

BIG LIFT #1

**RETROFITTING THE
SMALL BUILDING STOCK**

70,000 single- and small multifamily homes need to be electrified by a new industry powered by a workforce that represents the communities it serves.

Many of Boston's homes have stood for almost a century, and while they were built to last, they were not built to keep in the heat and rely upon a sprawling and leaky natural gas system.

While that has been good enough for most residents, the continued use of natural gas for heating at current scales is inconsistent with achieving net-zero emissions. Recent geopolitical conflict and long-term investment needs also challenge it.¹⁰⁶ Those who have means can leave it behind, but in doing so may leave those without means holding the bill to maintain it.^{29,97}

Figure 16. Changes to Boston's Small Residential Buildings



Retrofitting buildings can be achieved through the electrification of heat and cooking along with insulating and weatherizing the building envelope. Electrification does not need to happen all at once, but by 2050 most homes would need to be removed from the gas system using heat pumps, energy sharing, or some delivered fuel. It would also be beneficial to add EV chargers and solar panels along the way. Homes would be healthier, more comfortable, and more resilient.

This needs to happen in 70,000 single-family and small multifamily homes, and the collective ability to do so by 2050 has yet to be developed.

Massachusetts and Boston's nation-leading efficiency programs have been remarkably successful in reducing energy consumption in large buildings, including affordable public housing, but have faced significant challenges in touching the small residential stock (Figure 17). Boston's century-old iconic triple-deckers and small multifamily buildings face greater barriers⁸³ to accessing such programs; barriers that will continue to be problematic as the focus of energy efficiency programs shifts to electrification and deeper efficiency.

Slow adoption for energy efficient heating systems



100

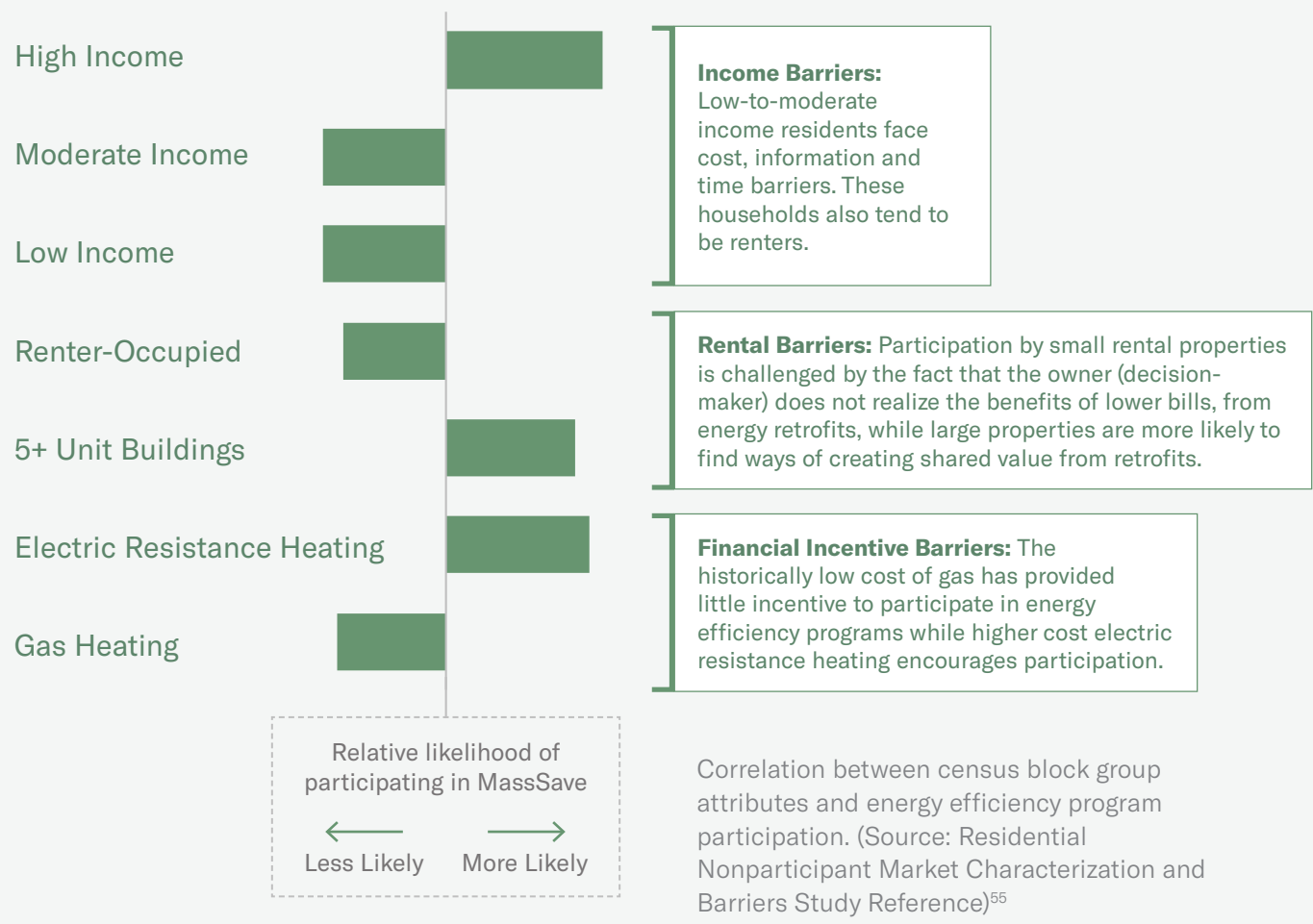
Heat pump installation permits.

