Promoting heat pumps in cold climates: comparing strategies

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ABSTRACT

As program strategies shift to address new policy objectives for GHG emission reductions, utility programs promoting heat pump adoption are playing an increasingly crucial role in supporting building electrification across the country. Because electrification objectives are relatively new, it is challenging to compare programs on their evaluated results, leaving most program planners with limited insight into what makes a successful heat pump program. To obtain insight and inform program planning for a state in the Northeast, the authors completed a program benchmarking exercise based on similar climates, saturation of heat pumps, policy goals, and innovation in program design. In this paper, the authors describe the results of this comparison task and provide insights for program planners throughout the country looking to maximize the impact of their heat pump programs. Our comparison found that rebate amounts and structures vary greatly across programs, that efficiency requirement of products tends to be relatively high, and that additional incentives are offered based on efficiency, electrification, and decommissioning of old systems. Interestingly, most of the reviewed programs are not offering higher incentives for income eligible customers, exacerbating inequitable accessibility to higher efficiency electrification products given the high upfront costs of these systems. In addition, this paper provides a set of heat pump program best practices to inform program design decisions. Finally, this paper will integrate market perspectives on current barriers and potential solutions, gleaned from interviews conducted to support the overall project.

Introduction

Background

With increased focus on emission reduction from buildings, heat pump programs have proliferated across utilities in the US. Given the newness of these programs, there is little insight into evaluation results that can help improve these program offerings and accelerate the deployment of heat pumps. Therefore, this paper aims to identify best practices through a program benchmarking exercise.

This work was conducted on behalf of the Energize Connecticut[SM] Sponsors Eversource and Avangrid, Inc. as part of a Heat Pump Evaluation Study. We used the following criteria to identify comparable heat pump programs in other jurisdictions:

- Climate – programs in similar climate zones as Connecticut
- Ambition – programs that have set ambitious goals to increase heat pump adoption
- Innovation – programs with a unique or innovative approach
- Best practices – programs that have been highlighted as examples of best practices in the industry

Based on the criteria described above, we reviewed heat pump programs from sponsors listed in Table 1. Most programs reviewed are located in climate zones equal or colder than Connecticut (Zone 5), allowing comparison of program treatment of cold-climate heat pumps. Massachusetts, Maine, and Vermont share similar characteristics with Connecticut, such as moderate natural gas infrastructure deployment and the predominance of oil as the primary source of heating, which could inform program design targeted to delivered fuel customers. States like New York, California, Minnesota were also included due to their ambitious GHG emission reduction goals. Similarly, Maine has set a target number for heat pump deployments in the state. Massachusetts, Maine, New York, and California exhibit higher adoption of heat pumps. While the climate in Sacramento Municipal Utility District's service area is milder than Connecticut's, their program includes innovative practices that can lead to higher adoption of heat pumps.

Table 1. Characteristics of the states of the program sponsors included in this study.

State	Population	Building America / IECC Climate Zone	Natural gas (NG) infrastructure	Predominant space heating fuel percentage	Program sponsors
CT	3,605,942	Cold (Zone 5)	Medium	Oil	Energize Connecticut
MA	7,029,949	Cold (Zone 5)	Medium	Natural Gas	Mass Save
ME	1,362,341	Cold/Very Cold (Zone 6, 7)	Low	Oil	Efficiency Maine
MN	5,706,504	Cold/Very Cold (Zone 6, 7)	Medium	Natural Gas	Minnesota Power
VT	643,085	Cold (Zone 6)	Low	Oil	Efficiency Vermont, Burlington Energy Department (BED)
NY	20,201,230	Mix-humid/Cold (Zone 4, 5, 6)	High	Natural Gas	New York State Energy Research and Development Authority (NYSERDA) + Joint Utilities of New York
CA	39,538,245	Hot-Dry/ Mixed-Dry/ Cold/Marine (Zone 2, 3, 4, 5, 6)	High	Natural Gas	Sacramento Municipal Utility District (SMUD)

Source: IEC and Building America Climate Zones 2015, EIA RECS 2020

In this paper, we consider three types of heat pumps widely used in the residential sector. Air source heat pumps use the heat energy from outside air for heating indoors. The resulting heated air can either be used for central heating, as with central air source heat pumps (CASHPs), or to provide zonal heating (e.g. a single room in a household), as with mini-split heat pumps (MSHPs). Finally, ground source heat pumps (GSHPs) instead use the more stable

temperature of the earth as the heat exchange medium (BPA 2018). Table 2 shows heat pump saturation for states in which programs were selected.

