Air Source Heat Pump Buying Guide

Air source heat pumps are an effective way to heat and cool homes, while also saving on operating costs and reducing greenhouse gas emissions. With technological advancements greatly improving this type of heating and cooling, thousands of cold-climate heat pumps are being installed at high rates of customer satisfaction. To increase buying confidence, this guide offers consumers diverse information and guidance to understand how heat pumps work, their major benefits, how to select the right type of heat pump, and how to find an installer who can accomplish a high-quality installation.

This guide is divided into two main sections. Part 1 describes what a heat pump is, how it works, what types are available, and how to think about choosing one for your home. It also includes general information about heating and cooling costs, and dispels some old myths about heat pumps that don't apply to today's high-efficiency models. Once you've decided you want to move forward with a heat pump, Part 2 introduces a series of steps to help you organize the process and offers a checklist of questions to ask potential installers. There is more specific guidance on what to look for during the design and installation process, based on the type of system you're installing and how it fits into your house.

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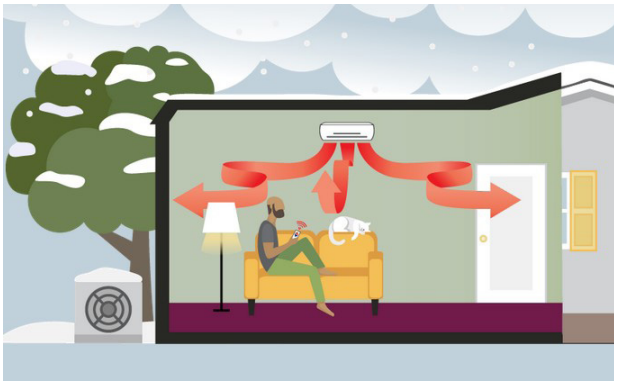
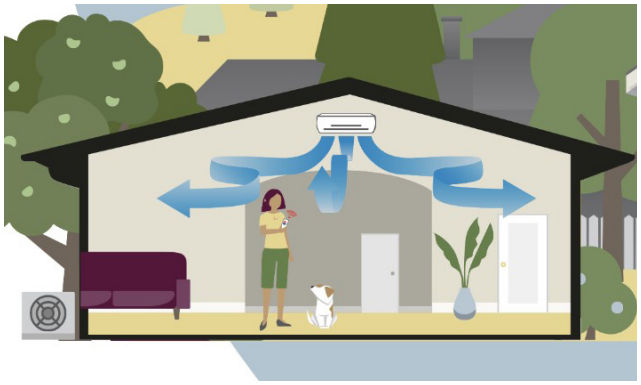
Cover photo courtesy of Diego Salazar, Product Manager (Ductless Division) of the Carrier Corporation, 2020
Part 2 cover photo used with permission from the NW Ductless Heat Pump Project, 2020

Part 1: Air Source Heat Pumps - The Basics

A heat pump is a super-efficient, economical, and environmentally-friendly way to heat and cool your home for year-round comfort. Heat pumps run on electricity, but their extreme high efficiency makes them affordable to operate.



The cost to heat a house with a heat pump is lower than oil, propane or electric baseboard; in some cases, much lower. Cost is roughly on par with gas heat: depending on electric and gas prices in your area, it may be a bit more or less than gas. High-performance heat pumps save on cooling too: their efficiency is typically more than double that of window units, and substantially more efficient than standard central AC systems.



If you're thinking about adding central AC or exploring what to do when your heating system needs replacing, or if you're renovating an old house or building a new one, a cold climate heat pump may be the best choice. Properly designed and installed, heat pumps are affordable to operate, highly comfortable, and easy on the environment. In many areas, rebates, incentives and/or favorable loan programs[1] can help pay for the installation – free money, and in some cases additional technical support, when you decide to buy a heat pump.

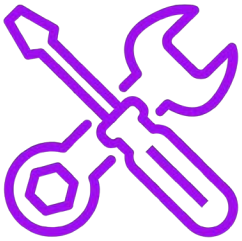
Features of Air Source Heat Pumps

Affordable

Clean Energy

Year-Round Heating & Cooling

Customizable



Healthy & Safe

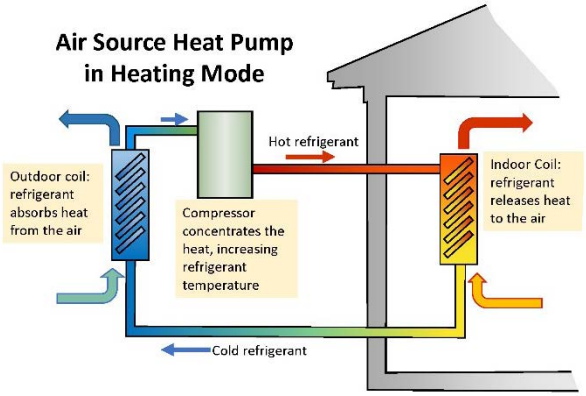
[1] www.dsireusa.org has a national listing of available programs by zip code. It helps to click "Apply Filter / Eligible sector / Residential / All Residential" and then "Apply Filter / Technology / HVAC / All HVAC". Also check with your state energy office, your local electric and/or gas utility, or your heat pump installer to learn about programs in your area. Pay attention to the rules and timeline, and be sure to submit any required paperwork.