1000+

Gas system replacement permits.

1 dot = 100 permits. Source: 2021 Data Small Residential Buildings, Boston Inspectional Services Department Permit Database.⁷⁶

Figure 17. Boston's small homes face several barriers to participation in MassSave energy efficiency programs.



In 2021 just over 100 heat pump installations were permitted in Boston's single-family, two-family, and three-family homes (Figure 10, on page 67), continuing a steady—but still nascent—increase in adoption.⁷⁶ Most of these were owner-occupied. In most cases, the new electrified heating system was installed alongside, rather than displacing, the existing fossil fuel system. Between 2019 and 2021, only 17 whole home “electrofits” (electric retrofits) were completed.¹³²

These numbers stand in stark contrast to:

- ▶ The more than 1,000 permitted gas system replacements per year.⁷⁶
- ▶ The 70,000 small residential buildings that contain nearly 130,000 units, approximately half of Boston's households.²⁷
- ▶ The need to install 1,000,000 heat pumps across Massachusetts by 2030 to meet the state's climate targets²⁹—a pace that would require 10,000 heat pump installs per year across Boston's building stock.

While electrifying heating systems is an essential step, so too is the need to insulate and seal up these homes in the near term; replace gas appliances such as stoves, water heaters, and dryers; install vehicle chargers; and steadily upgrade electric panels and services to accommodate increased electric loads. Long term goals include deeper energy efficiency—applying passive house principles to existing buildings—and more efficient heating strategies such as geothermal.

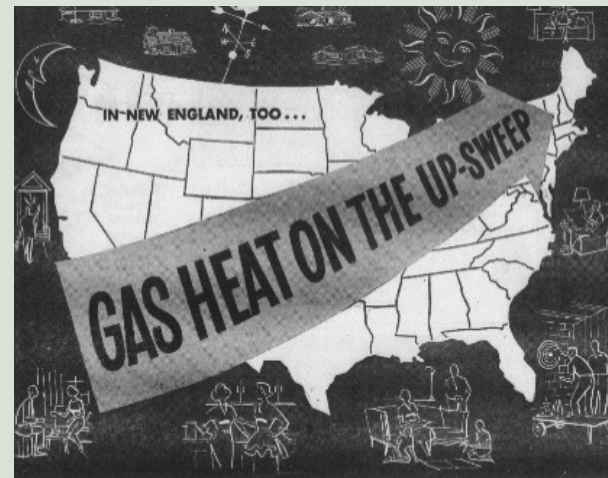
This task may sound daunting, but it is not unprecedented: The switch from manufactured to natural gas in the 1950s also necessitated transforming equipment in every gas-connected home (see next page).

