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# Upfront Cost of Home Electrification

## May 2023 benchmark report

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This first-edition benchmark report contains a statistical analysis of public data on home electrification project costs from the past several years. It is intended to provide policymakers, advocates, and researchers with ballpark estimates of the upfront cost of heat pump installations for heating, cooling, and water heating. Among our goals is to provide details to inform the implementation of electrification rebate programs in the Inflation Reduction Act as well as the design of complementary state and local building electrification incentive programs in the future. We aim to update this report on an annual or semi-annual basis as more cost data becomes available.

Estimating the upfront cost of home electrification is complicated. All homes and projects are unique, there is limited public data on prices paid in the market for heat pump installation and related projects, and prices can vary by thousands of dollars for similar jobs. Reputable sources ranging from regulatory bodies to home improvement websites [cite highly varied upfront costs](#). Finally, the comparison to the alternative cost of replacing existing appliances is often missing from estimates of the upfront costs of electrification—for example, if a heat pump is installed near the end of life of the existing HVAC system, a household can avoid the costs of a new air conditioner and fossil fuel furnace or boiler.

To estimate upfront costs of electrification, we analyze cost data sets obtained from Massachusetts and California, two states leading the way on heat pump installations. We validate our model against smaller data sets from New York and Maine. The full methodology is described [here](#), and we welcome feedback on how to improve the utility of this report in the future. You can send suggestions and recommendations for additional data sources to us at [upfrontcosts@rewiringamerica.org](mailto:upfrontcosts@rewiringamerica.org).

**Terminology:**

**Single-zone heat pump:** A single “mini-split” heat pump installation consisting of one outdoor unit and one indoor unit. Can heat a large room, a couple of connected rooms, or an open-floor-plan apartment up to about 1,000 square feet.

**Hybrid heat pump:** A heat pump installation that provides some but not all of the heating for a home, used in conjunction with a fossil or electric resistance backup system. This can be a centrally ducted heat pump, a single mini split, or a mini split with multiple indoor units.

**Whole-home heat pump:** A heat pump installation that provides all of the heating and cooling for a home. This can be a centrally ducted heat pump or a ductless system (mini split typically with multiple indoor units, and sometimes multiple outdoor units).

## Data Sources

### Massachusetts

Massachusetts has a relatively cold climate. The Massachusetts Clean Energy Center (MassCEC) ran a Residential Air-Source Heat Pump Program from November 2014 through March 2019, which provided incentives ranging from about \$500 to \$3,000 depending on heat pump size. They have provided a [detailed dataset](#) of around 21,000 projects, which we have disaggregated into single-zone (8,000 projects), hybrid (8,500 projects), and whole-home heat pumps (3,500 projects) for use in our model. The median total project cost across all installation types was around \$8,300 before incentives.

MassCEC also ran a Whole-Home Heat Pump Pilot from May 2019 through June 2021, and that [detailed dataset](#) has 158 projects. For these projects, Mass Save, the state’s energy efficiency program, offers a [whole-home rebate of \\$10,000](#). The median total project cost was around \$18,300 before incentives, and ranged from \$5,000 to

\$58,000. At the beginning of the pilot program, backup heat was encouraged, but by the end they [removed that recommendation](#), “reflecting growing acceptance of the ability of cold-climate heat pumps to serve as a stand-alone heating solution.”

## **California**

The TECH Clean California program has provided rebates on heat pumps and heat pump water heaters (HPWHs) since 2021. The TECH Clean incentive is given to contractors, and depends on the size of the system. These incentives were usually \$3,000, and the funding ran out in a few months. With new funding for 2023, they are reducing the incentive to \$1,000. They collect data about every install and [release public updates](#) each month. As of December 2022, the median total project cost for the 9,000 heat pump projects was around \$17,000 before incentives, and ranged from \$3,000 to almost \$70,000. All of these installs were whole-home, as they all either decommissioned previous infrastructure (89% of projects), or left it in place to run for emergency use only.

## **Maine**

Maine is one of the coldest states in the country, but air source heat pumps are being adopted by households at [twice the rate](#) of the rest of the US. The statewide rebate program, run by [Efficiency Maine](#), offers rebates up to \$2,000 for Low and Moderate Income (LMI) residents, and up to \$1,200 for everyone else. Efficiency Maine states that the installed cost of a heat pump is \$4,600. While they don't specify what this covers, we assume it is for a single-zone heat pump. Efficiency Maine also pays for heat pump water heaters to be installed in low-income households at a fixed price of \$2,500 for electric resistance replacement, and \$2,900 for fossil replacement (equipment plus installation).

Despite the great uptake of heat pumps, Efficiency Maine has not been publishing data on the equipment or installations themselves. One small dataset from South Portland, ME includes 36 projects completed in Fall of 2022. The total project cost ranged from \$3,000 to \$33,000 before incentives, with the lower end for a single-zone heat pump, and the upper end for 4-5 indoor units and sometimes a second outdoor unit. The average cost per zone (total cost divided by total number of indoor units) from this dataset is around \$5,200.