Air Source and Ground Source Heat Pumps

The two main categories of heat pump are air-source and ground-source. Air source heat pumps (or ASHPs) use an outdoor unit to extract heat from the air. Ground source heat pumps (or GSHPs; sometimes called "geothermal") use a network of underground pipes to extract heat from the earth in the winter, and to dump excess heat back in the summer. GSHPs are somewhat more efficient than ASHPs, but they are more expensive to install. They also require adequate land for drilling or burying the ground loop. (For more information, see this guide[2]). GSHPs make sense for some homeowners, but this guide focuses on air-source systems.

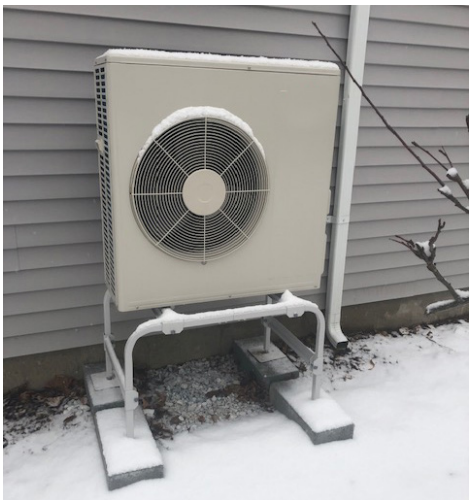
How Do Heat Pumps Work?

A heat pump works by harvesting heat energy. Believe it or not, everything that is warmer than outer space has heat energy in it, and heat pumps are able to push that energy into or out of your home. Even when it's below zero, there's still heat in the air. A heat pump effectively extracts heat from the cold outdoors, concentrates it, and delivers it inside to keep you comfortable all winter. (See illustration at right). According to the laws of physics, a lot less energy is required to move heat than to create it.



Original Diagram Courtesy of David Pill, Pill-Maraham Architects

A heat pump might look like a typical air conditioner. It is actually an air conditioner that's designed to operate in either direction, so it can heat or cool a house as needed. Another big difference from a typical AC is that advanced air source heat pumps are "variable capacity," which means the motors and fans can speed up or slow down to provide just the right amount of heating or cooling without constantly turning on and off. They are also quieter than most air conditioners and furnaces.[3]



Some people think that heat pumps just don't work below freezing, but modern technology has improved performance dramatically. Many of today's cold-climate models produce plenty of heat down to outdoor temperatures of 5, -5, or even -15 degrees Fahrenheit.

ASHP Myth #1: Heat pumps don't work below freezing
Some HVAC installers will tell their customers to turn off the heat pump when outside temperatures drop below freezing. Heat pumps of the 1980's and 90's often had such low heat output below 30ºF that installers would recommend switching them off and using the electric backup heat. Today's cold-climate units have enhanced heating capacity in cold weather, and should be left running under all outdoor conditions.

[2] geoexchange.org/wp-content/uploads/GHPs-Tapping-Energy-Beneath-Our-Feet.pdf
[3] Taken from Concord Municipal Light Plant (CMLP) "Learn More about ASHPs": https://concordma.gov/Faq.aspx?QID=462

