RESIDENTIAL GUIDE TO
AIR SOURCE HEAT PUMPS

RHODE ISLAND OFFICE OF ENERGY RESOURCES

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Guide to Air Source Heat Pumps

ABOUT THIS GUIDE

This guide provides a high-level overview of air source heat pumps (ASHP) for space and water heating. It is meant to help Rhode Islanders gain a basic understanding of this technology and equip them with knowledge to make informed decisions when considering ASHPs for their homes. For further and more technical information on ASHPs and other clean heating technologies (i.e., ground source heat pumps, biofuels, etc.) please refer to the following guides:

NEEP: Air Source Heat Pump Buying Guide

MCEC: Technologies for your Clean Energy Home

Vermonter's Guide to Residential Clean Heating & Cooling

Disclaimer

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ABOUT THE OFFICE OF ENERGY RESOURCES (OER)

The Rhode Island Office of Energy Resources' (OER) mission is to lead the state toward a clean, affordable, reliable, and equitable energy future.

OER develops policies and programs that respond to the state's evolving energy needs, while advancing environmental sustainability, energy security, and a vibrant clean energy economy. OER is committed to working with public and private-sector stakeholders to ensure that all Rhode Islanders have access to cost-effective, resilient, and sustainable energy solutions.

OER works closely with private and public stakeholders to increase the reliability and security of our energy supply, reduce energy costs and mitigate price volatility, and improve environmental quality. Rhode Islanders spend over $3 billion per year on energy to light their homes, keep the heat on, and fuel their vehicles. Fossil fuels such as natural gas, fuel oil, and gasoline supply the vast majority of these energy needs. By developing and implementing smart energy policies—such as those that promote energy efficiency and renewable energy—OER helps reduce Rhode Island's dependence on these out-of-state fuels, advancing our state as a national leader in the new clean energy economy.

AIR SOURCE HEAT PUMPS **(ASHPs)**

ASHPs provide home heating and cooling in a single system. They are three times more efficient than most fossil fuel heating systems and one of the most cost-effective heating and cooling methods on the market, because they move heat, rather than burn fossil fuels to create it. ASHPs also have the potential to be entirely fossil free when electricity is powered by renewables.

ASHPs have an outdoor compressor that can look just like a traditional AC unit. They are always raised above the ground to keep the internal fan above snow.

One outdoor unit is connected to up to 6 ductless indoor units, or to an indoor air handler (usually in the basement or attic) that distributes heating and cooling through a duct system.

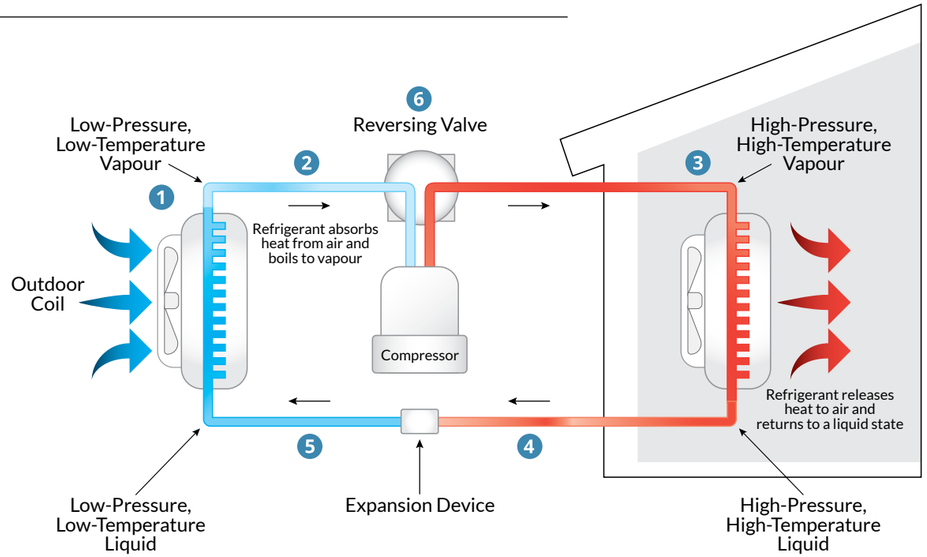
Ductless ASHP indoor wall unit

Ducted ASHP heating and cooling vent

A combination of ducted and ductless systems may be suitable for some homes. Ask your contractor what they recommend, based on the layout of your home, size of your rooms, and whether you already have heating/cooling ducts.

ASHPs are now advanced enough to meet all your heating & cooling needs, even in our very cold New England winters and hot summers.

AIR SOURCE HEAT PUMPS
HOW THEY WORK



The graphic above represents an ASHP process when in heating mode. The process is simply reversed when in cooling mode. A refrigerant is a type of liquid that absorbs and releases heat quickly. Similar to refrigerants that you add to your car's AC system or are in the coil behind your refrigerator.