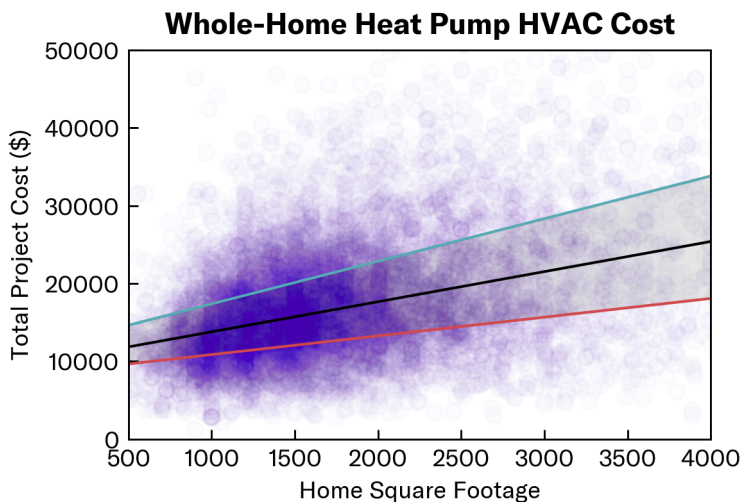
## New York

New York is also in a cold climate. As part of a 2017–2019 Air-Source Heat Pump Program, the New York State Energy Research and Development Authority (NYSERDA) offered rebates of \$1,500–\$4,500 to households who installed heat pumps, depending on heat pump size. NYSERDA published an [analysis of their program](#) including pricing data for 386 projects. The total project cost ranged from \$10,000 to \$30,000 before incentives, with an average cost of \$16,300.

## Cost Estimates

### Heat Pump HVAC: Whole-Home

The data plotted below represent total project costs (equipment plus installation costs) for a whole-home heat pump installation, derived from the TECH Clean California dataset and the two Massachusetts datasets. These costs have been adjusted to represent present-day national averages by correcting for inflation (since installations took place over the past decade) and location-specific materials & labor costs (since Massachusetts and California are relatively expensive markets).



In the data plotted to the left, the lines represent our modeled cost estimates. The black line is the median cost, the red line is the 25th percentile, and the blue line is the 75th percentile. Half of all projects fall between the red and blue lines, with 25% of installs cheaper (below the red line) and 25% more expensive (above the blue line).

Our modeled cost estimates for the 25th to 75th percentile of whole-home air source heat pumps are as follows:

## Whole-Home Heat Pump

<1,000 square foot home: see single-zone estimates below

1,500 square foot home: \$12,000–\$20,000 (median \$16,000)

2,000 square foot home: \$13,000–\$23,000 (median \$18,000)

3,000 square foot home: \$16,000–\$28,000 (median \$22,000)

**NOTE:** Range represents the 25th–75th percentile.

These are national estimates, and costs will vary significantly from market to market. Homes in moderate climates or with better insulation require less heating/cooling capacity and are likely to fall at the lower end of these ranges. Homes in colder climates or in regions with high labor costs are likely to fall at the higher end of these ranges. Hybrid heat pump installations with continued fossil-fuel backup in any size home and region will cost less than whole-home installations. Other factors, such as supply chain constraints, the familiarity of local HVAC contractors with heat pump technology, and the degree of price competition within local markets will also affect pricing, but are not possible to model with the available data.

To quantify some of the variability in costs based on climate, location, and home characteristics, we have developed a model that takes into account more information about a home in addition to its square footage, including whether the home needs new ductwork, whether the heat pump is installed in a cold climate, heat pump size/capacity, and heat pump efficiency. The results of this model are as follows:

### **Whole-Home Heat Pump:**

**Base price: \$10,000–\$17,000 (median \$13,000)**

**NOTE:** Range represents the 25th–75th percentile.

For a 1,500 square foot home, with 2.5 tons (30,000 BTU/hr) of heating/cooling, and an HSPF 10 (~HSPF2 8.5) heat pump in a moderate climate.

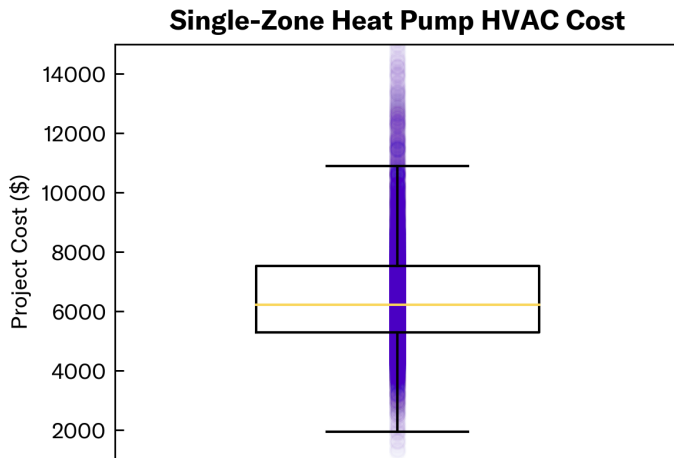
- + \$4,600 if ducts need to be replaced
- + \$2,800 if heat pump is installed in a cold climate
- + \$1,800 for every additional ton (12,000 BTU/hr) of heating/cooling capacity
- + \$1,700 for every additional 500 square feet
- + \$1,700 if panel/wiring needs to be upgraded
- + \$700 for every additional step up in heating efficiency (+1 HSPF)
  
- \$4,000 if you would otherwise be replacing a furnace\*
- \$4,000 if you would otherwise be replacing an air conditioner\*

\*Estimated to be 60% of the cost of a heat pump from a recent [decarbonization cost study](#), and verified to be close to \$8,000 for HVAC replacement via [Thumbtack](#).