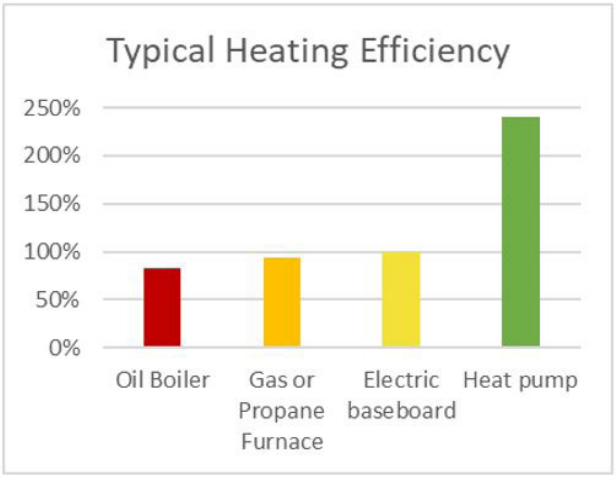
Major Benefits of Heat Pumps: Explained

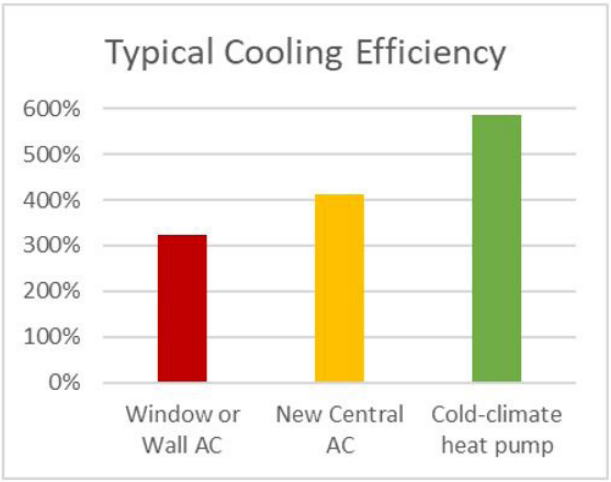
$ Affordable Technology - Efficiency and Heating Costs

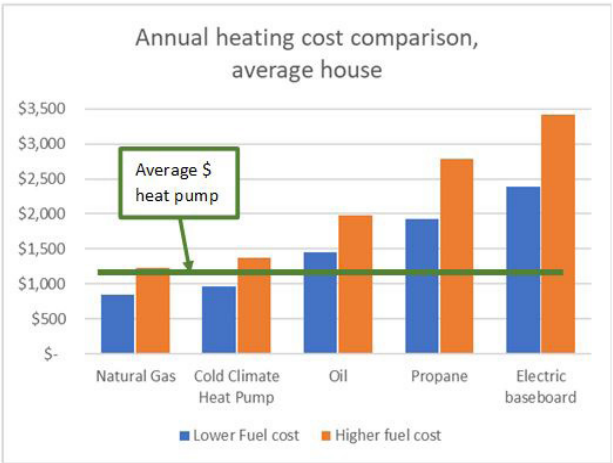
Efficiency: Air source heat pumps can heat a home at efficiencies of well over 400 percent in cool weather. For comparison, conventional heating systems that run on gas, oil, or propane have efficiencies between 80-97 percent. Burning fossil fuels for heating can never reach 100 percent, because some heat will always go up the chimney, along with moisture and other combustion byproducts. That leaves you paying for a lot more "heating potential" than what you actually get in your house. But when the heat pump efficiency is calculated, the useful heat delivered is much larger than the energy you buy at the meter. In a cold climate, the average efficiency for an entire winter is typically in the 200-250 percent range. That means over a winter, you get between two and almost three times the amount of heat for your house than what you buy at the meter. That translates to dollars saved!

Cooling efficiencies are much higher, too. Cold-climate heat pumps with variable speed capacity typically cool at twice the efficiency of common window ACs.

Heating costs: If your existing heat is low-cost natural gas, you may pay somewhat less to heat your house than with an air-source heat pump. If electric rates are lower, and gas rates are higher, that can easily flip. At a range of expected electric and fuel costs as shown in the chart (bottom-right), the heat pump beats any other fuel for heating cost. The degree of savings depends on your fuel and electric prices, so a range is shown for comparison.[4]







[4]For this comparison, the lower and higher prices used are $1.20 - 1.75/therm for gas; $0.14 - 0.20/kWh for electricity; $2.75 - 3.75/gallon for oil; and $2.50 - 3.60/gallon for propane.

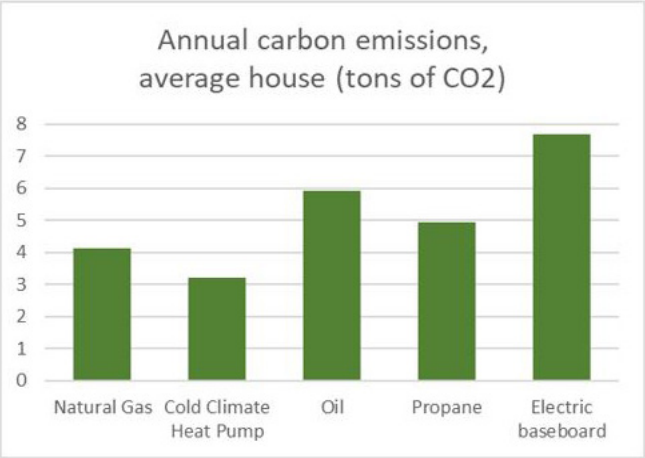
ASHP Myth #2: Heat pumps are expensive to operate

A lot of older heat pump models had low heat output and relied on costly electric backup heat. Frequent installation problems led to excessive use of electric heat. Most cold climate heat pumps have high heat output and don't even have electric backup heaters.

Remember too that unless you are currently heating with electric baseboards or other electric heaters (such as radiant panels), your electric bill will likely go up in the winter, possibly quite a bit. The heat pump uses electricity to operate; but of course, your fuel bills will also go down. If you start with a full tank of oil or propane, it may take a month or two before you start seeing the heating cost savings that balance out those higher electric bills.

