizes insights from:

1. **Multifamily respondents with a heat pump.** This subsection includes why they installed a heat pump, their experience having one, and whether they would recommend it to a multifamily colleague.

2. **Multifamily respondents without a heat pump.** This subsection includes their overall awareness of heat pumps and what they have previously heard about heat pumps.

3. **All respondents.** This subsection includes what Mass Save could do better to support the adoption of heat pumps.

5.1 Multifamily Respondents with a Heat Pump

In total, 48 of the multifamily stakeholders we surveyed (44%) have a heat pump currently installed in at least one of their multifamily properties. Obviously, the percentage of respondents to our survey sample with heat pumps greatly exceeds the saturation of heat pumps in the larger multifamily building population that we shared earlier in the report (4% central air source heat pump; 2% mini-split [ductless]; 1% heat pump water heater; <1% ground source heat pump).

This is true for two reasons:

1. **The percentages are not directly comparable.** In our survey, we asked respondents if they have a heat pump at *any* of their multifamily properties. Since respondents own or manage an average of seven properties, their response to our question does not directly reflect heat pump saturation broadly.

2. **A survey about heat pumps will disproportionately attract people with heat pumps.** People that have previously installed and are familiar with heat pumps are more likely to respond to a heat pump-specific survey invitation. We expected and welcomed this result since there were certain research questions (e.g., how likely are you to recommend a heat pump to others?) that only a respondent with a heat pump could answer.

Findings

- **Reason(s) for Installing a Heat Pump at Multifamily Property and Reported Hurdles During the Process.** Almost half of respondents mentioned facing no hurdles while installing a heat pump in their multifamily property. However, the hurdles that were encountered are, as expected, associated with the barriers found for heat pump adoption and are represented in Figure 2. 2

Figure 1. Reasons for installing heat pump
(Multiple Responses Allowed)

