

# Frequently Asked Questions About Heat Pumps




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# Introduction



Heat pump technology is not new, but improvements in efficiency, along with city, state, and federal climate goals have brought heat pumps to the forefront of the discussion. This document contains questions most often asked about heat pumps and their role in transitioning to all electric buildings that can be powered by clean energy.



**It's 2023  
(as of this writing)  
and everyone is  
talking about  
heat pumps!**



# Menu



What is a heat pump and how does it work?

What kinds of heat pumps are there?

What benefits do heat pumps have over furnaces and other heating methods?

Heat pump technology has been around for decades. What makes today's technology different?

Myth busting: Do residential heat pumps blow cold air?

Down to what temperature can a heat pump operate effectively?

Can hydronic heating systems (like radiators and boilers) be retrofitted to work with heat pumps?

Are heat pumps viable options for all sizes of residences, from small units to multi-family homes? What about commercial buildings?

What design temperatures are used for heat pumps?

Why is it especially important for the building envelope to be sound when installing a heat pump?

How do you know if you need a larger or newer electrical service panel to handle the demand of the heat pump?

How much maintenance does a heat pump require?

How can policy makers enable heat pumps in affordable housing projects?

How can heat pumps address comfort and air quality issues?

What incentives are coming in 2023 that are spurring heat pump installations?

What are some of the biggest barriers to widespread heat pump adoption?

In addition to HVAC technicians, who installs heat pumps? And what kinds of careers are available in clean energy?



Select any topic to navigate to the related section.



## What is a heat pump and how does it work?



Heat pumps move heat rather than generate heat. They can perform both heating and cooling: moving hot air (and humidity) out of a building in the warm months and taking warm air from the outside to warm the interior of a building (yes, there is enough warm air even on cold days). Moving heat takes far less energy than generating it. Therefore, heat pump systems are two to five times more efficient than traditional electric, propane, or oil heating and cooling systems.

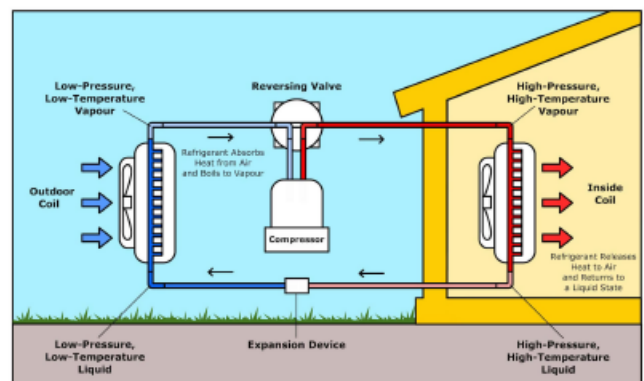
## What kinds of heat pumps are there?



### Ducted Air-Source Heat Pumps:

A ducted air-source heat pump transfers heat between your house and the air outside. Conditioned air is pushed throughout your home through ducts. These systems create more heat energy than the amount of consumed electrical energy because it transfers heat rather than creating it through combustion.

### Air-Source Heat Pumps Heating Cycle



Select the image to learn more.



### Ductless Air-Source Heat Pumps:

These are great options for homes that do not have ducts installed. One type is what's called a mini-split heat pump. Similar to standard air-source heat pumps, they contain both an air-handling unit inside and a compressor/condenser outside. Another type of ductless system is a reverse cycle chiller, which generates hot and cold water instead of air and can be used with radiant floor heating systems.

Image Credit: U.S. Department of Energy  
Visit: [Heat Pump Systems | Department of Energy](#)

**Geothermal Heat Pumps:** Geothermal heat pumps use the energy below Earth's surface and convert it into warm air. Because geothermal heat pumps take advantage of relatively constant ground or water temperatures, they have low operating costs.

Image Credit: U.S. Department of Energy  
Visit: [Heat Pump Systems | Department of Energy](#)

**Absorption Heat Pumps:** These heat pumps differ from compression heat pumps because they are driven by thermal instead of mechanical energy. Absorption heat pumps can harness thermal energy through the combustion of natural gas, steam from solar-heated water and air, or geothermal-heated water. These are relatively new to the residential market.