Heat Pumps Are Clean Energy - and Getting Cleaner

If reducing your carbon footprint is a priority, heat pumps are the cleanest option available because of their extreme efficiency. Unlike burning oil or gas, which will always produce carbon emissions, electricity from the grid that powers heat pumps tends to get greener every year. In the chart at right, average equivalent carbon emissions from the heat pump (for the northern US) are significantly lower than any other fuel.[5] Moreover, in many areas you can choose "green" energy options from your electric company that may be partly or completely generated by renewable energy or other green technologies.



For those who want the ultimate clean energy heating and cooling system, solar electric (photovoltaic or "PV") may allow you to generate 100 percent of the electricity needed to operate your heat pump, renewably. If you have a suitable location with solar access, net-zero or close to net-zero annual emissions is possible for many homes equipped with these technologies.

[5]The emissions levels for electricity vary significantly by state; in some areas of the Midwest and plain states, the emissions from a heat pump currently may slightly exceed those of natural gas.

Healthy and Safe

On top of being highly efficient machines with a lighter carbon footprint, heat pumps are able to filter and dehumidify air, which can improve the air quality and comfort of your home.

Also, by using electricity rather than burning fossil fuels to heat your home, heat pumps help eliminate the worry of gas leaks and carbon monoxide poisoning, and can reduce the danger of potential fires or explosion.

Customizable Solutions: Ducted and Ductless ASHPs

The two main types of air source heat pumps, ducted and ductless, each have hundreds of models available on the market today. This means there are thousands of system configurations (a "configuration" is a specific arrangement of outdoor and indoor unit types) for all different types of home layouts. Ducted and ductless heat pumps can be custom-designed, mixed, and matched to meet your home's heating and cooling needs.[6]

Ducted Heat Pumps (left) use your home's existing ductwork (or new ducts if needed) to disperse heated or cooled air throughout your home. The unit is connected with an outdoor compressor, and replaces a traditional central system like a furnace, or a furnace with AC. Many ducted heat pumps are centrally ducted systems that serve many rooms or an entire house. A variant of ducted systems known as "compact-ducted" uses much smaller air handlers that usually serve two to four rooms.

Ductless Heat Pumps (right), are often called "mini-split" heat pumps. A ductless unit or "head" is easier to install where there is no existing ductwork, and typically serves one room or area of a house. Ductless heads are usually mounted high on the wall as shown, but versions are also available to mount low on the wall, or embedded in the ceiling.

Single vs. Multi Zone A single-zone heat pump pairs one outdoor unit with one indoor unit. The most common single-zone configuration for ASHPs is the "ductless mini-split" shown to the right, but single-zone systems can also be ducted. A home can have several, separate single-zone systems. A "multi-zone" configuration is a single outdoor unit paired with two or more indoor units, to accommodate multiple indoor areas or "zones". Multi-zone configurations can include multiple ducted or ductless units, or a mix of both.

[6] Photos p. 8 & p. 17 top-right taken from Mitsubishi Heating & Cooling Illustration Gallery, used with permission from Mitsubishi Electric Trane HVAC US LLC, 2019

What Configuration of Heat Pump is Right for my Home?

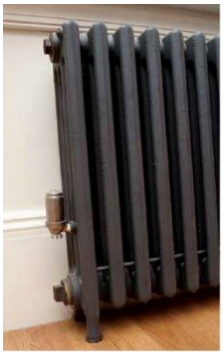
The type of heat pump that makes the most sense depends on your situation. Below are some scenarios that can help you to gauge what is the right type of heat pump installation for you, your house, and your budget.

I have an existing duct system

If your home already has a furnace (a centrally ducted system that blows warm air from registers in the floor, walls, or ceiling), it may make sense to install a central ducted heat pump that either replaces, or in some cases supplements, the furnace. However, if existing ducts are mostly in the attic, garage, and/or crawlspace, they may leak so much heat and air conditioning into those spaces that it's better to add new ductless units.

I have baseboards or radiators

If your home has hot water/electric heat baseboards or radiators, some ductless units or a combination of ductless and ducted may be the perfect solution. From one or two zones that can focus heating and cooling where they are needed the most, to a more comprehensive system that covers the whole house, a heat pump system can improve your comfort, reduce energy costs, and add air conditioning at the same time. A typical whole-house system may consist of two to five ductless units, or a combination with one or two ductless units and a compact-ducted system for the bedrooms. If you have steam heat, a whole-house system is often the best option; with other baseboard or radiator systems, you can go with whole-house or use the "start small" approach described below.