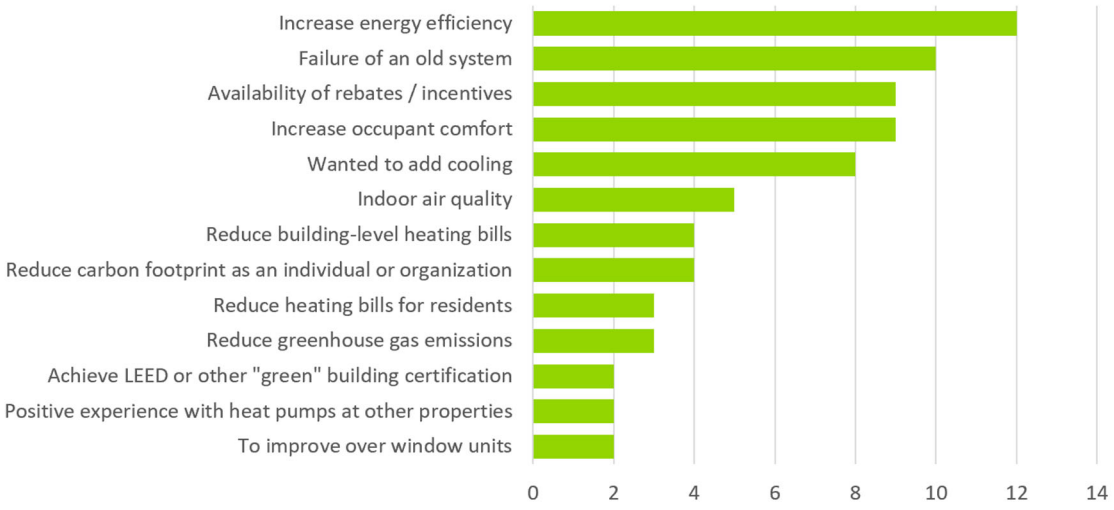
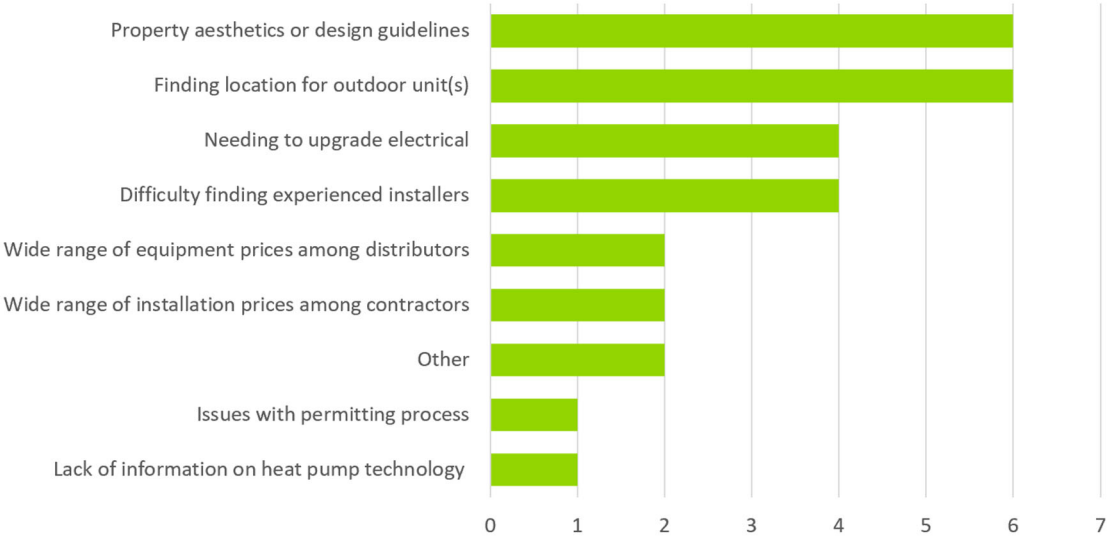
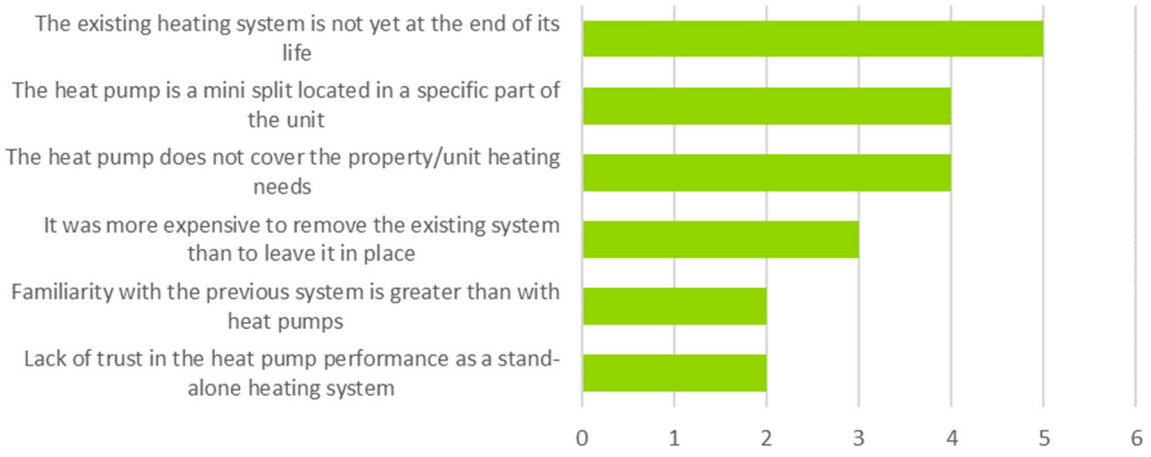


Figure 2. Hurdles Encountered When Installing HPs
(Multiple Responses Allowed)



- **Back-up Systems.** Almost half of respondents with heat pumps at their properties have a back-up[13] heating system in place. When asked about these, the subset of respondents with back-up systems indicated different reasons why they kept the system (**Error! Reference source not found.**), and most of them mentioned they use the old system only on extremely cold days.

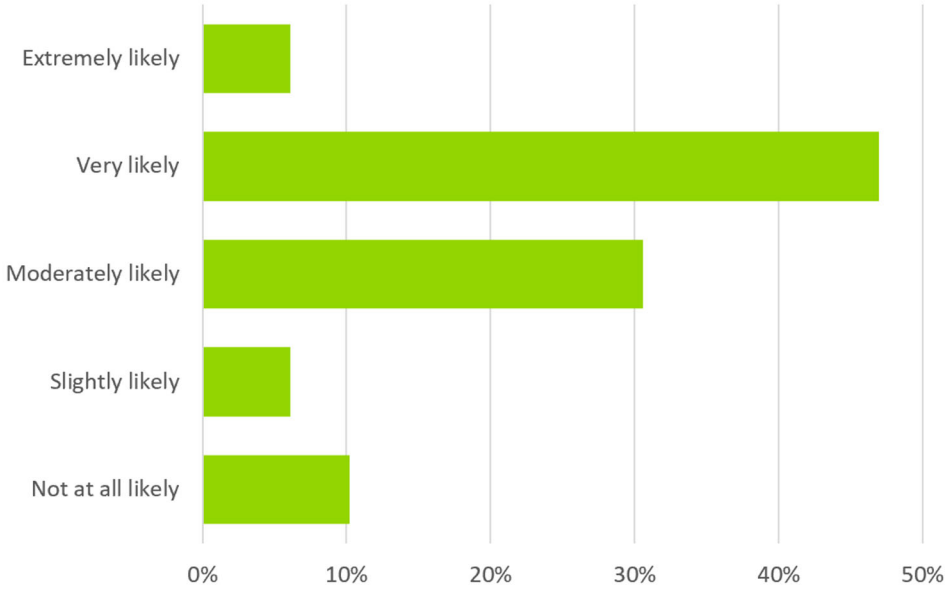
Figure 3. Reasons for Keeping a Back-Up System