1. A fan blows air over a system of coils with very cold, low pressure refrigerant which absorbs heat from the outside air. Heat can be drawn from the air even when it's very cold out.
2. The refrigerant flows to the compressor which mechanically increases the pressure of the refrigerant, causing the captured heat to warm up even more.
3. The refrigerant moves to the indoor unit and releases heat.
4. The refrigerant then moves to the expansion device, lowering the pressure of the refrigerant, which makes it very cold again.
5. The refrigerant returns to the outdoor unit to begin the cycle again.
6. The reversing valve is responsible for directing the flow of the refrigerant when switching between heating and cooling mode.

When shopping around for an ASHP, look for a system with a high heating seasonal performance factor (HSPF) greater than 9 and a Seasonal Energy Efficiency Rating (SEER) greater than 15. These indicate that the system works very efficiently in our climate.

WEATHERIZE
FIRST

Maximize your comfort and minimize costs by weatherizing your home first. Air sealing and insulation are the two types of weatherization upgrades that prevent warm air in the winter, and cool air in the summer, from leaking out of your home.

GET A HOME ENERGY ASSESSMENT

You can schedule a free home energy assessment through your utility company. A home energy specialist will conduct a basement to attic evaluation to identify which areas in your home need reinforcing and give you a good idea of the types of upgrades you can make to improve the weatherization of your home.

Check with your utility company to see what the current incentives for weatherizing are. A significant portion of the costs is often covered!

TYPES OF WEATHERIZATION

Weather Sealing

Tightening seals around doors and windows.

Insulation

Better insulation in attics, basements, walls. You can also insulate hot water pipes and any ductwork in your home to minimize the amount of heat that escapes before it reaches its destination in your home.

COSTS & **INCENTIVES**

The cost of an ASHP system is largely dependent on your needs and the characteristics of your home. If looking for supplemental heating or cooling, the cost of a single unit mini split ASHP starts at around **$5,000**. Whole home ASHPs cost, on average, between **$15,000** and **$30,000**, including installation (before incentives) but can be far less, especially if your home already has central air conditioning.

CONSIDER THE FOLLOWING FACTORS WHEN DECIDING TO INSTALL AN ASHP:

- Better sealed homes will need less heating & cooling, lowering both the cost of the system and overall monthly energy bills.
- When installed and used correctly, monthly energy bills will be significantly lower with ASHP than with oil or electric resistance heating.
- Properly sized ASHP are likely to increase comfort.
- ASHP have no to low emissions (depends on electricity source) relative to fossil fuel systems. When used to fully replace fossil fuel heating, they eliminate the risk of heating related carbon monoxide leaks and fires.
- If your heating system is 10+ years old, consider replacing or supplementing it with an ASHP before it fails.
- If installing or replacing central AC, consider upgrading to a heat pump to get highly efficient heating & cooling all in one unit.

An additional cost consideration is the need to upgrade to 200 amp electrical service if your home does not already have it. You will need to hire an electrician for this, which can cost around $2,000.

Compare the cost of an ASHP with that of a new boiler or furnace. Consider the other benefits of installing the heat pump in your home and the overall savings on energy bills over the life of the system. Rebates and other incentives can reduce the difference in upfront costs.

ASHP rebates and incentives may be available through your utility provider, so be sure to check those out before making any investment decisions.

ASHPs can be more affordable than you think. Consider all the incentives and no-cost loans available to you, as well as the other factors listed.

WORKING WITH **YOUR CONTRACTOR**

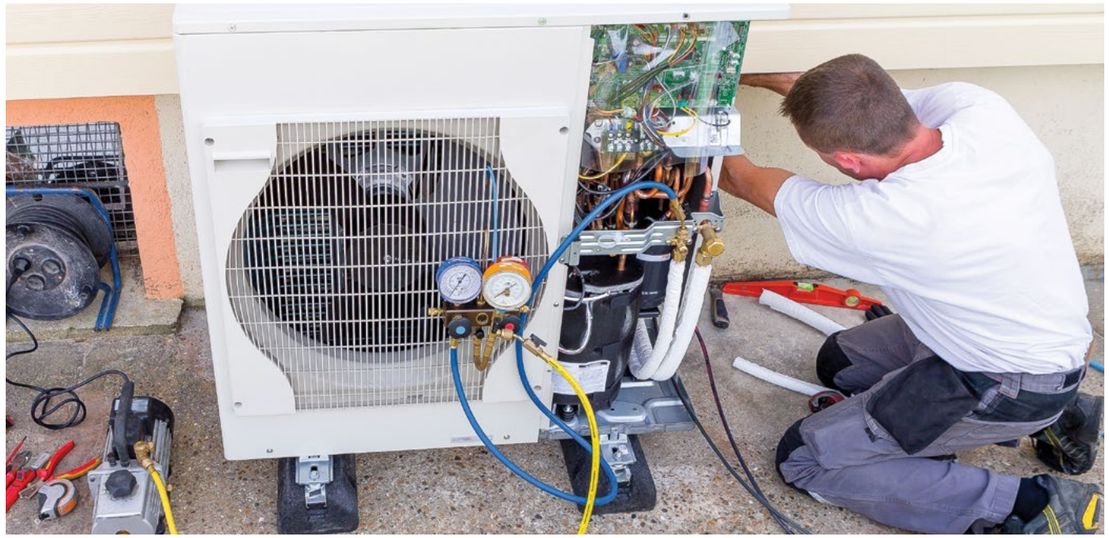
To maximize comfort and efficiency, your heat pump needs to be sized correctly. Many contractors use general rules of thumb or swap out systems like for like. These habits should be avoided when you install a new heat pump because they can lead to poor performance and higher operating costs.