Table 2. Heat pump saturation by state.

State	Population	No. of households with central HP	% of households with central HP	No. of households with mini split HP	% of households with mini split HP	No. of households with ground source /geothermal heat pump
CT	3,605,942	20,057	1.5%	3,314	0.2%	n/a
MA	7,029,949	57,972	2.1%	43,205	1.6%	6,481
ME	1,362,341	2,624	0.5%	22,299	3.9%	n/a
MN	5,706,504	43,699	2.0%	n/a	n/a	17,283
VT	643,085	1,920	0.7%	2,810	1.1%	n/a
NY	20,201,230	213,577	2.8%	105,515	1.4%	18,137
CA	39,538,245	408,768	3.1%	140,465	1.1%	n/a

Note: Ground source/geothermal heat pumps are included in central heat pump figures (mostly air source heat pumps), but are shown separately for reference. Saturation provides context but does not correlate necessarily with heat pump program as the latter are deployed in the service area of the utility, which could be smaller than the state area (i.e., SMUD in California). Source: US Census Bureau 2020, EIA RECS 2020.

From each heat pump program listed in Table 1 we took a closer look at the following program components for benchmarking purposes:

- **Eligibility**: The consumer segment or type qualified for program participation. For example, residential customers are an eligible segmentation; low-income customers are another common customer segmentation.
- **Efficiency metric/rating**: The efficiency standard required for heat pumps to qualify for the program. For example, heat pumps may have to meet a minimum HSPF2 to qualify.
- **Incentive structure**: This includes the rebate structure (e.g., $/unit, $/ton or $/10,000 Btu/h of max heating capacity @ 5F), whether there is a tier amount based on system efficiency or partial versus full displacement.
- **Incentive amount ($):** The total monetary value associated with the rebate structure.
- **Participating contractors**: The program might require the heat pump to be installed by a program participating contractor (contractor network list).
- **Cold climate heat pumps:** Whether the program specifically requires cold climate heat pumps, offers higher incentives for these or is not a requirement.

In addition, we identified a list of best practices from heat pump programs and ranked EnergizeCT heat pump program against it to identify opportunities for improvement. To define these best practices, we took the following approach:

First, we reviewed a significant body of existing literature about the heat pumps/electrification markets and programmatic efforts to encourage greater adoption written by people working in the field. We considered recommendations that consistently appeared in this literature as an indication of industry consensus and therefore a best practice.

Second, our team found that several programs have electrified/installed heat pumps in greater quantities (e.g., Maine). Under the assumption that their success was driven by a confluence of programmatic or policy characteristics, our team gave more weight to the possibility those characteristics reflected best practices.

Third, our team has worked on numerous electrification/HP studies and interacted with many program managers/market actors. That experience has provided us with anecdotal insights into what works and what does not. We also applied our professional judgment as part of the previous two criteria.

Finally, we share findings from interviews with different market actors in Connecticut, identifying barriers for heat pump adoption and offering solutions to overcome these.

Results of Residential Heat Pump Program Benchmarking

This section includes measures specific results for the following tech:

- Central Air Source Heat Pump (CASHP)
- Minisplit Heat Pump (MSHP)
- Ground Source Heat Pump (GSHP)

Residential Central Air Source Heat Pump

For CASHPs we found that:

- All programs offer a prescriptive market rate incentive.
- 4 out of 8 programs offer higher incentives for income-qualified customers.
- 7 out of 8 programs require installation by qualified contractors.
- All programs have set minimum heating efficiency ratings (HSPF2) ranging from 7.7 to 9.5, while 6 out of 8 have set minimum cooling efficiency ratings (SEER2) ranging from 14.3 to 15.2. Six out of 8 programs imposed minimum efficiency requirements at low temperatures (COP at 5F >= 1.75).
- Of the seven programs in cold climate zones, 5 offer incentives only for cold climate heat pumps, while Minnesota Power offers higher incentives for cold climate heat pumps. Programs incentivizing cold climate heat pumps use either NEEP's cold climate ASHP specification or Energy Star v6.1.

Table 3 summarizes the incentive structures for each CASHP program, including the total incentive range possible for each program, as well as for income eligible (IE) customers. We find that there are multiple different incentive structures across the programs, each with varying levels of additional incentives for certain displacement scenarios, higher-efficiency systems, and income-eligibility, leading to a wide range of possible total incentives per heat pump among the programs.