- **Likelihood of recommending heat pumps to others.** On average, respondents seem to be content with heat pump performance to recommend their use to other peers. We asked respondents the reason for answering *moderate* to *not at all likely* to recommend heat pumps to others, and the most common answers were **inefficiency, cold air, costly, dry air, noisy.**

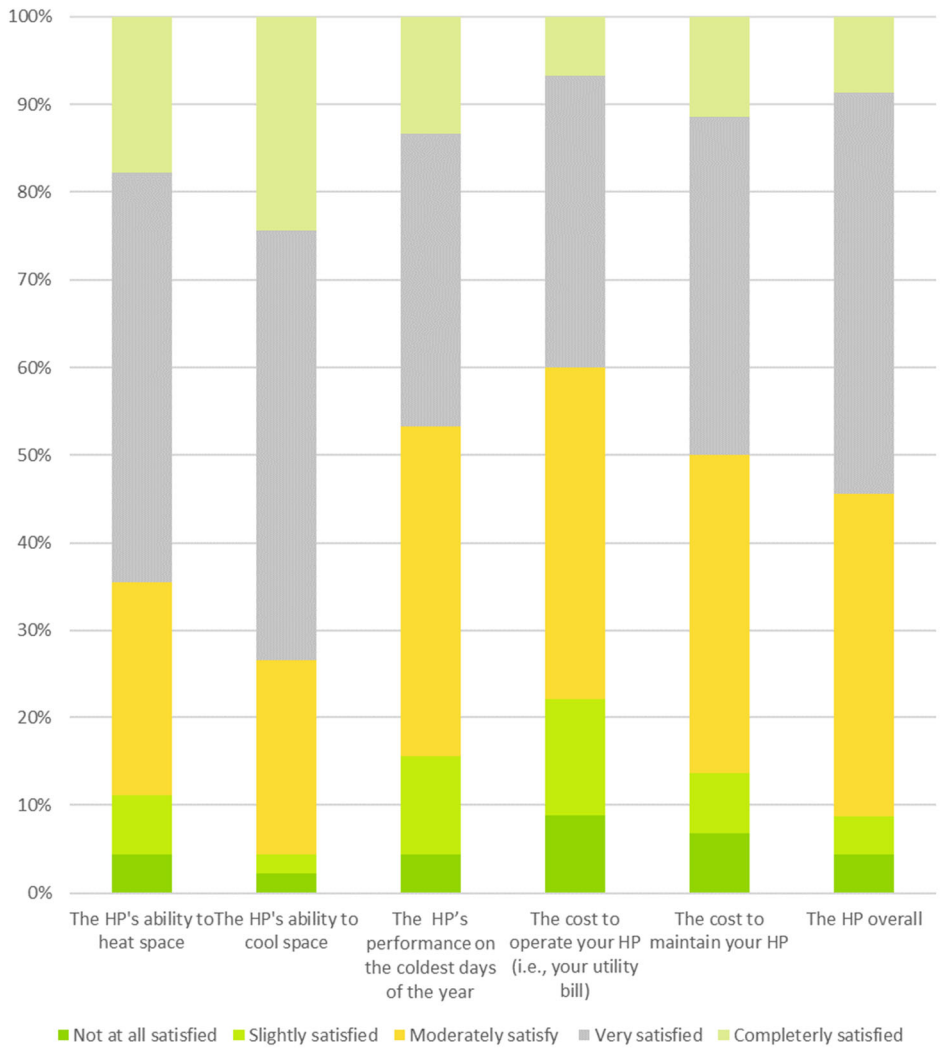
[13] We used the term "back-up system" in the survey to reference that the previous/existing heating system was not disconnected or taken out during the installation of heat pumps. This means the system can be a supplement or back up to the heat pump system.

