



# **COST OF RESIDENTIAL AIR-SOURCE HEAT PUMPS**

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## **Prepared For**

Board of Trustees of the Fuel Merchants  
Association of New Jersey

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## I. Summary of Data

Diversified Energy Specialists is a renewable energy consulting and environmental markets trading company based in Wilmington, Massachusetts. We have extensively studied the installation cost of residential air-source heat pump systems to the homeowner. We have completed case studies on residential air-source heat pump rebate programs in New York and Massachusetts and have closely followed the ongoing Massachusetts Clean Energy Center’s Whole-Home Heat Pump Pilot Program.

### A. Study 1: MassCEC Whole-Home Air-Source Heat Pump Pilot Program

The Massachusetts Clean Energy Center launched a Whole-Home Air-Source Heat Pump Pilot Program in May 2019<sup>1</sup>. The pilot program required that the air-source heat pumps must be capable of heating the entire home and be in use throughout the heating season. For existing homes, the program only serves existing homes displacing natural gas. For new construction, the homes cannot include any fossil fuel appliances for other uses like hot water and cooking. On September 29, 2020 the program director, Meg Howard, provided an update to the Whole-Home Heat Pump Pilot Program<sup>2</sup>. A total of 84 projects have been approved: 53 existing building, 24 new construction, and 7 gut rehab. For the 53 existing building projects, the average conditioned square footage of home was 1,590 sq. ft., and the average project cost was \$21,479. For the 24 new construction projects, the average conditioned square footage of home was 1,694 sq. ft., and the average project cost was \$14,349. For the 7 gut rehab projects, the average conditioned square footage of home was 1,204 sq. ft., and the average project cost was \$12,315.

**Table 1: Massachusetts Clean Energy Center Whole-Home Heat Pump Pilot – September Update**

Project Type	Number of Projects in MassCEC Pilot	Average Conditioned Square Footage of Home	Average Project Cost
Existing Building	53	1,590	\$21,479
New Construction	24	1,694	\$14,349
Gut Rehab	7	1,204	\$12,315
<b>Total</b>	<b>84</b>	<b>1,588</b>	<b>\$18,678</b>

### B. Study 2: MassCEC Residential Air-Source Heat Pump Rebate Program 2014-2019

The Massachusetts Clean Energy Center offered a Residential Air-Source Heat Pump Rebate program from 2014-2019. Diversified Energy Specialists filed a public information request and received those applications. Over the course of the program, 16,572 applications were submitted for retrofit installations in existing homes. Based on the data, Diversified Energy Specialists estimated that 622 of those applications for rebates could provide 80% or more of the residences annual heat load.

<sup>1</sup> <https://files-cdn.masscec.com/Program%20Summary%20%E2%80%93%20Whole-Home%20ASHP%20Pilot%202002172021.pdf>

<sup>2</sup> <https://www.masscec.com/blog/2020/09/29/september-whole-home-heat-pump-pilot-update-still-time-apply>

**Table 2: Massachusetts Clean Energy Center Residential Heat Pump Rebate Program 2014-2019**

Project Type	Number of Retrofit Installations	Average Conditioned Square Footage of Home	Average Project Cost
> 80% Annual Heat Load	622	1,502	\$20,428

Based on the application data, Diversified Energy Specialists estimated that *92.8% of the 622 retrofit installations retained their existing central heating system as supplement.*

### C. Study 3: NYSERDA Residential Air-Source Heat Pump Rebate Program 2017-2019

NYSERDA offered a residential Air-Source Heat Pump Rebate Program from 2017-2019. NYSERDA published the application data on New York State’s publicly available data website<sup>3</sup>. Over the course of the program, 5,756 applications were submitted for installations from single-family detached homes. Based on the publicly available data, Diversified Energy Specialists estimated that 386 of those applications for rebates could be considered whole-home solutions.

**Table 3: NYSERDA Residential Heat Pump Rebate Program 2017-2019**

Project Type	Number of Whole-Home Installations	Average Conditioned Square Footage of Home	Average Project Cost
Single-Family Detached House	386	1,663	\$16,272

Based on the application data, Diversified Energy Specialists estimated that a minimum of 45.4% of the 386 single-family detached house installations *retained their existing central heating system as supplement.* Many applications did not include a response regarding a supplementary heat source, therefore Diversified Energy Specialists views 45.4% as a conservative estimate.

## II. Conclusion

The extensive data sets in Massachusetts and New York suggest that the installation of air-source heat pump systems at the residential level is too costly for most low- and middle-income homeowners in the northeast. The average conditioned square footage of the homes for these installations is 10-20% lower than the median household size in both Massachusetts and New York, suggesting that homeowners in average and above average sized homes are choosing not to install air-source heat pump systems for their heating needs. Scaling the average cost of installation to the median sized household in each state provides a clearer picture of the residential cost of installation homeowners face.

**Table 4: Cost of Residential Air-Source Heat Pumps (Existing Home)**

Program	State	Median Square Footage of Residence	Estimated Project Cost
MassCEC Whole-Home Heat Pump Pilot Program	MA	1,912	\$25,829
MassCEC Air-Source Heat Pump Rebate Program	MA	1,912	\$21,572
NYSERDA Air-Source Heat Pump Rebate Program	NY	1,764	\$17,260

<sup>3</sup> <https://data.ny.gov/Energy-Environment/NYSERDA-Supported-Air-Source-Heat-Pump-Projects-20/dpke-svni>

Policy in the northeast has historically focused on retrofitting air-source heat pump systems in homes with fossil-fired systems at the end-of-life of the fossil-fired system. Replacing and upgrading a natural gas, propane, or heating oil system at the end-of-life in the northeast typically costs a homeowner \$7,000 - \$10,000. When comparing that cost of retrofitting an air-source heat pump system, it is a no-brainer for most low-and middle-income households in the northeast. *Spending an additional \$10,000 - \$15,000 to retrofit an air-source heat pump system is not affordable for most homeowners.*

All three air-source heat pump programs studied did not require the removal of the existing heating system. The existing heating system is typically retained as a supplementary heat source to compensate for the inadequacy of air-source heat pumps on cold days. If the removal of the existing fossil fuel heating system were required in these programs, the average project cost would be considerably higher. Removing the existing heating system would incur an additional cost and require the installation a supplementary heat source, typically electric resistance heat, to keep the home warm on cold days.

Diversified Energy Specialists has many residential air-source heat pump clients in Massachusetts. DES helps homeowners that install air-source heat pump systems receive the rebates and incentives that are available in the state. When filing applications, many homeowners have relayed that the air-source heat pump installation companies have strongly recommended against removing the legacy fossil fuel system. *The reason that many of the largest air-source heat pump installers in Massachusetts are telling homeowners to retain their legacy fossil fuel heating system is because retrofit air-source heat pump systems are not able to sufficiently heat a home in the cold weather.* Air-source heat pump installation companies have told homeowners to expect to use their legacy heating system for 10-15% of the annual heat load. Not only are air-source heat pump systems ineffective on cold winter days, but they are also extremely expensive to run during the winter peak hours.