A low-wall or "floor mounted" unit can be a great replacement for an old radiator

I have one room with heating/cooling needs

You may have one room or area of the house that is never comfortable, perhaps a room over a garage or a basement space.[7] Perhaps you are planning an addition and you're surprised at how expensive it is to extend your existing heating system to serve it. A single ductless unit may be a great choice for heating and cooling. That may be all you need, or it might be the first step in a "start small" approach (explained below).

[7] Photos p. 4, p. 8 top-right, top-left, p. 9 bottom-left, p. 16 right, p. 18 taken from GoingDuctless.com Ductless Image Library, used with permission from the NW Ductless Heat Pump Project, 2019

I'm building a new home or doing a major renovation

Any new or major rehab project is a good prospect for an air source heat pump. If it's a smaller house or apartment, and built to current energy efficiency standards, often just one or two ductless units can do the job well. Or you could use a compact-ducted system for the bedrooms, plus a ductless unit for the main living space. Bigger is not better: in any sized home, a properly-sized heat pump will save you money on the installation, and that savings can help pay for energy upgrades to the building. "Over-sized" systems (systems that are much bigger than needed) cost more to install and cost more to operate, and that's why it's important to start small.

Start small

If your existing system isn't near the end of its life, think about installing one or two single zone ductless units where they can do the most for you – in the family room, in the living/dining/kitchen area of an open plan house, or in the master bedroom. Once you get some experience using them, see how well they work, and how well they can heat and cool the whole house when the weather isn't extreme. Then you can plan on getting some help with weatherization (below), and when you're ready (or when your main heating system needs replacement) you can finish the job. At that point, if you can avoid replacing the existing heating system, the added cost to add more heat pumps to heat and cool your whole house may be minimal.[8]

Weatherize

Improving your home's efficiency by insulating, air sealing, and other weatherization steps will help your heat pumps work more effectively. Take advantage of home energy assessments and any programs that may be available to help you weatherize. Whether you do it first, or as a step in the "start small" approach, weatherizing will save you money on heating and cooling, improve your comfort, and (as with heat pumps) may be financed through incentives or rebates to help pay for it. See the weatherization/home performance section in this guide.[9] Other resources on weatherization or home performance may be available on your electric or gas utility website, or from your state energy office

[8] Photos p. 9 right, p. 10 bottom-right by John Curtis ©2002 Reprinted with permission from Insulate and Weatherize by Bruce Harley, published by the Taunton Press.

[9] Energy STAR, DIY Guide to Sealing and Insulating: www.energystar.gov/sites/default/files/asset/document/DIY_Guide_2016.pdf

System Installation and Maintenance Costs

The cost to install a heat pump varies widely. It will depend on the type of system, the installer, the area where you live, whether you need any pre-work such as electric service upgrade, and any rebates that are available. A very rough cost range for basic ductless or compact-ducted systems is somewhere between $3,000-6,000 for each room or space being served directly by an indoor head or supply duct. Different brands vary in price, efficiency and features. Central ducted systems are less expensive on a per-room basis, if you already have ducts that are suitable to use for the system. But if the duct system needs significant upgrades this can add hundreds or even thousands to the total. Of course, added features or accessories like floor- or ceiling-mounted ductless systems, remote wall-mounted thermostats, or surge protectors all add to the cost, but they may be valuable additions. Complicated or tricky installation conditions, wiring upgrades, extra building code or permit requirements, and other similar situations also cost more, but may be bottom-line prerequisites for the job.

The cost to install a brand-new heat pump shouldn't be evaluated only on the dollar savings for heating and cooling your house. The cost may be fully or partly justified by increased comfort, greenhouse gas savings, and other benefits. Also, there are a number of situations that make the investment timely and affordable. Factors that can reduce cost and encourage you to consider a heat pump sooner rather than later, include:

- If your existing heating system is getting older, you might consider supplementing or replacing it with a heat pump before it fails completely. This will give you time to shop around for the best replacement system. Remember, the true cost to install the heat pump system is merely the difference between its full cost and what you would have spent on a new boiler or furnace.
- If you're considering installing a new central air conditioner, or replacing an existing one, a heat pump may cost only a little more and will provide heating as well as cooling. Or, several ductless heat pumps may cost less than a new central air conditioner in a home without ducts; but unlike an AC system it can heat your house for most or all of the winter, saving money all year.
- If you heat with oil, propane or electricity, a heat pump can save significantly on heating costs.

What you spend to maintain the heat pump should be similar to other HVAC systems. If you change or clean the filters regularly yourself, it should be adequate to have regular service checks every 2-3 years, similar to gas equipment, and less often than the annual visits needed for oil heaters.

Part 2: How to Proceed - Shop Like a Pro

How to Shop for a Heat Pump in Five Steps

Step 1: Plan ahead.