Image Credit: U.S. Department of Energy  
Visit: [Heat Pump Systems | Department of Energy](#)





### What benefits do heat pumps have over furnaces and other heating methods?

Heat pumps have several advantages, such as:

1. **Double duty.** Heat pumps provide heating AND cooling in the same unit.
2. **Flexibility.** Heat pumps can be installed with or without ducts.
3. **Improved health and safety.** Heat pumps are all electric, not combustion based.
4. **Efficiency.** Heat pump technology is two to five times more efficient than even the most efficient natural gas boilers and furnaces.

There are also heat pump water heaters (HPWH) that operate under the same principle.

They take the warmth (and humidity) from the air (often in a basement or garage) and transfer it to the water. HPWHs are ENERGY STAR qualified and use 60-70% less energy than electric resistance water heaters, saving consumers more than \$340 annually on average.

Image Credit: U.S. Department of Energy

### Heat pump technology has been around for decades. What makes today's technology different?

Today's technology uses updated refrigerants. They offer variable-speed fans and compressors, modified refrigerant cycles, electronic expansion valves, and sophisticated controls. This means they operate more safely and efficiently than ever before. Most importantly, modern cold-climate heat pumps offer a solid performance well below 0°F.



## Myth busting: Do residential heat pumps blow cold air?

Although some systems can produce cold air briefly while in defrost mode, heat pumps do not blow cold air. That misconception likely comes from the fact that air moved by heat pumps doesn't get **as hot** as those produced by combustion systems. Think about it like this – While furnaces produce blasts of hot air, heat pumps provide a steady stream of warm air to reach the desired temperature.



## Down to what temperature can a heat pump operate effectively?

Cold climate heat pump products can operate at temperatures as low as -22 degrees Fahrenheit. Check out the graph at right. This shows the indoor air temperature from a commercial project with variable refrigerant flow (VRF) in Wisconsin, as the outdoor temperature ranged from 3 to 15 degrees F. Notice how even on a day when it's extremely cold, the system is keeping up.

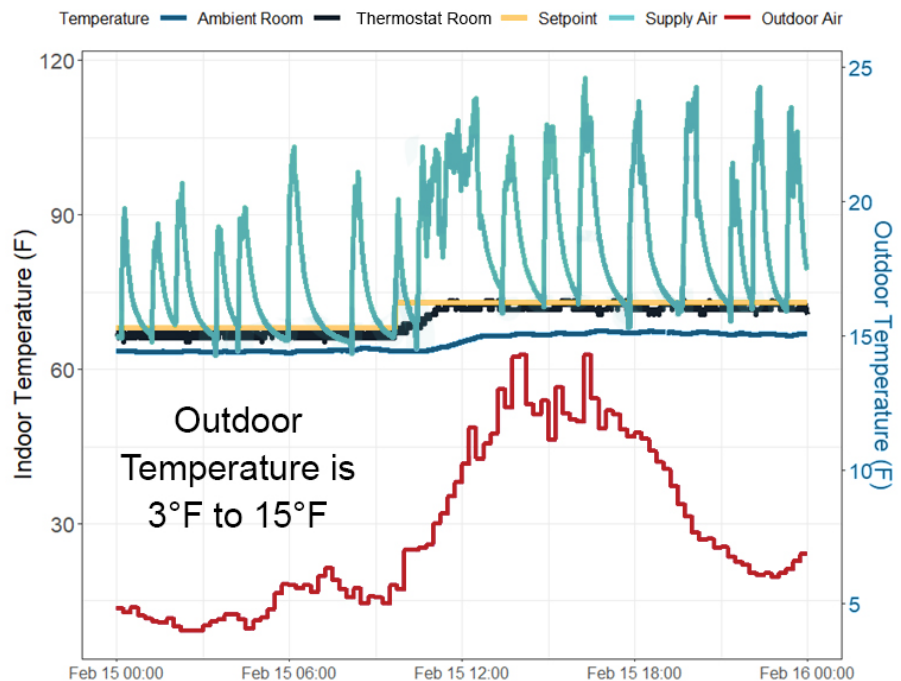


Image Provided by Slipstream

## Can hydronic heating systems (like radiators and boilers) be retrofitted to work with heat pumps?

Yes, there are **many** heat pump solutions when it comes to retrofitting, even for large and small hydronic systems. Ductless heat pumps that augment the existing hydronic systems are good choices. And low temperature hydronic systems may be fitted with air to water heat pumps.