Table 3. Incentive structures for residential CAHSPs among programs studied.

Program	Incentive Structure	Base Incentive	Additional Incentives for….				Total Incentive Range
			Cold Climate	Partial Displacement	Full Disp. / Replacement	Higher Efficiency	
Mass Save	$/ton or $	$1,250/ton	Requirement	$1,250/ton	$10,000 $16,000 (IE)	No	$1,250/ton 16,000 (IE)
SMUD	$	$750 for electric-to electric	No	No	Requirement $750 for electric-to electric $2,000-$3,500 gas-to-electric	$2,000 (2 stage) or $3,500 (variable)	$750 - $3,500
NYSERDA + Joint Utilities	$/10,000 Btu/h of max heating capacity at NEEP 5F	$500/ 10,000Btu/h at NEEP 5F set by utility	Requirement	No	Requirement	No	$500- $1,400 /10,000Btu/h max at NEEP 5F (varies by utility)
Efficiency Maine	$	40% project cost up to $4,000	No	No	No	No	80% of project cost up to $8,000 (IE)
Minnesota Power	$	$400	$1,000	No	No	No	$400 - $1,000
BED	$	$1,000 (≤ 2 tons) – $1,500 (2-4 tons) $2,000 (> 4 tons)	Requirement	No	No	$2,250 (≤ 2 tons) $5,450 (2-4 tons) $7,450 (4-6 tons)	$1,000 - $7,850 (IE)
Efficiency Vermont	$	$1,000 (≤ 2 tons) – $1,500 (2-4 tons) $2,000 (> 4 tons)	Requirement	No	No	No	$1,000 - $4,200 (IE) (varies by utility)
Energize Connecticut	$/ton	$750/ton	Requirement	$750/ton	No	No	$750/ton (up to $15,000)

Note: “IE” refers to income eligible customers.

Residential Mini Split Heat Pump

For MSHPs, and like CASHP, we found that:

- All programs offer a prescriptive market rate incentive.
- Three out of 8 programs offer higher incentives for income-qualified customers.

- Seven out of 8 programs require installation by qualified contractors.
- All programs have set minimum heating efficiency ratings (HSPF2) ranging from 7.8 to 8.5, while 6 out of 8 have set minimum cooling efficiency ratings (SEER2) ranging from 15.2 to 16. Six out of 8 programs imposed minimum efficiency requirements at low temperatures (COP at 5F >= 1.75).
- Of the seven programs in cold climate zones, five offer incentives only for cold climate heat pumps, while Minnesota Power offers higher incentives for cold climate heat pumps. Programs incentivizing cold climate heat pumps use either NEEP's cold climate ASHP specification or Energy Star v6.1.

Table 4 summarizes the incentive structures for mini split heat pump program, including the total incentive range possible for each program, as well as for income eligible (IE) customers. The incentive structure is the same as for CASHP across programs. The incentive amount stays constant for almost all cases, expect for small changes in programs in VT.

Table 4. Incentive structures for residential MSHPs among programs studied.

Program	Incentive Structure	Base Incentive	Additional Incentives for….				Total Incentive Range
			Cold Climate	Partial Displacement	Full Disp. / Replacement	Higher Efficiency	
Mass Save	$ or $/ton	$1,250/ton	Requirement	$1,250/ton	≤$10,000 ≤$16,000 (IE)	No	$1,250/ton (up to $10,000-16,000 (IE))
SMUD	$	$2,000 for 2-stage	No	No	Requirement $750 electric-to electric $2,000-$3,500 gas-to-electric	$2,000 (2 stage) or $3,500 (variable)	$750 - $3,500
NYSERDA + Joint Utilities	$/10,000 Btu/h of max heating capacity at NEEP 5F	$500/ 10,000Btu/h at NEEP 5F set by utility	Requirement	No	Requirement	No	$500-$1,400 /10,000Btu/h max at NEEP 5F (varies by utility)
Efficiency Maine	$	40% project cost up to $4,000	No	No	No	No	80% of project cost up to $8,000 (IE)
Minnesota Power	$	$400	$1,000	No	No	No	$400 - $1,000
BED	$	$2,100	Requirement	No	No	No	$2,100 (≤ 2 tons) –$2500 (Multizone > 2 tons)

Program	Incentive Structure	Base Incentive	Additional Incentives for….				Total Incentive Range
			Cold Climate	Partial Displacement	Full Disp. / Replacement	Higher Efficiency	
Efficiency Vermont	$	$350(≤ 2 tons) $450 (> 2 tons)	Requirement	No	No	No	$350 - $2,550 (IE) (varies by utility)
Energize Connecticut	$/ton	$750/ton	Requirement	$750/ton	No	No	$750/ton (up to $15,000)

Note: "IE" refers to income eligible customers.