Figure 4. Likelihood of Recommending Heat Pumps



- **Heat pump use satisfaction.** We asked respondents to evaluate their satisfaction with different characteristics of heat pump such as performance, costs, and overall use. In general, respondents rated their existing heat pumps favorably. They offered marginally higher scores for heat pumps ability to provide heating and cooling and slightly lower ratings for the cost of operation (implying some respondents expected greater savings) and cold weather performance.

Figure 5. Satisfaction with HPs performance, costs and overall

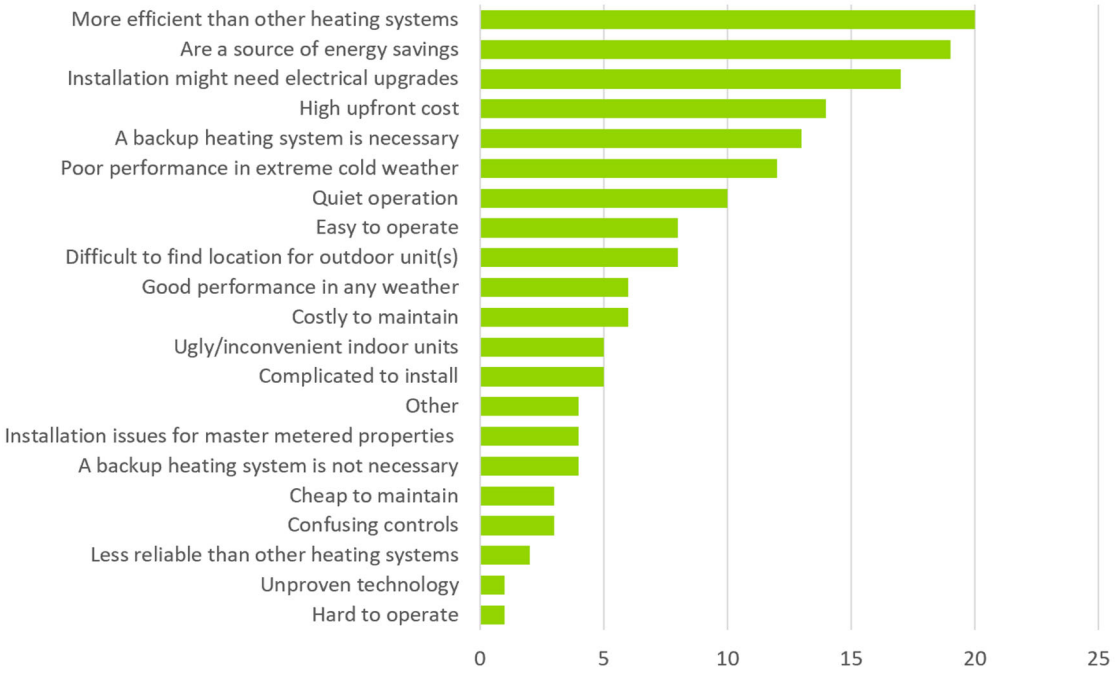


5.2 MF Respondents without a Heat Pump

From respondents without heat pumps, we discovered several responses.

- **Heat Pump Awareness.** In 6, we asked respondents what they have heard about heat pumps and ranked the results. From respondents that have changed their heating system in the last 5 years, 67% claimed that nobody had spoken with them about installing heat pumps.