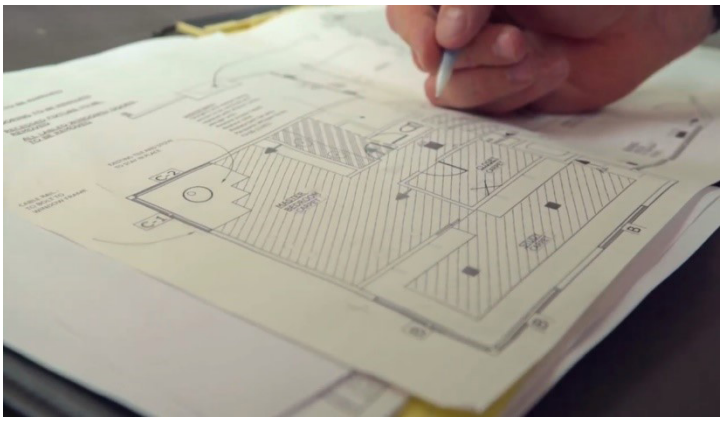
If you wait until your existing heating system fails, you won't be able to find the right contractor or properly plan for a heat pump installation. Most likely you'll get an updated version of exactly what you have now, which may not be the best choice. At the same time, the full installed cost of a heat pump often isn't justified on energy cost savings alone. If you're planning a renovation, if you have a comfort problem, or if your existing equipment is getting older (15 years is considered a typical lifetime for most furnaces and boilers), you will soon be spending money anyway on a system; now is the time to plan for a partial or full heat pump conversion.

Step 2: Find a quality installer.

Contact your trusted heating and cooling company and say you're interested in a heat pump. Also, see if your local utility or rebate program has a list of qualified installers. This can also help ensure you receive any available rebates. You can find information on your local program's website. You can also get referrals from family, friends, or neighbors.

Step 3: Shop around.

Once you find an installer, ask if they'll do a free evaluation and quote. Avoid shopping only on price; the quality of the design and installation matters just as much. Think through the section "Additional guidance to help you choose the right system size and design" below, and talk over the options with your potential contractor(s). Make sure they have a reputable track record, and can service equipment when needed. If your contractor says "heat pumps don't really work in cold climates" or "every heat pump needs a backup system", find someone else. Remember, the lowest bid isn't always the best value, and a high price doesn't guarantee competence or quality.



Step 4: Insist on load calculations.

If you're getting a ductless heat pump for the main living space and it's clear that it won't heat the whole house, it may be fine to estimate the heat pump size based on installer experience. But if you want to heat your entire home, the proposal should always start with a load calculation. This means the installer measures the rooms and window dimensions and makes a list of the insulation values in attics, walls, and basements, along with window types and direction. All are needed to calculate the amount of necessary heating and cooling to keep the house comfortable (called heating and cooling loads). This is often called a "Manual J" (the name of a widely recognized load calculation procedure).

"Bigger" is not "better" when it comes to heat pumps. In fact "too big" can create real performance problems. Installers should always start with measurements of the house and avoid using additional "safety factors"; the procedures already have a healthy margin of safety built in. Also note that for multi-zone systems, it is extremely important to calculate loads correctly and avoid indoor units that are too large for the rooms they serve. Central systems and single-zone systems (ductless or ducted) are somewhat more forgiving, because they allow for a wider range of efficient operating conditions.

Step 5: Checklist of important questions to ask a contractor

Keep the following checklist of questions on hand to help ensure your contractor is prepared to correctly design and install your system:

- ☐ Can you provide references from previous customers with similar systems?
- ☐ Have you participated in manufacturer training for the systems you would install?
- ☐ Do you know about available incentives or rebates, and will you provide assistance in applying for them?
- ☐ Do you use the NEEP Sizing and Selecting Guide and Cold-Climate Installation Guide[10] to inform your work?
- ☐ Will you choose equipment from the NEEP cold-climate air-source heat pump list, and use the information in the listing to help size the system properly?
- ☐ Where will you mount the outdoor unit(s), and how? (Brackets bolted to an exterior wall may create unwanted noise in a sensitive area like a bedroom; ground-mounted units should always be on a stand to keep them above the normal snow line. Units should also be shielded from rain and snowmelt dripping off the roof.)
- ☐ If exterior "line sets" (piping) will be visible, where will they be placed?
- ☐ What type of indoor units are you recommending, where will they be located, and why?
- ☐ Do you recommend a wall-mounted thermostat or control? (This is needed for ducted systems. For ductless units serving larger spaces, it can enhance comfort by sensing the temperature in a central location.)
- ☐ Do you always perform a triple evacuation before charging the refrigerant lines?
- ☐ Will I need to hire my own electrician to provide the electrical work? Will I need any electrical service upgrade to accommodate the heat pumps? (This is not unusual in older houses.)
- ☐ Will you use any subcontractors in the process? If so, who are they and what jobs will they do?
- ☐ Will you provide training for me on how to properly operate and maintain the system?
- ☐ Do you provide a warranty for the systems you install, and how long is it?