Residential Ground Source Heat Pump

For GSHP, we found that:

- All programs offer a prescriptive market rate incentive.
- Two out of 6 programs offer higher incentives for income-qualified customers.
- Five out of 6 programs require installation by qualified contractors, MN Power offers an additional incentive when GSHP is installed by participating contractor.
- Two programs (MassSave and NYSERDA) require GSHP to cover the full load of the house with MassSave requesting proof of sufficient weatherization to qualify.
- All programs require Energy Star certified products with the same EER and COP requirements for the different GSHP options: water-to-water and air-to-water and direct geoexchange (DGX).

Table 5 summarizes the incentive structures for each GSHP program, including the total incentive range possible for each program, as well as for income eligible (IE) customers. Incentive structures are simpler in general across programs than for the other technologies. In the case of GSHPs new incentive structures are available such as a dollar amount per household (i.e., MassSave) or a percentage of the project cost up to a certain amount (i.e., efficiency Maine).

Table 5. Incentive structures for residential GSHPs among programs studied.

Program	Incentive Structure	Base Incentive	Additional Incentives for….			Total Incentive Range
			Partial Displacement	Full Disp. / Replacement	Income Eligible	
Mass Save	$/ton or $	$2,000/ton	No	$15,000	$25,000	$2,000/ton-$25,000 (IE)

Program	Incentive Structure	Base Incentive	Additional Incentives for….			Total Incentive Range
			Partial Displacement	Full Disp. / Replacement	Income Eligible	
NYSERDA + Joint Utilities	$/10,000 Btu/h of full load heating capacity as certified by AHRI	$1,500 /10,000 Btu/h of full load heating capacity as certified by AHRI	No	Requirement	No	$1,500-$2,000 /10,000 Btu/h of full load heating capacity as certified by AHRI (varies by utility)
Efficiency Maine	% off	30% off project up to $3,000	No	No	No	30% off project up to $3,000
Minnesota Power	$/ton	$800/ton	No	No	No	$800-$1,000 (bonus for using MNGHPA installer)
Efficiency Vermont	$/ton	≤10: $2,100 /ton 10-20: $1,500/ton > 20-50: $1,000/ton	No	No	$500 bonus	$1,000-$2,600 (IE) /ton
Energize Connecticut	$/ton	$1,500/ton	No	No	No	$1,500/ton up to $15,000

Program Best Practices

Table 6 lists the 12 identified best practices throughout this study. Our findings show that EnergizeCT is already applying 7 of the 12 best practices (number 5 to 11), is partially aligned with best practice numbers 4 and 5, and has an opportunity to improve their offerings with number 1, 2 and 3. Other exemplary programs are highlighted under each best practice, including a brief description of how the program is implementing each.

Table 6. Best practices for heat pump programs

	Best Practices	**Example**	**Description**
1	Rebates for electrical service/panel upgrades	SMUD	SMUD offers electric panel, wiring, or service upgrade rebates to offset the cost of fuel-switching. Only gas-to-electric conversions qualify.
2	Facilitate incentive stacking (federal, state, local)	Efficiency Vermont	Efficiency Vermont advertises and accepts applications for “bonus” incentives offered through local distribution utilities.