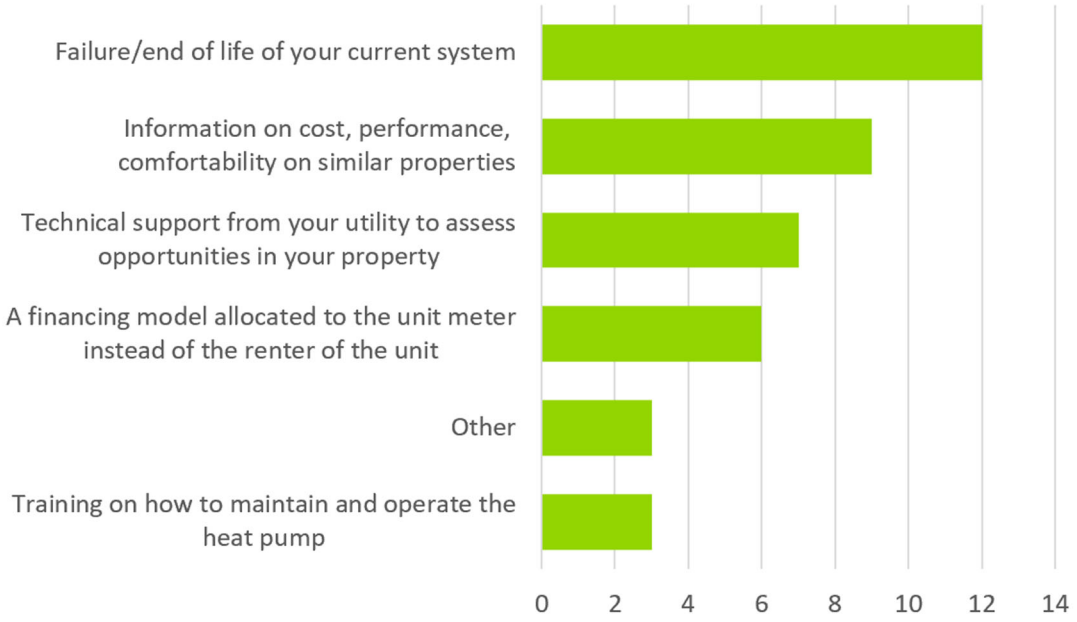
Figure 6. "What have you heard about heat pumps?"
(Count of Responses - Multiple Responses Allowed)



- **Awareness of rebates.** Interestingly, about half of respondents without heat pumps that signaled upfront cost as a major barrier for adoption, answered they were unaware of the existence of heat pump rebates.

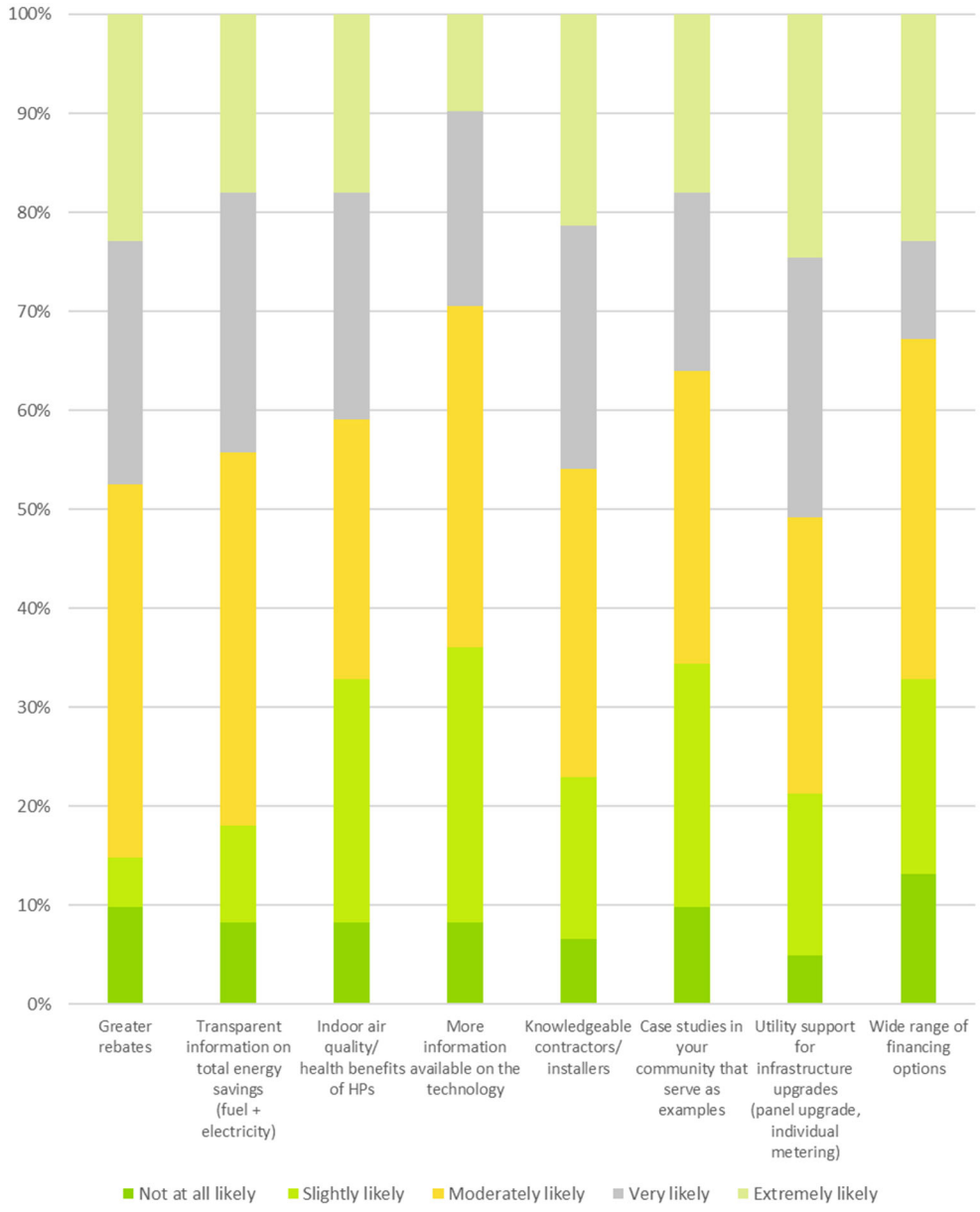
- **Drivers to install heat pumps.** When asked what would make them consider installing a heat pump at this property, respondents ranked their drivers as follows:

