



Air-Source Heat Pumps: Protecting the Financial-Wellbeing of Low-Income Families While Addressing Climate Change

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"I'm retired and received a \$700 electric bill last winter. I knew I needed to do something. I found out there was a program [through [Action, Inc.](#)] that could install a better system to help with my bills. Since I got the heat pump installed, I haven't gotten a heating bill more than \$300."

— Deb, Rockport, MA

This issue brief provides an overview of issues to consider for advocates of programs aimed at increasing electrification for residential energy customers while protecting vulnerable low-income families. A carefully designed program can save low-income customers hundreds of dollars in energy bills while removing carbon from the atmosphere.

Public policy continues to drive electrification as cities and states try to reduce dependence on fossil fuels, particularly natural gas, which accounts for one-third of national energy consumption (Source: [EIA](#)). Natural gas serves as the main source of home heating for at least 49% of residential households nationwide (Source: [Energy Saver](#)).

In Massachusetts, approximately 55% of homes use natural gas while 30% use oil and 9% use electricity for heating as of 2019 (Source: [Massachusetts Residential Baseline Study, 2020, p. 67](#)).¹ Combustion of fossil fuels like natural gas, oil, and propane in residential and commercial buildings drives up greenhouse gas (GHG) emissions, contributing to climate change. In an effort to reduce emissions, cities and states are looking to move away from natural gas, oil, and propane, and encourage electrification. These electrification efforts, which are particularly robust on the West Coast and in the Northeast, incentivize the use of air source heat pumps (ASHPs) to displace fossil fuel and electric resistance systems in homes and buildings (Source: [ACEEE](#)).

The Massachusetts Clean Energy and Climate Plan for 2030 (CECP) exemplifies the move toward increased electrification. To reduce emissions and energy waste, the CECP emphasizes the importance of transitioning to ASHP technology, with an immediate focus on displacing oil and propane systems (Source: [CECP 2030, p. 28](#)). Estimating that approximately one million residential fossil fuel systems (gas, oil, and propane furnaces and boilers) will reach the end of their life between 2021 and 2030, the CECP proposes incentivizing and enabling these households to adopt high efficiency heat pump systems (Source: [CECP 2030, p. 28](#)). In effect, the plan proposes installing one million heat pumps in homes by 2030 in an effort to transition Massachusetts households to cleaner energy and reduce greenhouse gas emissions.²

Some Key Potential Benefits of Air Source Heat Pumps

- Energy savings and reductions in GHG emissions
- Lower heating energy bills for households converting from electric resistance systems and oil/propane furnaces
- Heating and cooling system in one
- Eliminates the need for less effective and physically cumbersome window units
- Cooling system dehumidifies and filters indoor air

While advancing electrification through the adoption of ASHPs helps move cities and states away from fossil fuels, what are some considerations for ensuring that electrification policies do not harm the financial well-being of families? To ensure that households, particularly low-income families, benefit from heat pump conversion, Massachusetts electrification efforts should prioritize weatherization, energy education, and carefully designed conversion of electric resistance heat and oil/propane furnaces to ensure total savings for low-income families.

Address Heating Costs and Reduce GHGs by Weatherizing Homes before Installing ASHPs

Massachusetts homes tend to be older than those in most states, and old homes often contain more drafts and leaks than newer constructions. The average home age in Massachusetts is 54 years old, second to New York in oldest average home age (Source: [National Home Builders Association](#)). Lack of insulation and inadequate air sealing in old homes causes leaks, requiring often outdated heating systems to work overtime to keep the home warm. This leads to higher energy bills for households and creates an additional financial burden for already cash-strapped families. Low-income families in these homes spend a greater portion of their income on home heating than higher-income families. In 2017, Low Income Home Energy Assistance Program (LIHEAP) recipient households spent double the percentage of household income on heating as the average household because their incomes are so low. (Source: [LIHEAP Data, 2017](#), p. ii). If not implemented to meet the specific needs of low-income families, programs incentivizing heat pump adoption could exacerbate heating costs, especially for some low-income families living in old homes.

To ensure that low-income families benefit from heat pump technology, programs should weatherize homes before installing ASHPs. Weatherizing not only costs less than ASHP installation but also increases household comfort and can significantly reduce energy use, thereby lowering GHG emissions. Weatherizing the home first also allows for “right-sizing” the ASHP equipment that may later be installed and lowering the initial capital cost. In addition, robust weatherization of homes upfront makes the process of heat pump adoption simpler for customers who choose that path later (Source: [Mass Save Three-Year Energy Efficiency Plan](#), p. 68).

Home Heating Infrastructure and Feasibility of ASHP Conversion

Home age also influences heating fuel type and system infrastructure, illuminating some key cost-related hurdles to broad heat pump adoption in Massachusetts. Older homes often rely on natural gas, oil, or propane boilers, while newer homes are more likely to have gas or electric furnaces which push air through ducts. The deep penetration of natural gas and the prevalence of ductless systems (such as boilers) in Massachusetts present some major challenges to the ASHP goals set in the CECP 2030. In effect, the costs of switching households to ASHPs depend on whether the existing heating system uses natural gas, oil, or propane, and whether the system has ducts. At the present time, switching gas-heated homes to ASHPs is not deemed cost-effective and therefore is usually not done for income-eligible customers.