	Best Practices	Example	Description
3	IE bonus incentives	Efficiency Maine	Efficiency Maine provides tiered rebates based on household income, which are structured in three tiers: low income, moderate income and “any income”. Low income receives the highest rebates amount and “any income” the lowest.
4	Customer education materials	Efficiency Maine/Mass Save	Efficiency Maine and Mass Save offer robust customer education resources on their website – focused on dispelling myths regarding cold climate performance (Efficiency Maine) and teaching customers how to use their heat pump (both).
5	Work with manufacturers and distributors for contractor training	Efficiency Vermont	Efficiency Vermont partners with distributors for contractor outreach and technical training, ensuring adequate knowledge amongst contractors.
6	Work with distributors to establish robust supply chains	Efficiency Vermont	Efficiency Vermont works closely with distributors to ensure adequate supply in Vermont and has largely implemented a midstream incentive for electrification technologies.
7	Provide minimum efficiency criterion and/or qualified product lists	Most programs reviewed	Most programs use tailor-designed ASHP specifications or qualified product lists.
8	Training opportunities for contractors	NYSERDA, Mass Save	NY Clean Heat imposes contractor training requirements and offers a rich selection of experiential and on-demand (online) training resources. NYSERDA also offers funding for on-the-job training. MassSave also offers a bevy of online training to contractors covering both sales strategy and technical training.
9	Cultivate and utilize certified/qualified contractor networks	Most Programs	Most programs administer contractor networks for heat pump installers. Some programs restrict incentives to participating contractors.

	Best Practices	Example	Description
10	Bundle heating electrification measures with weatherization	Mass Save NYSERDA	Mass Save mandates proof of sufficient weatherization for their whole home ASHP incentive and offers a bonus incentive for their partial home ASHP incentive. NY Clean Heat offers bonus incentives for heat pump projects that are coupled with a significant envelope upgrade. The envelope upgrade must produce a quantifiable impact on heat pump sizing to be eligible for this measure package.
11	Offer technical assistance for major retrofit or new construction (C&I)	Mass Save	Mass Save's C&I New Construction & Major Renovations offer no–cost technical support to design teams considering efficient electric new construction.
12	Financial support through low-cost loans	Most programs reviewed	Most programs offer low-cost financing for HVAC upgrades.

Market Barriers and Recommendations

In this section we highlight the top findings related to market and program design and list recommendations to address these barriers.

General Market Findings

1. Almost half of the contractors interviewed in Connecticut expressed concerns that (mainly air source) heat pumps cannot meet the full heating load, especially in cold climates like Connecticut. All contractors interviewed are part of the Heat Pump Installer Network, which evidences the need for continued education as the heat pumps incentivized by the program are only cold climate heat pumps.
2. The incremental cost of heat pumps compared to other HVAC options is still a barrier for widespread adoption. Contractors mentioned that the rebates help but prices keep going up. Our customer surveys show that lower income customers are opting for traditional heating equipment when they participate in Company's efficiency programs. These customers stated that, even with the rebates, the upfront cost was still too high for them to purchase these products, which implies that the incremental cost of heat pumps is a higher barrier for lower income customers.
3. Contractors and manufacturers alike shared concerns on uncertainties about the program's future. They indicated that they cannot confidently promote incentivized heat pumps if rapid changes to program's are the norm and they don't receive enough advance notice.

Technology-specific Findings

4. Many contractors claim that integrated controls do not make sense in several mini split with backup system scenarios. Contractors pointed specifically to cases where mini splits cannot properly pair with existing system when the distribution of the mini

splits and the thermostats are different, when there are too many thermostats running the central system, or when the mini split is limited to a specific area of the house. As a result, some contractors opt to not install integrated controls when installing mini splits, with some not even offering the rebate to customers. This leaves customers unable to participate in the program. On the other hand, many contractors claimed to install integrated controls even in situations where it doesn't make sense just to comply with program requirements, which could ultimately lead to a bad customer experience.

5. Contractors that do not view heat pumps favorably still recommend central ASHP for the replacement of central AC systems based on efficiency and price (accounting for rebates). While new central ACs have similar efficiencies and COPs as central ASHPs, variable speed ACs are not common in the market with most sales of ACs being 1 or 2 stage compressors. The opposite is true for cold climate heat pumps incentivized by EnergizeCT programs, where most heat pumps up to 5.4 tons are variable speed compressors. Thus, there are efficiency gains from installing heat pumps instead of ACs, especially when considering the aggregate impact on the grid of cooling households during summer peak.
6. EnergizeCT heat pump incentive program requires the heat pump installed to be the primary heating system but does not state how much of the heating load the installed heat pump must be capable of covering. Most if not all GSHP installations already cover the full heating load, however this is not true for central ASHPs and MSHPs. This program design element is creating a lost opportunity to further displace GHG emissions and inefficient systems.

Based on the findings above we provide the following recommendations for program design that best addressed these barriers for meeting program and state goals and avoids the lock -in of undersize or inefficient systems.