Figure 7. Drivers for Installing Heat Pump
(Count of Responses)



- **Likelihood to adopt heat pumps.** We asked respondents what the likelihood was to adopt heat pumps based on different economic, technical, informational offerings. Offers that helped offset the cost of heat pumps (greater rebates, more financing options, support for related infrastructure upgrades) generally scored highest.

Figure 8. Likelihood of Heat Pump Adoption



5.3 All Multifamily Respondents

Of all 108 respondents, with and without heat pumps, only 32% replied when asked what Mass Save could do to better support the adoption of heat pumps. They agreed on: **education campaigns, educating HVAC companies, more rebates, a list of experienced installers, pros and cons of different systems with average costs, and more information in general.** Essentially, respondents requested a wider range of available information and promotion on heat pumps.

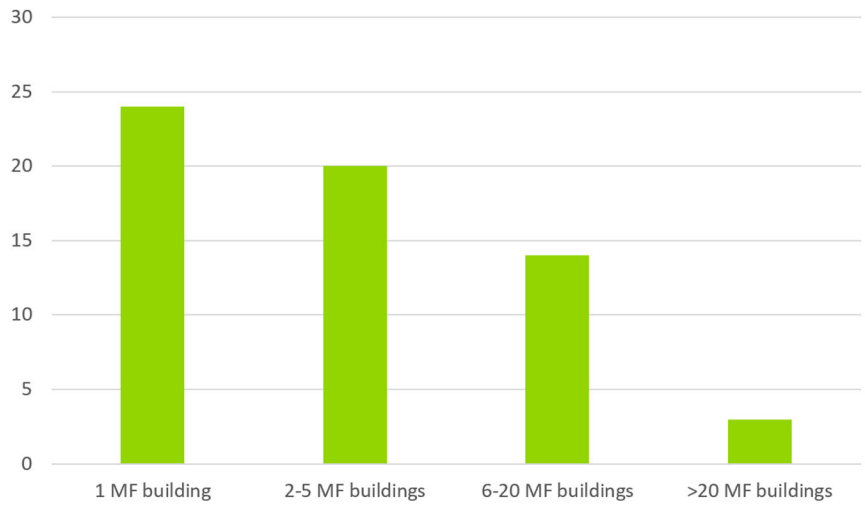
Appendix A. Surveyed Multifamily Stakeholders

A.1 All Multifamily Respondents

- **Program participation**. 61% of respondents self-reported that they have previously participated in a PA program.[14]

- **Owners and managers of MF buildings.** A large percentage of respondents own or manage 1 to 5 buildings (64%), with the highest response reaching 120 buildings, which are managed by one company (see ownership/management distribution in Figure A.1.1). Buildings with 3-4 units are the most common type amongst respondents owning or managing only 1 building. From respondents with more than 1 building, we can infer that property managers tend to aggregate one type of building (3-4 units, 5-20 units or 20+ units) in their portfolio, whereas owners tend to have a broader spectrum in their real estate assets.

Figure A.1.1. Distribution of respondents by building sizes



[14] We asked for participation in any PA programs to address familiarity with offerings and programs overall.