Always ask for a quote that details the equipment model numbers and itemizes any other parts and accessories that you'll be charged for. If possible, try to get options for two or three alternatives from the same contractor so you can consider a range of options, with some explanation of the differences and the benefits of the various options.

[10] Resources taken from: https://neep.org/ASHPInstallerResources

Additional guidance to help you choose the right system size and design

A contractor that can answer the checklist of questions above is likely prepared to properly design and install air source heat systems in the best interest of you and your home. But to avoid unnecessary expense and give you additional confidence in your purchase, this section offers some additional tips for correct sizing and designing of many common system types, as well as how to avoid possible issues specific to that type of system.

Note: This section is slightly more technical than the rest of this guide. This information is not imperative to know, but can help you choose the most efficient and cost-effective solution.

Centrally ducted heat pump: An outright replacement of a furnace with a ducted heat pump.

Things to consider with centrally ducted systems

- If you're using existing ductwork from a gas or oil furnace, the air flow for a heat pump may be significantly higher. A careful assessment of the ductwork is needed, and significant duct upgrades may be necessary. Any weatherization that has been done to the house helps reduce that possibility.
- Some centrally-ducted heat pumps have lower heating output at colder temperatures, and rely on electric heaters in the ductwork to make up the difference in the coldest weather. Try to get a heat pump with enough heating output to fully meet the heating load without needing the electric heaters. If your installer still wants to put in an electric heaters, that's OK – but find out how to shut them off, until or unless you actually need them.
- Some houses have multiple furnaces. In that case, if you want to start small, replace the system that serves the lower floor(s) of the house, or the most lived-in areas, first. It's not common to install a new central heat pump in a home that has no existing ducts, due to the expense of building the ductwork.

Centrally ducted dual-fuel system: This may take the form of a new, dual-fuel furnace and heat pump system, or it may be a heat pump coil added to (or replacing) an air conditioner coil on an existing furnace.

Things to consider with dual-fuel systems

- Dual fuel systems allow for the flexibility of heating with a heat pump or with a more traditional gas or oil furnace. This can give customers the chance to use each system optimally based on costs and environmental benefits.
- In a dual-fuel system, the heat pump must shut off any time the furnace runs. Often the heat pump can meet the heating needs of the house, down to 30 or 20 degrees, or even lower. A dual-fuel thermostat typically controls which system operates, based on the outdoor temperature.

- A dual-fuel system won't save as much of your existing heating fuel compared to a full-replacement central heat pump, which eliminates use of the old fuel entirely.
- If you heat with oil or propane, a full replacement heat pump is cheaper to operate than dual-fuel; with natural gas, the dual-fuel system is likely more economical for heating
- If you have a relatively new furnace with an older central AC, or if you are planning to add a new central AC to the furnace, you might buy "up" to a heat pump. This creates a dual-fuel system for a modest extra cost over an AC system.
- Care should be given in selecting an add-on heat pump coil that is compatible with your existing furnace. You may need to settle for a non-"cold climate" heat pump that's compatible with your existing furnace, but it can still save significant heating fuel which a standard AC can't.[11]

Ductless system: A single-zone system with a single indoor head (mounted high on the wall, low on the wall, or embedded in the ceiling) connected to a single outdoor unit.

Things to consider with ductless

- A ductless unit can provide heating or cooling to adjacent rooms when the rooms are in an "open plan" with large open doorways or no walls between them. But rooms with frequently closed doors will not get nearly as much heat and will run cool in the winter.
- Remember there will be some room-to-room variation in temperature if using a single zone system to condition multiple rooms. If you prefer cool bedrooms in the winter, this may be ideal.
- If you like every room exactly the same, it may not be the best option unless you have a separate heating zone for each bedroom.
- A first-floor ductless system can add significant heat to the upstairs bedrooms as well, if there is an open stairway.
- First floor units won't provide any cooling to the second floor, and upper floor units won't heat the first floor. If you want both heating and air conditioning in a two-story house, you'll need at least two indoor units.
- One or two ductless units may be all you need for a small house, or a very efficient (new or renovated) house. Similarly, they could be the first step in the "start small" strategy discussed on page 10.