Based on this, we can generate cost estimates for more detailed project parameters in specific regions of the country. For example, a heat pump installation in a cold climate like Vermont is projected to cost \$5,300 more than for a similarly sized home in a warmer climate, assuming a \$2,800 premium for cold climate, \$1,800 for an extra ton of heating capacity, and \$700 for an increase in heating efficiency (measured in terms of Heating Season Performance Factor or HSPF).

### **Heat Pump HVAC: Single-Zone**

The data plotted below are total project costs (equipment plus installation costs) for a single-zone heat pump installation, derived from the Massachusetts Air-Source Heat Pump dataset. These costs have been adjusted to represent present-day national averages by correcting for inflation and location-specific materials & labor costs.



In the data plotted to the left, the boxed area represents the 25th to the 75th percentile of project costs. The yellow line in the middle represents the median, or 50th percentile, cost. Based on this, we would expect the middle range (25th to 75th percentile) for an installed single-zone air source heat pump to be:

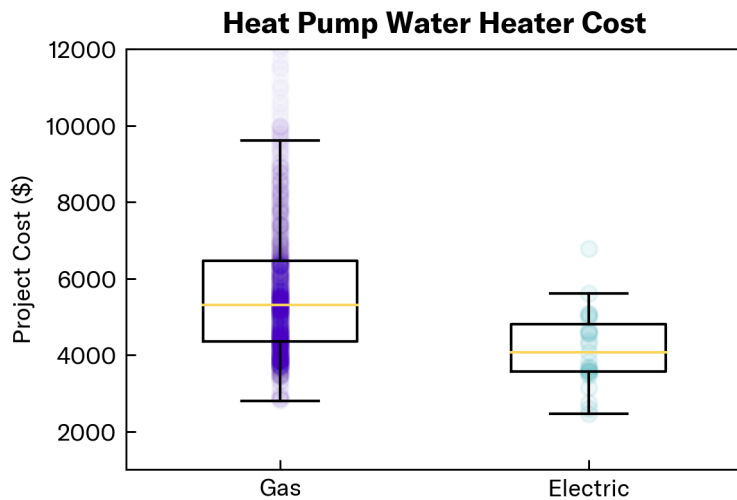
### Single-Zone Heat Pump

\$5,300–\$7,500 (median \$6,200)

**NOTE:** Range represents the 25th–75th percentile.

### Heat Pump Water Heaters

The data plotted below are total project costs (equipment plus installation costs) for a heat pump water heater installation, derived from the TECH Clean California dataset. These costs have been adjusted to represent present-day national averages by correcting for inflation and location-specific materials & labor costs.



In the data plotted to the left, the boxed area represents the 25th to the 75th percentile of project costs. The yellow line in the middle represents the median, or 50th percentile, cost. Costs are disaggregated between households replacing gas water heaters and households replacing electric resistance water heaters.

For heat pump water heaters, we did not identify a strong correlation between cost and any of the input features (e.g., square footage, water heater size in gallons, or water heater efficiency). However, if the household was replacing a gas water heater, the additional wiring required for a gas-to-electric swap made it more expensive than just replacing an existing electric resistance water heater.

Based on this, we would expect the middle range (25th to 75th percentile) for an installed heat pump water heater to be:

**Heat Pump Water Heater**

Replacing electric resistance: \$3,600–\$4,800 (median \$4,100)

Replacing gas: \$4,300–\$6,500 (median \$5,300)

**NOTE:** Range represents the 25th–75th percentile.

To translate heat pump water heater costs from national averages to location-specific cost estimates, we multiply by location-specific cost factors.



## Electric Stoves & Dryers

To calculate the average cost of efficient electric appliances, we examine Google Shopping results. Unlike the upfront cost of heat pumps or heat pump water heaters, we do not expect the cost of installing an electric appliance to vary significantly across the country. This does not include costs related to wiring when switching from gas to electric (most large electric appliances like stoves and dryers require a 240 V circuit, while gas appliances require a 120 V circuit). The difference in cost between replacing a gas and an electric resistance water heater is approximately the cost of installing a new 240 V circuit (\$1,200), although this can vary widely depending on location and the distance from the electrical panel to the appliance.

### Stove

Induction Range: \$1,300+

Induction Cooktop: \$850+

Portable Induction Cooktop: \$60+

Electric Resistance Range: \$700+

### Dryer

Heat Pump Dryer: \$1,000+

Electric Resistance Dryer: \$500+

**NOTE:** Prices are for base models and do not include the cost of wiring.