Figure A.1.2. One MF properties distribution by type of building

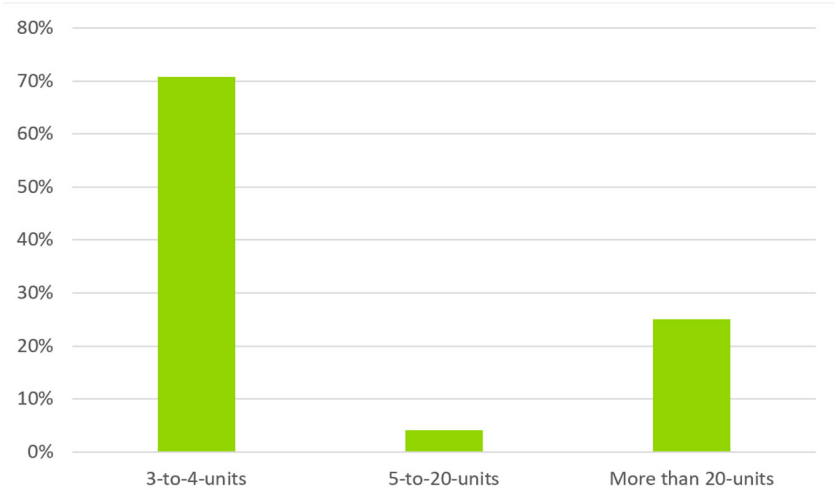
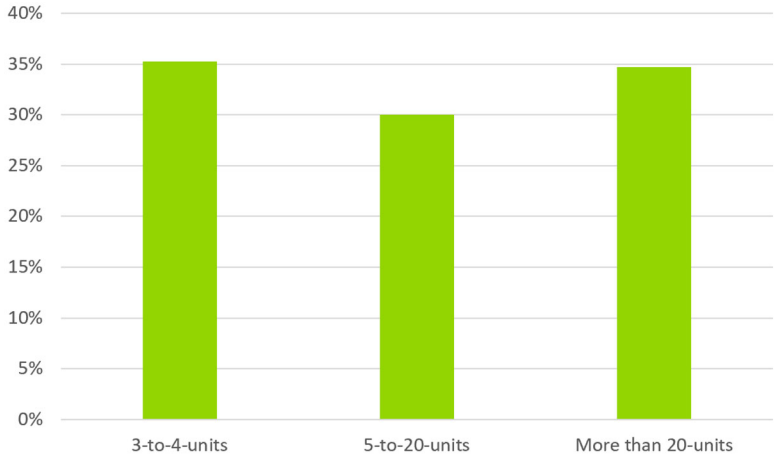


Figure A.1.3. More than 1 MF properties distribution by type of building



- **Condo owners.** Almost all condo owners have a homeowner association (HOA) in the building and almost half of them are part of the HOA board. When it comes to HVAC upgrade decisions, condo owners are involved in 75% of cases, while HOA is in 45% of cases. The decision-making process varies significantly by building, with HOA being able to decide on behalf of owners. HOA recommendations are sent to owners for approval or multiple options presented to owners for vote.

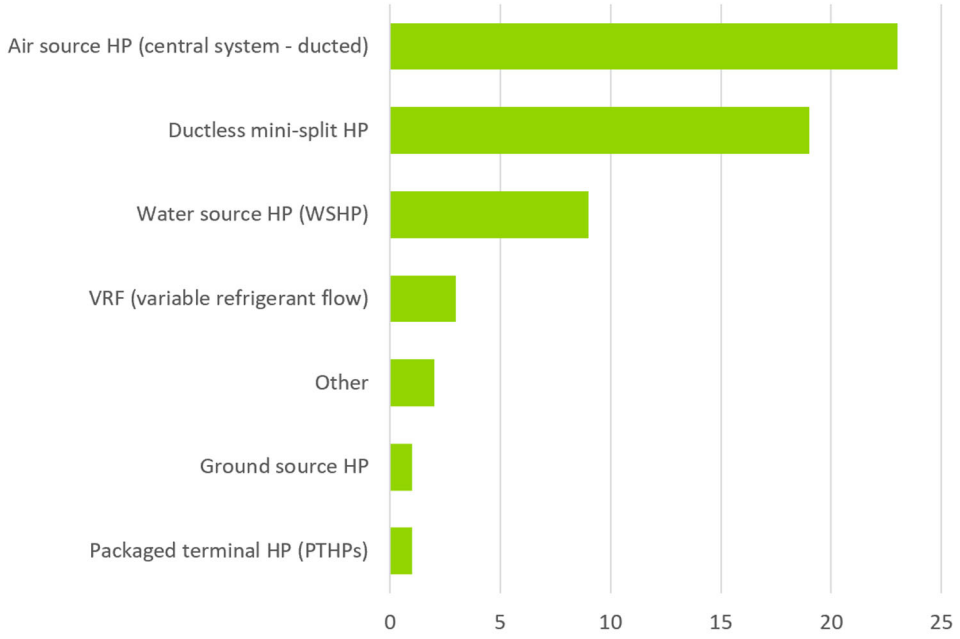
- About half of respondents have a heat pump in at least one of their properties.