## Are heat pumps viable options for all sizes of residences, from small units to multi-family homes? What about commercial buildings?

Heat pumps can work for buildings of all sizes. For larger buildings or buildings with multiple zones like hotels, offices, dormitories, multi-family homes, and historic retrofitting, variable refrigerant flow (VRF) systems are the best option. VRF systems are responsive to outdoor conditions, efficient, and can be set to heat (or cool) each area of a building to different temperatures.



## What design temperatures are used for heat pumps?

Design temperature refers to the outdoor temperature used to determine what size heating unit is needed. Industry practice recommends using a design temperature that would work 99% of the time. In other words, the temperature is lower than the design temperature for only 1% of the hours in a year.





**Why is it especially important for the building envelope to be sound when installing a heat pump?**

Newer homes (hopefully) are well sealed and have good insulation. Older homes, however, may not be well insulated and may leak conditioned air.

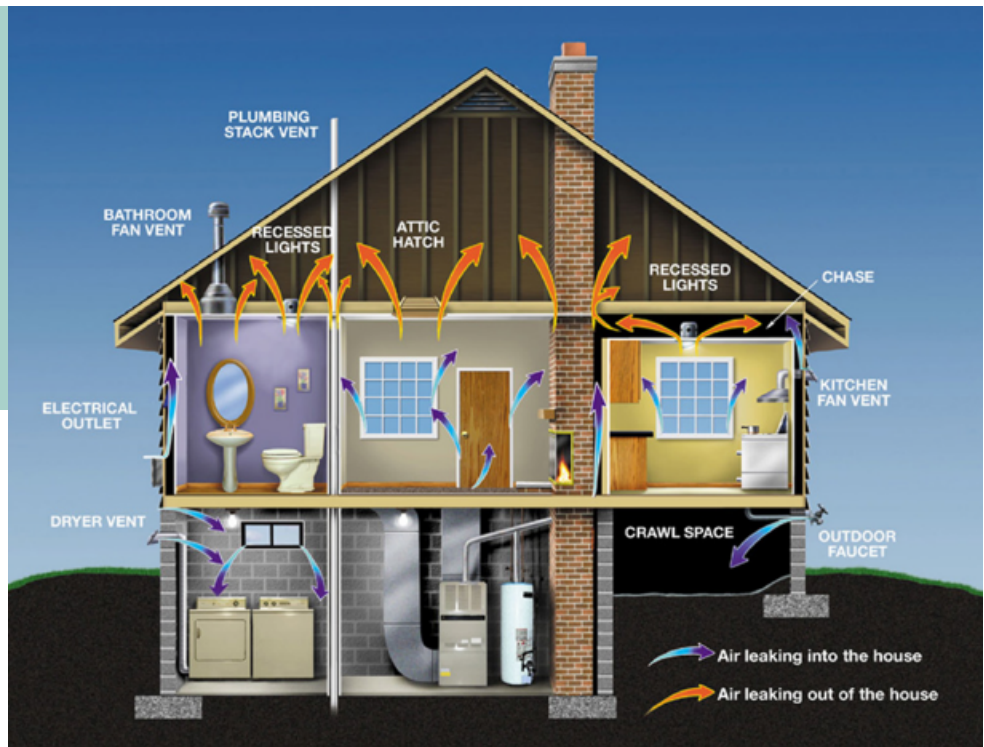


Image Credit U.S. Department of Energy  
Select the image to learn more.

Basic weatherization measures can improve the comfort of the occupant and reduce the overall size of the heat pump system needed.