Most Massachusetts homes rely on natural gas, which is the dominant heating fuel, followed by fuel oil,³ with a small percentage using electricity for heating (Source: [Mass.gov](#), [EIA](#)). Almost all homes that currently heat with electricity use electric resistance heating. There are relatively few homes that currently have ASHPs. Electric resistance heating results in very high bills during the winter. Families relying on electricity for heating in colder regions like the Northeast and Midwest spend more on heating than families in those same regions who use natural gas for heating

(Source: [LIHEAP Data, 2017](#), p. 24). Converting expensive electric resistance to ASHPs confers significant benefits to households, lowering their heating costs (Source: [ACEEE](#)). As Deb from Rockport, Massachusetts noted, transitioning from electric resistance to an ASHP saved her hundreds of dollars on her monthly bills. For these reasons, many of the relevant stakeholders, including the state’s Energy Office, give priority to replacing existing oil- and propane-fueled heating systems and electric resistance (baseboard) heating with ASHPs.

Like electric resistance systems, oil and propane heating systems tend to result in higher energy bills for the household. Carefully designed displacement of those systems (including water heaters) with high-efficiency ASHPs can lower energy bills and greatly reduce GHG emissions (Source: [ACEEE](#)).

However, full displacement of natural gas boilers or furnaces with ASHPs for space heating reduces GHG emissions less than replacing oil and propane systems with ASHPs (Source: [Mass Save Three-Year Energy Efficiency Plan](#), p. 13). Displacement of natural gas systems also usually confers no economic benefits to customers compared to displacing oil systems.⁴ In fact, households that switch from natural gas boilers or furnaces to an ASHP may experience higher heating bills (Source: [Mass Save Three-Year Energy Efficiency Plan](#), p. 13). Ultimately, switching households to ASHPs from electric resistance and carefully identified oil or propane systems provides more bill savings than switching households from natural gas to ASHPs.

“Brendan [at Action, Inc.] spent a lot of time explaining how my old system worked versus how a heat pump would work. He answered my questions later about how to set my thermostat and whatever other questions I had. He was so knowledgeable. I can’t be thankful enough.”

—Deb, Rockport, Massachusetts

Prioritize Consumer Education about Program Availability and Heat Pump Advantages

Many homeowners are hesitant to adopt new technology and may be unlikely to adopt ASHPs. For this reason, consumer education should be a top priority and, in the low-income sector, will require more targeted funding to ensure capacity for program implementation.

Deb in Rockport, Massachusetts eagerly converted from electric resistance to an ASHP system to avoid another massive heating bill, but she did not make the decision overnight. Instead, she received detailed education from Action, Inc., the community action agency in her area, about ASHP technology that enabled her to come to an informed decision. She explained that the program manager answered all her questions and helped her understand why she would benefit from heat pump adoption. She has spread word about the program to friends and family and strongly believes more outreach is needed to make sure people know about the program that helped her.

A successful strategy for broad heat pump adoption requires recognition that each potential heat pump client is unique and will need strong outreach and education. While the CECP highlights that the Massachusetts Department of Energy Resources (DOER) will also work to ensure that [Mass Save](#) develops increased consumer education in 2022-2024,⁵ it is essential that the program target education as a priority for funding. Without substantial education and outreach, the goals of increased heat pump adoption as outlined in the CECP will remain out of reach.

Conclusion

Air source heat pumps, coupled with weatherization, can reduce low-income home energy bills by hundreds of dollars while lowering GHG emissions that contribute to climate change. There are many thousands of low-income homes with electric resistance or oil/propane furnace heating that, with customer education and careful design, can be retrofitted with air source heat pumps to simultaneously reduce greenhouse gasses and decrease low-income energy consumption. To maximize the beneficial impact of ASHP installations, public policy should:

- Address the home's weatherization needs as the first step before installing an ASHP.
- Give first priority to homes with electric resistance or oil/propane heating systems, as converting these homes to ASHPs will be financially beneficial to the household as well as beneficial to the environment.
- Mandate a vigorous program of outreach and education for low-income homeowners as part of the conversion plan.

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Endnotes

¹ These statistics do not account for the number of homes that use propane, coal, and wood for space heating in Massachusetts. The figures noted above were drawn from the [Baseline Study](#) and other sources.

² On July 15, 2021, Massachusetts Environmental Affairs Secretary Kathleen Theoharides announced ambitious greenhouse gas reduction goals that specifically apply to the state's regulated electric and gas companies and that will require significantly ramped-up installation of ASHPs. (Source: [Baker-Polito Administration Sets Ambitious Emissions Reduction Goal for Energy Efficiency Plan](#))

³ Households in the Northeast rely more on oil for heating than any other region. "In the winter of 2019–2020, about 5.5 million households in the United States used heating oil (distillate fuel oil) as their main space heating fuel, and about 81% of those households were in the U.S. Northeast census region," according to the [EIA](#).

⁴ ACEEE found that for homeowners who convert gas furnaces to heat pumps, the payback period often exceeds ten years, making the economics of heat pump adoption less compelling for these customers (Source: [ACEEE](#)).

⁵ "DOER will also work to ensure that Mass Save® develops increased air source and ground source heat pump incentives and consumer education in 2022-2024 and expands access to energy efficiency and clean heating for low- and moderate-income renters and homeowners in Environmental Justice communities through targeted community-based incentives and outreach programs, and increased funding for pre-weatherization barriers" (Source: [CECP 2030](#), p.32).