A.2 Respondents with heat pumps

- **Heat pump in multifamily properties.** The graph below shows the heat pump saturation levels by type among respondents. This was a multiple response question, as more than one type of heat pump can be in the same building. The results show air

source heat pumps as the favorite in multifamily buildings, which coincided with the market saturation by type of heat pump referenced in Section 1.2 of this report.

Figure A.2.1. Type of heat pump among respondents[15]



A.3 Respondents without heat pumps

- **Heating systems and fuels.** When asked respondents about their current heating system and type of fuel used, boilers and natural gas took the lead for each category respectively (Figure A.3.1 and A.3.2). Propane, oil, and electricity account for 34% of known fuel responses and are great candidates for replacement with heat pumps using existing rebates.

[15] Eight respondents answer they did not know what type of heat pump was installed at their MF property or the MF property they lived in (renters).

Figure A.3.1. Current heating system
(Count of Response)

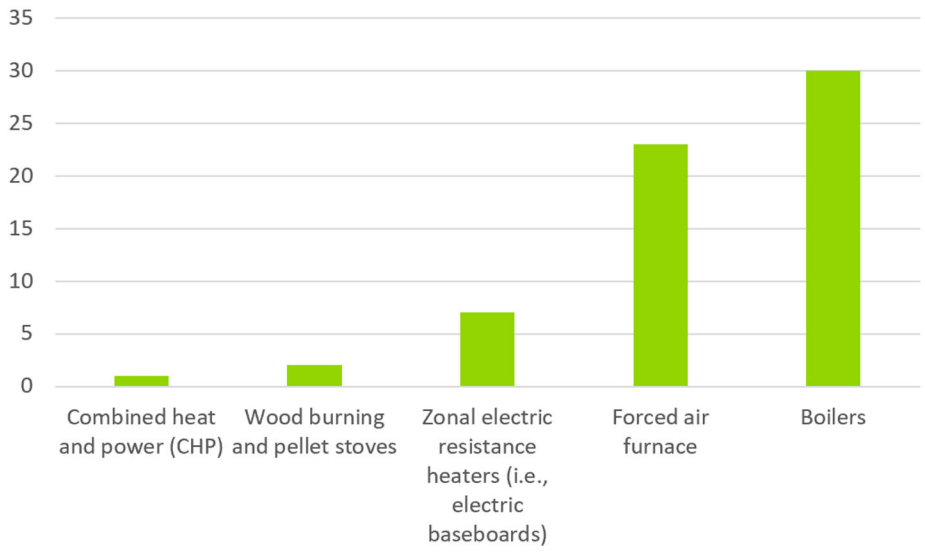
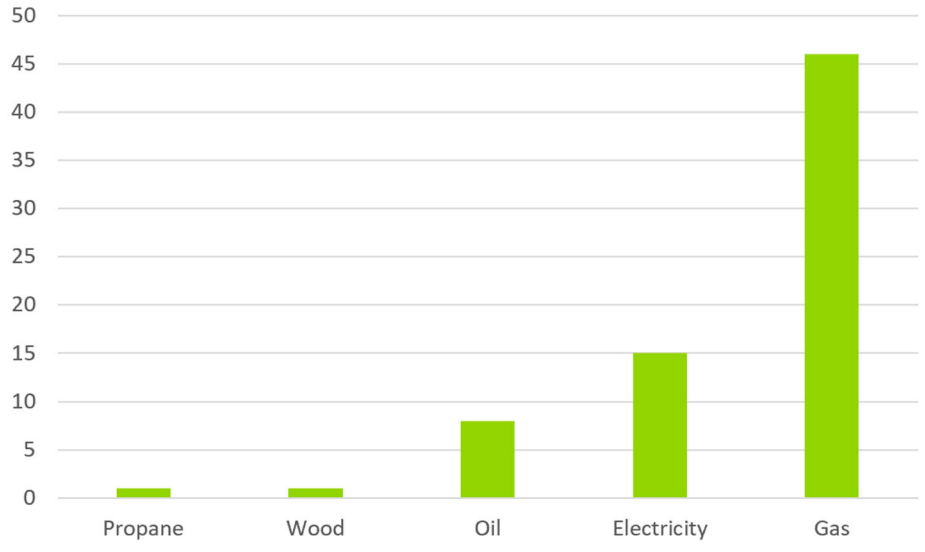



Figure A.3.2. Current heating fuel
(Count of Response)