Making Things Work: The Last Time Every Home Was Retrofitted

The transition from gas manufactured locally out of coal and biomass to natural gas piped in from the south required changes to every appliance to ensure compatibility. The effort was described by the former president of Boston Gas, John Bacon:

“We bought a company from the South. They were good at it. They had these trucks with lathes and machine shops, and they went from house to house and did the work. They hit Boston of course, which had some of the oldest appliances in the country. And we had to alter every range, every water heater, every single appliance. If we couldn’t get to a house on the list, we’d keep trying to get in it, until the end when we’d connect an area. If the houses weren’t converted, they were cut off. We had a couple of situations where he had to break in to get the appliances converted. We’d get a permit from the city, and we’d have an officer with us, and we’d go there and make things work.”

The transition made gas safer and cheaper, leading to its rapid adoption in the '50s and '60s. Early customers were incentivized by free appliances and marketed to aggressively. Eventually, in the words of a recent utility executive, gas began to “sell itself.”



350% more New England Homes have Gas Heat now than in 1950
You will eventually... why not now?

CHALLENGES

Making the massive switch this time requires overcoming four key challenges:

1

Household Barriers: Inertia & Funding Gaps .

Most of Boston’s building stock is old, leaky, and dependent on fossil fuels for heating. The costs of energy efficiency interventions are relatively high, and while the benefits are substantial, they tend to be diffuse and spread over long time horizons. Upfront costs can be hard to justify when full electrification costs more than remaining on gas—even though gas will become more expensive in the long term.^{23,29,97}

2

Supply-Side Barriers: Inertia .

Even when funding is available, the contracting and financing process can be cumbersome. The workforce will need to be drastically expanded, better trained, and represent the communities they work in. New supply chains and practices will need to be developed to streamline retrofits. This will be very difficult for an industry that is averse to risks associated with new approaches—one that too often dissuades customers from electrification strategies because they don’t understand them or don’t have the workforce to install them, and currently has year-long waiting lists for some interventions.

3

Entanglement Barriers: Conflicting Interests; Misalignment and Technical Feasibility .

An unmanaged exit of customers from an old gas system will burden those who cannot leave with the costs of maintaining it. While the cost of electrification is high today, the costs of gas will increase dramatically as utilities serve fewer customers on a system that is increasingly expensive to maintain. It is in Boston’s interest to strategically right-size this system, but the current regulatory framework and financial interests of investor-owned gas distribution companies challenge such efforts.



Policy Barrier: Knowledge Gaps

Current data resources and metrics are insufficient to effectively guide the transition to achieve steady emissions reductions, manage costs, and ensure equitable outcomes.

Progress Assessment

In the coming years, the pace of electrification and efficiency retrofits will accelerate, spurred by rebate and tax credit incentives offered by MassSave⁹⁵ and the federal Inflation Reduction Act.³⁷ Combined with growing customer preferences for electric alternatives, this will yield a gradual electrification—constrained in part by limits on the industry—that will be insufficient for achieving net zero and risk leaving behind those with less capability to upgrade their home. An equitable transition consistent with net zero by 2050 is currently out of reach for many homes across the city. In the small residential stock, Boston is currently not on pace for an equitable transition. The Inflation Reduction Act, along with efforts by the City, MassCEC and the Green Ribbon Commission to develop a green bank to finance projects all establish a potential pivot point for beginning to scale up efforts to make the building stock last for the next century.