1. **Further educate contractors about heat pump performance.** EnergizeCT training center already offers several technical training courses for contractors. But given contractor's perception, an annual mandatory webinar for contractors in the heat pump installer network focusing on testimonials and case studies of heat pump without backup systems can help eradicate these concerns. Short materials or communications with specific examples or success stories on these issues can also change this perception. Contractor's testimonials can help increase confidence in these systems. Additionally, access to NEEP's cold climate ASHP product list and sizing tool could result in improved installations practices across the state.
2. **Include bonus incentives for income eligible customers – consider sourcing IRA funds**. The upfront cost of heat pumps creates an even larger barrier to adoption for income eligible customers. Providing higher heat pump incentives for income eligible customers brings equity to building electrification and helps assure that electrification programs have extensive penetration in low-income residences. Depending on how IRA funds are structured in the state, combining existing program rebates with IRA funding could enable a greater number of income eligible customers to electrify. One option is to couple existing rebates with IRA funds to cover the differential cost for income eligible customers and support service upgrades when needed.

3. **Communicate program changes further in advance so supply side partners can confidently integrate program incentives in their selling cycles.** Based on comments made by these market actors, the team recommends that program stakeholders communicate changes to incentive level or equipment eligibility at least three months in advance of the change. Program stakeholders should also consider a longer notification window for commercial incentives and equipment given the more protracted timeline associated with commercial upgrades (relative to residential projects). The study encourages the Companies to work with the HPIN to determine the most appropriate, potentially sector-specific notification windows for incentive and equipment eligibility changes.
4. **Consider eliminating the integrated controls requirement for installation of mini splits in certain partial displacement scenarios.** Eliminating this requirement will ensure that all customers have access to mini split rebates, reduce customer discomfort and contractor call backs (addressing disconnections and error messages), and streamline the installation process. Contractors would need to educate customers on proper operation of heat pump and existing system without integrated controls and leave an EnergizeCT one-pager user tips for these scenarios. Nevertheless, findings show that most customers without integrated controls (mainly mini split customers) are already manually switching to the backup system at a lower temperature than those with integrated controls (mostly central ASHPs).
5. **Ensure that program rebates for central ASHPs are sufficient to favor the installation of central ASHPs instead of central ACs**. Based on findings, the program can leverage contractor support for the installation of central ASHPs to replace central ACs to increase savings and reduce impact on the grid. As rebates are driving this trend, is important that program managers regularly observe market prices to ensure rebates continue to favor adoption of central ASHPs over central ACs.
6. **Establish a higher incentive for heat pumps covering the full heating load of the household.** This recommendation provides flexibility for those customers and contractors that are not sure about heat pump performance in cold climates, allowing them to test the limits of the heat pump without the risk of not having a backup system. Higher incentives for heat pump installations that meet the full heating load will drive up this type of adoption, avoiding the lost opportunity of locking in a system of smaller size for years to come. While customers might continue to use the old heating system during the coldest days, continued education, customer testimonials and the opportunity to test switching systems at lower temperatures can help increase the usage of the heat pump leading to further displacement of the old system. On the contractor side, the promotion of successful case studies can help eradicate contractors' perceptions that heat pumps cannot provide the full heating load needed in winter.

Conclusion

As the addition of renewable energy resources continues to decarbonize electricity generation, heat pumps will be the leading measure to reduce emission from household space heating. In order to increase adoption of heat pumps across the US, programs should be designed

in a way that encourages customer participation and provides the tools for contractors to navigate this transition. Our benchmarking study and the market and program recommendations provides a list of the key elements to consider for a successful design of a heat pump program.

Each jurisdiction will encounter specific market barriers, such as an old distribution system where infrastructure upgrades are needed, an area dominated by delivered fuel for space heating, a workforce reticent to change, or cold climate zones. Successful programs will cater to these local conditions. Certain conditions like the predominance of delivered fuel heating systems will be a market advantage for heat pump deployment given the cost effectiveness of this replacement scenario. But certainly, other factors will play a role on increasing adoption rates and utilization of heat pumps such as working closely with heat pump contractors, offering clear and short educational resources for customers, and including requirements to optimize heat pump usage. The latest market trend across heat pump programs is to stop incentivizing partial displacements and focus on whole home solutions, where the heat pump is expected to cover the full heating load of the building (NY) or at least 80% (ME).

Programs will need to keep adapting to changing market conditions. The best practices and recommendations for program design proposed in this paper can help reduce barriers to encourage more widespread market adoption and deployment of clean and efficient space heating equipment while avoiding lost opportunities.

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