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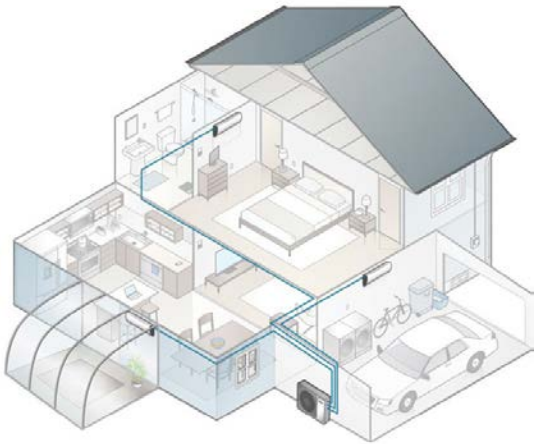
[11]Additional images (p. 9 top-left, middle-left & p. 15 bottom-right) provided by Bruce Harley, Bruce Harley Energy Consulting LLC

Compact-ducted system: A variation of the ductless system, with recessed heads that utilize short runs of air ducts to serve two to four separate rooms (sometimes called a "ducted mini-split")

Things to consider with compact-ducted:

- A single compact-ducted system can provide both heating and cooling in several smaller rooms at higher efficiencies, and lower operating costs, than a multi-zone system with a ductless head in each room. Typical installation costs are similar.
- Make sure ducts are completely sealed and carefully insulated, especially if they are installed in an attic, garage, or a vented crawlspace. Have the installer or a third party do a duct leakage test.
- Some compact-ducted systems don't have a lot of fan power available to move the air. The installer has to pay careful attention to selecting the right air handling unit, and to proper design of the duct system.
- For many houses, a combination of one or more zones each of ducted and ductless is a great setup. A ductless unit for the living/kitchen/dining area, and a compact-ducted for the bedrooms, is common. A basement family room or addition that really needs to be a separate zone may require its own ductless unit.

Multi-zone: Usually installed as a whole-home solution or to cover the majority of a home, a multi-zone system consists of multiple ductless and/or ducted indoor units in different areas of a house, all connected to a single outdoor unit.



(Source: Broadley's Energy Solutions, 2019)

Things to consider with multi-zone:

- Although multi-zone is a convenient method to manage comfort in separate rooms, it is also easy to over-size multi-zone systems. Over-sizing can cause significant operating problems including high operating cost and over-heating of smaller rooms. It is far better to use a separate, single-zone system for the main living space, at least. It's also best to combine bedrooms or other small rooms with one to two compact-ducted systems, or to use separate single-zone ductless heads in each room. Ask your installer to be strategic by minimizing the total number of zones served by any multi-zone unit, while maximizing the number of single-zone systems in the house.
- Single zone systems and multi-zone systems are comparable in cost per zone
- Some installers will propose an oversized multi-zone outdoor unit for "future expansion," leaving space for an additional indoor head to be installed later. Try to avoid this; it will hurt the operating efficiency even more, costing extra for heating and cooling right from the start. Plan for any expansion by adding another single-zone system.
- Some homes have very limited options for outdoor unit placement, for practical and/or aesthetic reasons; that may tip the scales towards a single multi-zone system.

Integrated Controls

When you leave an existing central heating system (boiler or furnace) in place, and plan to use your heat pump as much as you can, it's important to understand how the heat pump co-exists with the central system. If the heat pump is a centrally-ducted dual-fuel system, there will be one thermostat to handle both devices. But a central furnace or boiler may not "play well" with ductless unit(s) that are controlled with the typical hand-held remote. Depending on your house, there may be options for better controls. These include fairly standard wall-mounted thermostats (these may be wired or wireless) that help a ductless heat pump to better monitor the temperature of the whole room, or they may include "integrated controls" that manage both the heat pump(s) and the existing heating system. This will minimize the use of your existing heat while maximizing the use of the heat pump – and maximizing your savings.

Once Your Heat Pump is Installed

There are a few things that make heat pumps different from other heating equipment you may be used to. Heat pumps naturally develop frost on the outdoor unit during operation, so all heat pumps have defrost cycles that will happen for a few minutes, every hour or so, when it's cold outside. The unit may make gurgling sounds and briefly stop heating, but this is normal. In general, modern cold-climate heat pumps maintain a very warm output temperature even at below zero outdoor temperatures, but the air coming from the unit may not feel as "hot" as a conventional furnace. Cold-climate heat pumps will provide the most efficiency when the thermostat is not turned up and down dramatically – set it for comfort, but generally "set it and forget it". It will continue to produce heat (or cooling) at a slow and steady pace, which enhances comfort and saves you money. Also, it's important to keep snow from piling up on or around the outdoor unit. That's why it needs to be mounted up off the ground, but in extreme snow or drifting winds it's good to check up and (gently!) shovel around and below the unit to keep it clear. Remember to change or wash the air filter(s) regularly.

ASHP Myth #3: Heat pumps blow cold air
Heat pumps from past decades frequently had two problems that caused cold air to blow, leading to lots of comfort complaints. Every time they came on, the fan would run full blast, delivering cold air from the basement or attic as the heating coil slowly warmed up. Combined with the seriously reduced heating capacity of older models in cold weather, the air temperature at the supply registers would often feel cool or even cold. Modern cold climate systems have variable speed fans, improved controls and higher heating output – all working together to maintain cozy, warm temperatures.

Refer to NEEP's guide, Getting The Most Out of Your Heat Pump for lots more details and many helpful operating tips.