Things to do before installing a heat pump

- Contact your local utility for a home energy assessment (often provided free of charge!).
- Make weatherization improvements (see p. 9).
- Find out if you need to upgrade your electrical panel to 200 amp (common in older houses).
- Get quotes from at least three contractors (see below).

Things you can do to help ensure your heat pump is sized correctly

- Request a blower door test to determine where and how much air leakage is in your home.
- Request the contractor perform a load calculation (sometimes referred to as a “Manual J”), which determines how much heating and cooling your home needs, based on the space.
- Track how much fuel you typically use for heating and provide the contractor with this information.
- Tell your contractor about the areas of your home that are too hot or too cold for your comfort level.



QUESTIONS TO ASK

- How frequently do you do heat pump installations, and can you provide references?
- What types of indoor and outdoor units will you use? Where will they be located and why?
- How will the thermostat controls be set up and will they be integrated with an old fossil fuel system in the house?
- What is the cost of installation and equipment?
- Are there incentives available? Who will apply for the incentives?
- Is there any special financing available?
- How long does the installation take?
- What can I do in advance to prepare for the installation?
- Can you walk me through how to use my heat pump, to get the best results?
- Can you show me how to clean and/or replace the filters in my system?
- Do you provide any routine maintenance services for this system?

TREAT YOUR INSTALLER RIGHT

On the day of the installation, let the person(s) know which bathroom they can use, and offer them something to drink. Try to understand their work areas and clear a wide path if possible. If you have pets, make sure you secure them away to avoid any unintentional escapes. Having a good relationship with your contractor pays off for both parties.

HEAT PUMP
WATER HEATER

Similar to air source heat pumps, heat pump water heaters (HPWHs) also use a fan and a refrigerant loop to move heat. New models are available that can be plugged into a standard outlet, making installation quick and easy!

If you place the fan inside your home in your basement, for example this can lower the temperature in that area. This may be beneficial if your washer and dryer are also in the same space, or you need dehumidification in the summer. For when it's colder, you can have a duct installed to funnel air to and/or from outdoors to prevent the temperature from dropping inside.

Talk to your contractor about the pros and cons of different placements and configurations, based on your home. Don't forget to ask if a drain will be necessary in the room or whether condensate will be pumped outdoors.

Most heat pump water heaters are hybrid models that can provide electric resistance back up heating. Make sure the system is always on the "heat pump only" or "hybrid" setting. This ensures that the heat pump is doing most of your water heating and the electric resistance back up will rarely turn on, saving you money.

Yearly savings on water heating costs can be between $100–$250 when using a HPWH instead of an electric resistance, oil, or propane water heater. The lifespan of a HPWH is often longer than conventional systems and 10–year warranties are frequently included.

What to consider:

Does your home have enough amps and the appropriate voltage?
Most HPWHs require 15–30 amps and 240 volts. If your home has a 100 amp panel, you may need to upgrade to 200 amps and check that you have the appropriate voltage.

120 volt HPWHs that can be plugged into a standard outlet are becoming more available.

Do you have the space?
A HPWH needs at least 750 cubic feet of open space (ex. 10x10 ft. room with 7.5 ft. ceiling height) to have sufficient air to collect heat from. The space should also have an average temperature of 50–90˚F.

Do you have a drain?
The condensate from the HPWH should run into a drain in the room or be ducted outside or a drain elsewhere.

Can you vent to the outdoors?
Consider whether the heat pump can be vented to the outdoors in the colder months, to prevent too much indoor cooling from hot water generation.

Can you place it close to noisy areas?
HPWHs may produce some noise which you may not want to have near your bedrooms or office.

