

About Air Source Heat Pumps

How do air source heat pumps work?

Air source heat pumps (ASHP) are electric appliances that provide heating and cooling by moving heat into a building (for heating) or out of a building (for cooling).

Heat pumps do not create heat through burning fossil fuels like conventional heating systems. Instead, heat pumps transfer heat from one place to another by using a refrigerant that absorbs heat from the air and moves it in or out of a building. This is similar to the way that a refrigerator or air conditioner works—except that it can move heat in either direction to provide both heating and cooling.

Since it takes far less energy to move heat than it does to create heat, air source heat pumps are much more efficient: while a fossil fuel heating system is 80-90% efficient (wasting 10-20% of every dollar you spend on oil, gas, or propane), an air source heat pump can be 200-400% efficient, providing 2-4 units of heat for every unit of electricity you pay for.

Air source heat pumps are considered to be clean heating and cooling technologies because the source of heat used for your home comes from the outdoor air as opposed to burning fossil fuels. The electricity from Eversource that will power your heat pump is currently 16% from renewable resources, allowing you to reduce your carbon footprint by over 16%. In addition, as the town moves forward on their aggregation program, you will have the opportunity to use even less fossil fuels.

ASHPs are installed as either supplemental systems (displacing some but not all of the heating or cooling from the existing heating or cooling system for select areas in your home) or as primary systems completely replacing the existing system (or keeping the existing system in place but only for backup). Special controls are available to coordinate with your existing system.

Types of Air Source Heat Pumps

There are two types of ASHP systems commonly installed in homes in Massachusetts:

Ductless air source heat pumps can provide heating and air conditioning without the need for central ductwork. Each ductless system includes one outdoor unit connected to one (single-zone) or more (multi-zone) indoor wall, floor, or ceiling air distribution units. Ductless ASHPs are often referred to as ductless mini-splits.

Ductless indoor units come with remote or wireless controls (or smartphone apps!) that give you control over each unit and allow you to use them for heating, cooling, dehumidification, or as a fan. Because each indoor unit can be controlled individually (forming independent heating/cooling "zones"), you can heat or cool different zones in your home to different temperatures depending on personal comfort preferences—or reduce your energy use even more by turning down the unit in zones that are not being used.

Ducted air source heat pumps have an outdoor unit that is connected to an air handler (similar to a furnace or central air conditioner) in a building's ductwork, which is used to heat or cool the building. Ducted (also known as "central" or "unitary") ASHPs are not much different from central air conditioners, except that they provide heating and cooling in a single system (and they don't really look any different from afar!). Ducted ASHPs can work with your home's existing ductwork, though some modifications may be necessary to adapt it from being suited for a furnace or central AC to being suited for a heat pump.



From left to right: (1) a ductless outdoor unit, (2) a standard wall-mounted indoor unit, (3) a floor-mounted indoor unit, and (4) a ceiling cassette indoor unit.

Ducted air source heat pumps can be installed in a “hybrid” or “dual-fuel” configuration, where the heat pump is directly matched with an existing or new furnace. This configuration automatically switches to the lower-cost heating system based on outdoor air temperature and can be a great option for homeowners with existing ductwork that want to keep the existing furnace in place while saving on heating and cooling. When temperatures drop below a certain level, the furnace kicks in, and in the summer, the heat pump provides central air conditioning.

There are many reasons why an air source heat pump could be a good fit for your home:

- **Improved home comfort and health.** In addition to providing cooling, heat pumps filter and dehumidify air, which can improve air quality and the comfort of your home. In particular, the filtration provided by ductless systems can significantly reduce allergens in your home for sensitive individuals. Central ASHP air handlers have room for a variety of optional air quality and comfort improving devices, including electrostatic filters, UV filters, Humidifiers, and Heat recovery ventilators.
- **Flexible options.** Heat pumps are a flexible technology that can be installed in homes of all shapes and sizes with different needs—whether you need a whole-home system replacement, have (or don’t have) ductwork, want to add zoning to your home, want to increase the efficiency of heating your home, or want to add extra heating/cooling to that part of your home which isn’t as comfortable as it should be.
- **Energy savings.** You could save hundreds of dollars a year on your heating bill by installing an air source heat pump if you heat with a higher cost fuel like oil, propane, or electric resistance. There’s no need to pay thousands of dollars to get a gas connection to your home: a cleaner alternative is available.
- **High-efficiency cooling, no ductwork required.** Air source heat pumps also provide air conditioning or dehumidification and are more efficient and much quieter than window air conditioners because the

noisy compressor is outside. Ductless ASHPs can allow you to reclaim your windows and avoid having to install ductwork to stay comfortable in the summer.