Doing so is a big lift that requires:

- ▶ **Industrial policy** that establishes a consistent and ambitious pace of electrification as the core decarbonization strategy for the small building stock.
- ▶ **Market development** policy that reinforces industrial policy by developing workforce needs, supply chains, and business development.
- ▶ Proactive **transition planning** to manage costs and ensure optimal outcomes for ratepayers, particularly those with less ability to transition.
- ▶ **Improved data collection** and reporting to support these efforts.



Boosting installation of solar systems on small housing units throughout the city will help residents save money on electricity and spur new business and employment opportunities.

Rooftop solar installation. (Source: Akarawut Lohacharoenvanich /iStock)

Priority Actions

Industrial Policy Signal

Overview

The state needs to provide a clear signal that electrification is the foundational step of building decarbonization. DOER should accept Boston's application to become one of 10 communities to establish fossil fuel-free building codes.¹³³ DOER should evaluate a timeline for appliance and equipment standards, like California,¹³⁴ that drives the small residential market toward predominantly electric replacements by the late 2030s. The Commonwealth and City should prepare to leverage incoming federal funding to drive retrofits in Boston's small building stock.

Responsible Parties

- ▶ City of Boston
- ▶ MassSave
- ▶ Action for Boston Community Development (ABCD)
- ▶ MA Department of Energy Resources (DOER)
- ▶ State legislature
- ▶ Community groups

Indicators of Progress

The appropriately timely adoption of predominantly zero emissions and electric appliance and heating standards will be essential for establishing market signals on electrification. Better understanding the customer adoption of electric equipment is essential for ensuring progress. Data management recommendations are given in the rightmost column.

Market Development

Overview

Existing workforce development programs barely support industry needs. Green jobs should be seen as a rewarding career path that can help create durable wealth in low-income communities.

Supply chain improvements such as automation, standardization, and local manufacturing can be used to push down costs. Implementors can leverage pending funding from the IRA to promote these objectives.

New business models (e.g., performance contracting) should be encouraged.

Responsible Parties

- ▶ MassSave
- ▶ Industry Participants
- ▶ MassCEC
- ▶ MA Department of Energy Resources (DOER)
- ▶ Boston Public Schools

Indicators of Progress

MassSave and MassCEC should track and report the count and demographics of entrants into various green career paths.

MassSave should track and regularly report the cost of equipment and labor.

MassSave, MassCEC and DOER should evaluate the effectiveness of existing and emerging retrofit models.

Gas Transition Planning

Overview

The DPU should develop a framework for the ongoing rightsizing of the gas system by focusing on: (1) retirement of costly-to-maintain, leak prone infrastructure; and (2) long-term targeted electrification and transition to alternative heating strategies. The city, in partnership with its gas and electric utilities, should immediately pursue street and neighborhood-level implementation pilots to transition these areas off of the gas network.

Responsible Parties

- ▶ MA Department of Public Utilities (DPU)
- ▶ Eversource
- ▶ National Grid
- ▶ City of Boston
- ▶ MassCEC
- ▶ Affected residents
- ▶ State legislature

Indicators of Progress

Utilities should report¹³⁵ with geographic detail: gas system size, ongoing gas use, customers, changes to customer bills over time, and impact of pilot studies.

Improve Data

Overview

Tracking building energy assets can support city and household planning. The Massachusetts Division of Local Services should establish standards for tracking building energy assets for the small residential stock. City of Boston inspectional services and the assessor's office should implement such standards. MassSave is anticipated to improve its data tracking and reporting. A third party and stakeholders should evaluate and provide recommendations on preliminary improvements.

Responsible Parties

- ▶ Assessing Department (City of Boston)
- ▶ Inspectional Services (City of Boston)
- ▶ MA Division of Local Services
- ▶ MassSave

Indicators of Progress

The Division of Local Services and the City of Boston's Tax Assessor's Office should implement energy asset building performance tracking.