Do you want Wi-Fi integration?
Connected with your phone, you can adjust hot water controls and monitor leaks and service notifications.

What are the costs and incentives?
- Do you need an electrical upgrade?
- What are the quotes from 2–3 different contractors?
- Are there incentives?

Operation:

Set it and forget it! Set the temperature as low as is comfortable (usually 120˚F) and don't change it frequently, which will lead to higher electricity usage.

Use "heat pump only" or "hybrid" mode whenever possible. This will avoid the use of the electric resistance coils which use more electricity to heat.

Set the system to "vacation" mode when you are away, if your HPWH has it.

Clean the air filters regularly. Follow directions from your installer/manufacturer. Guidelines typically suggest you check every 1–2 months that filters are clean and allowing proper airflow. Filters can be washed with a cloth and water. Let dry before replacing.

Check the condensate overflow line. Follow directions from your installer/manufacturer if you see any blockages or issues.

OPTIMAL USE
SET IT AND FORGET IT

Like all heating & cooling systems, the efficiency and lifetime of an ASHP can be improved by proper use. A correctly sized, used, and maintained system will maximize comfort, overall energy savings, and the longevity of the system.

PROPER SIZING

Traditionally, heating and air conditioning systems are oversized for the spaces they are heating and cooling, but bigger doesn't always mean better. In fact, comfort increases and costs decrease when an ASHP is properly sized to your home. This means taking a close look, together with your contractor, at how much heating and cooling your home needs, known as the "load," which will lead to better results.

TEMPERATURE SETTINGS

Set it and forget it!

Set the temperature to what is comfortable and don't turn the system off or down when you leave, even when it's for a day or two. Heat pumps are more efficient when they operate at a steady setting. Changing the settings throughout the day (which we know from our old fossil fuel systems) can cause spikes in electricity usage which will be reflected in your utility bill.

If you have a ductless unit serving multiple areas, keep doors between these areas open to help air flow circulate properly.

Adjust in very cold weather

If you only have heat pump heating, you can raise the temperature and set airflow to the maximum setting in very cold weather. Modern day cold climate ASHPs are more than capable of heating your home, even on very cold Rhode Island winter days. If you still have your old heating system as a back up, you should normally keep the thermostat for that system set 5–10˚ lower than the setting for your heat pump. When the weather is very cold, you can turn up the back up thermostat by a few degrees, to supplement the heat pump. Your contractor can also install integrated controls that can manage this for you.

Hot weather comfort

If your system has a "dry" setting, try that before lowering the cooling temperature. Removing humidity is key to improving comfort on hot, muggy days in our climate.

Spring/Fall

Turn the system off and open the windows at times of year when the outdoor climate is mild, and no heating or cooling is needed.

SYSTEM MAINTENANCE

- Follow instructions in your product's manual.
- Check filters monthly and clean or replace as needed.
- Keep the air vanes on a ductless system open.
- Clear the outdoor units of any snow, ice, and debris.
- Trim back any encroaching bushes.
- Good air flow around both the indoor and outdoor units are critical to efficient operation.

GETTING AN ASHP
STEP BY STEP

SCHEDULE AN ENERGY AUDIT
through your local utility
(often free of charge!)

COLLECT INFORMATION
on rebates and incentives, and financing options for both weatherization and heat pump installation.

MAKE WEATHERIZATION IMPROVEMENTS.
- After your home energy audit, take the recommendations and decide which ones you'd like to pursue before sizing your new heat pump. (Some, like attic insulation make sense to install after the ASHP installation)
- Check for rebates and incentives to help cover the cost of these upgrades.

CONSIDER WHAT YOUR HOME NEEDS.
- Look at old bills to estimate how much you use to heat and cool your home.
- What rooms are the hardest to heat in the winter and cool in the summer?
- Do you want to completely displace fossil fuels and make your whole home heating & cooling electric?
- Do you have existing ductwork?

CONTACT 3+ CONTRACTORS/HVAC INSTALLERS.
- Insist on a thorough load calculation and consideration for the unique layout and use of your home.
- Get at least three quotes for costs and type of equipment. Weigh the pros and cons of the equipment choices some higher priced systems might have additional controls that help you to further optimize comfort and be easier to service in the long run.
- Don't forget to ask the questions on p.13.

HIRE AN ELECTRICIAN
to upgrade to 200 amp electric service, if your contractor says you need to.

SCHEDULE INSTALLATION
after choosing a contractor and equipment.

LEARN HOW TO USE YOUR HEAT PUMP CORRECTLY
- Ask your contractor about the controls in your home.
- Check out p.16 of this guide.

ENJOY YOUR NEW SYSTEM, AND DON'T FORGET: SET IT AND FORGET IT!
Keep an eye on your energy costs, if anything seems unreasonable, be sure to follow up with your contractor.

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