- **Lower your carbon footprint.** As a clean heating and cooling technology, converting from burning fossil fuels to using an air source heat pump will help reduce your carbon footprint and dependence on imported fossil fuels. Using solar PV or other renewable electricity sources can further offset emissions from the electricity powering your heat pump.
- **Increased resiliency.** Efficiently cooling even one room in a home may be a life-saver for people vulnerable to excessively high temperatures during heat waves.
- **Whisper-quiet.** Have you been relying on noisy window units for cooling? Are you a light sleeper? Ductless mini splits in particular are extremely quiet—so quiet that you might not hear that they're on until you're right next to them!

Concerned about heat pump performance in January? Don't be; Mainers and Vermonters have installed the most cold-climate heat pumps out of any New England state in the past few years—over 50,000 since 2013, and both states are significantly colder than Massachusetts in the winter!

The Massachusetts utilities have also set a target of installing 62,000 heat pumps between 2019 and 2021 as a means to improve statewide energy efficiency, reduce emissions, and bring more benefits to residents and businesses. Cold climate ASHPs are certified based on their performance at 5°F and can continue providing heat even when winter air is well below zero: today's cold climate air source heat pumps can extract heat from the air all the way down to -13°F.

- **Higher upfront costs.** ASHPs cost more upfront than fossil fuel or central AC systems (but typically less than the two combined!). However, their higher efficiency will typically pay back the difference against oil, propane, or electric resistance over the course of several years.
- **Aesthetic considerations (ductless).** ASHPs are typically installed indoors as a wall mounted unit. If you're concerned about aesthetics, discuss other installation options like ground-mounted or ceiling-recessed units with one of our installers.
- **Reduced performance in extreme cold.** The heating output and efficiency of ASHPs declines as outdoor air temperature declines below zero, though the ASHP will continue providing heat as low as -15°F. Consider keeping your existing heating system in place as a backup system to utilize on the coldest days of the year, as heating with a heat pump on those days can be more expensive than using the backup system.
- **Defrosting.** Frost can form on the outdoor unit during periods of high humidity and near-freezing temperatures, obstructing airflow. When this occurs, the outdoor unit initiates a defrost cycle, which temporarily uses additional energy and reduces heating output.

Good Fit?

ASHPs can be installed in most homes. If you answer “Yes” to any of the questions below, a ductless or ducted ASHP could be a great fit for you:

- Do you heat with oil, propane or electric resistance?
- Is your existing heating or air conditioning system, including older ASHP, 15+ years old?
- Do you want central air conditioning but don't have/don't want to install ductwork?
- Do you have persistent hot or cold spots in your home?
- Do you want more control over the temperature in individual rooms in your home?
- Are you sensitive to air pollutants and allergens?
- Do you want to reduce your carbon footprint?

The best way to find out whether an air source heat pump is a good fit for your home is to get started with a no-cost, no-commitment site visit from an installer.

Maintenance

Annual system maintenance, which consists of cleaning air filters and an annual checkup for the indoor and outdoor units, costs roughly the same as annual servicing charges for a boiler or furnace (\$100-200/year). You can also clean or replace the filters yourself, which can help to keep your system running well for many years.

Otherwise, the only other maintenance requirement would be to keep your outdoor unit clear of snow during the winter, just like you would need to keep your furnace or boiler vents clear.

Heat pumps have an expected lifetime of ~15 years – similar to an average furnace or central AC system life expectancy.

Longevity

A ductless ASHP indoor unit is quieter when running than a refrigerator and much quieter than a typical window AC unit. Ducted ASHPs are no louder than a central air conditioner and much quieter and less odiferous than a roaring oil burner.

Middle of Winter

Be sure to install a **cold climate** air source heat pump that is certified for its performance at 5F. These can operate at temperatures down to -13F. Air source heat pumps lose efficiency as it gets colder, so as the temperature drops into the teens and single digits, you may want to consider using your backup fossil fuel heating system. This will save money but without doing this you should still come out ahead because when it's in the 30's and 40's you'll be saving energy over a fossil fuel or older system.

You will also want to keep your outdoor condenser unit clear of snow and ice to maintain airflow and minimize defrosting necessary (which reduces heating output and efficiency). While our installer will mount it on a raised platform or on the side of your wall, you'll want to keep the area around the condenser free of snow--just like keeping your furnace/boiler vents clear during snowstorms!

Requirements

If you have 100Amp electrical service, you may need an upgrade. An installer can do this upgrade for you. Be sure to install enough for your EV charger!