**How do you know if you need a larger or newer electrical service panel to handle the added load of the heat pump?**

The National Electrical Code® (NEC 220.83®) shows how to calculate if a home can handle additional electrification loads. The calculation is based on the amperage of the existing appliances and equipment as well as the amp draw of the new equipment being installed. With this information, an energy auditor, HVAC designer, or electrician should



be able to make the determination. See Jon Harrod's more detailed explanation in this **[Green Building Advisor article](#)**.

### **How much maintenance does a heat pump require?**

Like all HVAC systems, heat pump systems should be regularly serviced for the best performance and longevity.



### **How can policy-makers enable affordable housing heat pump projects?**

Policymakers can enact legislation that provides increased funding for homeowners and housing providers, especially those in low- and moderate-income areas, for both heat pump installation and electrical infrastructure upgrades. Importantly, “energy burden” (the percentage of a household's total income spent on home energy bills.) should be addressed by policy makers and utilities. When buildings are transitioned from relatively inexpensive fuel sources like natural gas, the installation of an electric heat pump, even if extremely efficient, may increase the system owner’s utility costs. Understanding both the installation and operating costs is critical to an equitable path forward.



### **How can heat pumps address comfort and air quality issues?**

Many houses have poor heat distribution, which makes us feel too cold or too hot in certain rooms. A well-designed heat pump installation can help rectify this issue, making the house more comfortable while using less energy. Heat pumps can improve air quality in the building by eliminating combustion by-products. Heat pumps also help with dehumidification, filtration, and ventilation.



## What incentives are coming in 2023 that are spurring heat pump installations?

- a. The Inflation Reduction Act (IRA) includes incentives for heat pump installations and electrical panel upgrades. This includes tax credits along with state-level rebates.
- b. The [Energy Efficient Home Improvement Credit](#) has been extended through 2032 and provides a tax credit of 30% of the installed cost (HVAC) and 30% of the material cost (insulation, windows). It is capped at \$1200 per year (\$2000 per year for heat pumps and heat pump water heaters). Electrical upgrades are also eligible.
- c. The [Clean Energy Tax Credit](#) applies to solar PV, geothermal heat pumps, and storage. It covers 30% of the cost with no cap, and the tax credits can be carried over to future years. This percentage drops to 26% in 2033 and 22% in 2034.
- d. The New Energy-Efficient Home Credit is for builders of energy-efficient homes. It provides a tax credit of \$2500 for single-family and manufactured homes or \$5000 for those that are Zero Energy ready. Multi-family buildings are eligible for a credit of \$500-1000 (\$2500/\$5000 for prevailing wage).
- e. The HOMES program is a state-run program with \$4.3 billion in funding. It includes modeled and measured saving pathways, 80%/\$8000 for LMI households, and 50%/\$4000 for non-LMI households.

There are rebate caps such as:

1. Heat pump: \$8000
2. Heat pump water heater: \$1750
3. Electric stove, cooktop, range, oven, or heat pump clothes dryer: \$840
4. Electric load service upgrade: \$4000
5. Wiring upgrades: \$2500
6. Insulation and air-sealing: \$1600
7. All measures total \$14,000



## What are some of the biggest barriers to widespread heat pump adoption?

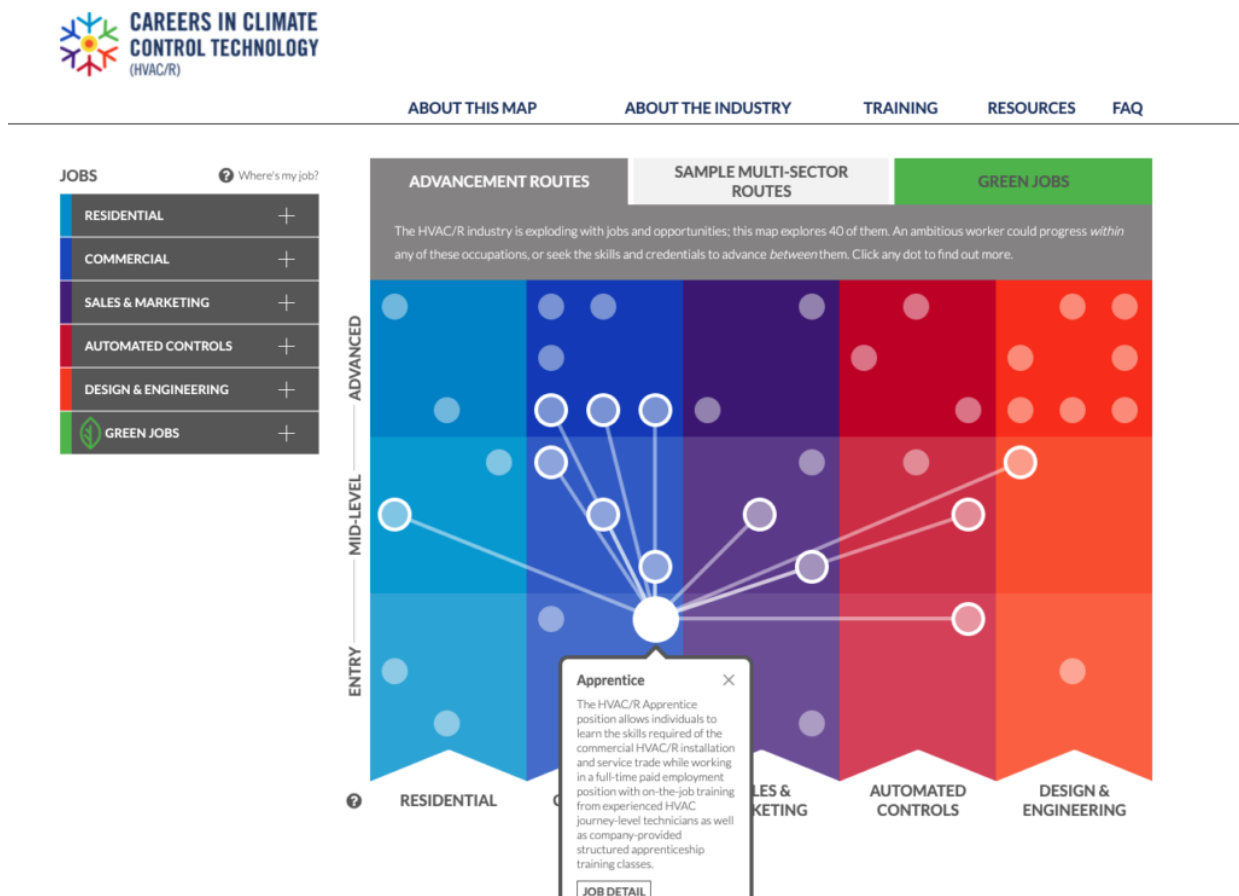
**Education.** Consumers need to understand the opportunities that current heat pump technology offers, such as improved comfort and health, lower energy use, and the available incentives.

**Installers.** For widespread adoption, so that everyone who is ready to make the transition can have a high-quality installation, we need to increase the workforce to meet the growing demand. There is a need for technicians, contractors, and others that know how to install and maintain these systems. These “energy heroes” will be part of the millions of clean energy sector jobs that will be needed to realize state and federal climate goals.

**In addition to HVAC technicians, who installs heat pumps? And what kinds of careers are available in clean energy?**

There are a wide variety of career opportunities and paths in heat pump installation, solar, and other clean energy industries. From technician to

crew leader to contractor, there are jobs for every level of skill and experience, including “new collar” jobs that may not require a four-year degree. To learn more about career options, required certifications and experience, and career paths, click the image below to check out the IREC Career Maps.



IREC's Careers in Climate Control Technology Map explores an industry exploding with job opportunities in heating, air conditioning, and refrigeration technologies (HVAC/R) describes diverse occupations across the industry, chart possible progression between them, and identify the sorts of credentials necessary to do them well.

**To learn more about career options, required certifications and experience, and career paths, select the image above to check out the IREC Career Maps.**



## Why are heat pumps such an important topic?

Transitioning from fossil-fuel-based heating and cooling equipment to efficient heat pump space and water heating is one of many steps we can take to reach ambitious clean energy goals.

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