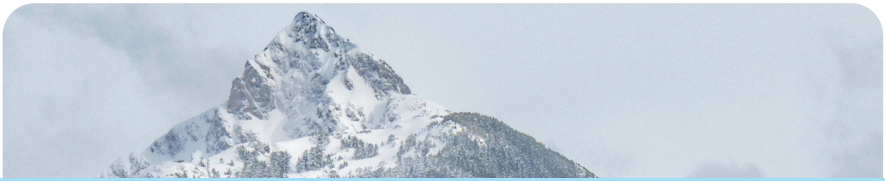


HEAT PUMPS IN ALASKA

Alaska Housing
FINANCE CORPORATION

HEAT PUMPS IN ALASKA?

Heat pumps heat and cool buildings, and the advances in the past two decades have expanded their use to heat buildings in cold climates. Their use in New England, northern tier states, the Pacific Northwest, and Canada has become widespread. Alaskans have also adopted heat pumps for building heating, especially in coastal areas. In fact, heat pumps are now the most common heating system installed in homes from Ketchikan to Kodiak, and their uses are spreading to other areas of the state. So yes, heat pumps do work in Alaska, but they aren't suitable for everyone or every location. This booklet will help you decide if a heat pump is right for you.

ALASKA TIP: A great tool for Alaskans considering a heat pump is the Alaska Heat Pump Calculator. **https://heatpump.analysisnorth.com**

WHAT IS A HEAT PUMP?

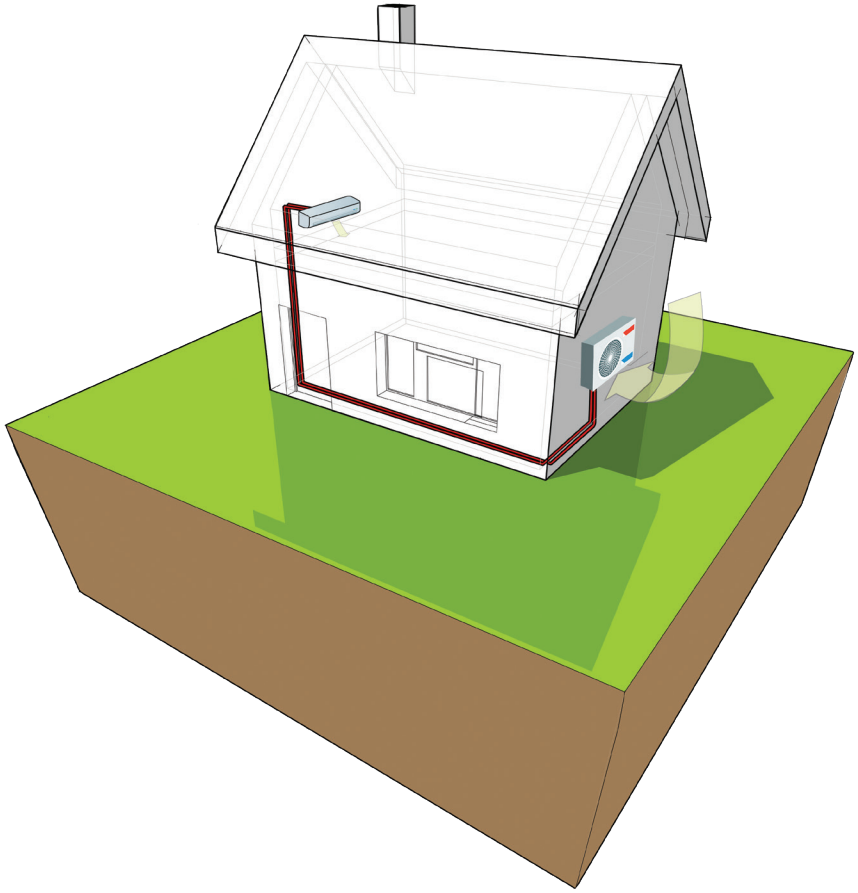
A heat pump moves energy. It does this by taking energy from a source (outside air, for example), transferring it to a special fluid called a refrigerant, then releasing that energy to another area, such as the inside of a building. It pumps heat! Heat pumps are used to heat some Alaska buildings by moving energy from outside to the inside—even in winter! Even if a heat pump cannot be used for a portion of the year, its efficiency may make a heat pump cost effective in some regions for winter heating and summer cooling. Additionally, the same heat pump you install to heat your home in winter can cool your home on those hot summer days. Heat pumps are rapidly gaining popularity for several reasons, including high efficiency, a wide array of options and applications, and relative simplicity.

TYPES OF HEAT PUMPS

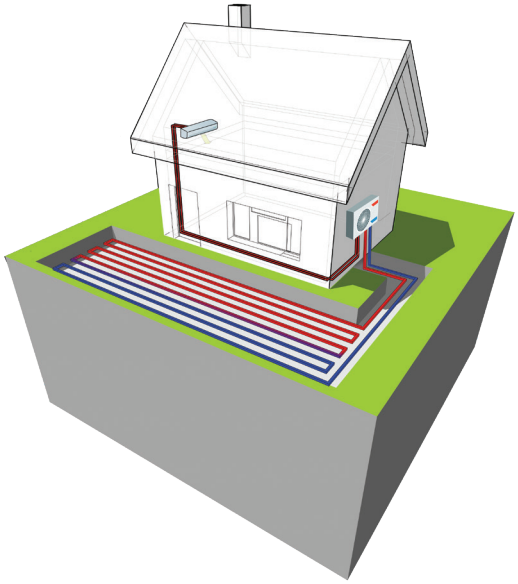
There are two ways heat pumps are classified: by 1) their heat source and 2) how heat is released to heat the home.

1) Heat Source

There are three categories of heat pumps based on their heat source: air-source, ground-source (geothermal), and water-source. All three types use a refrigerant to absorb heat from the source and move it to where it is released.

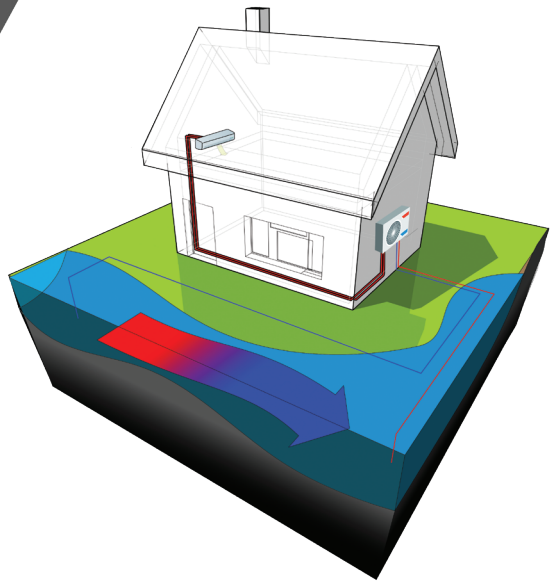


Air-source heat pumps absorb heat from outdoor air (even cold air) and, through the heat pump cycle, transfer that heat to the building's interior. They are relatively easy and cost-effective to install and operate. An example is shown above. Air-source heat pumps are common in Southeast Alaska.



Ground-source heat pumps absorb heat using a series of tubes (ground loops) installed in the ground. They offer high efficiency and consistent performance since the ground temperature remains relatively stable throughout the year. However, they require more upfront investment because ground loops must be buried.

Water-source heat pumps absorb heat from water, such as a lake or pond. They are efficient and may be a viable option in areas with access to a nearby body of water.



2) Heat Release

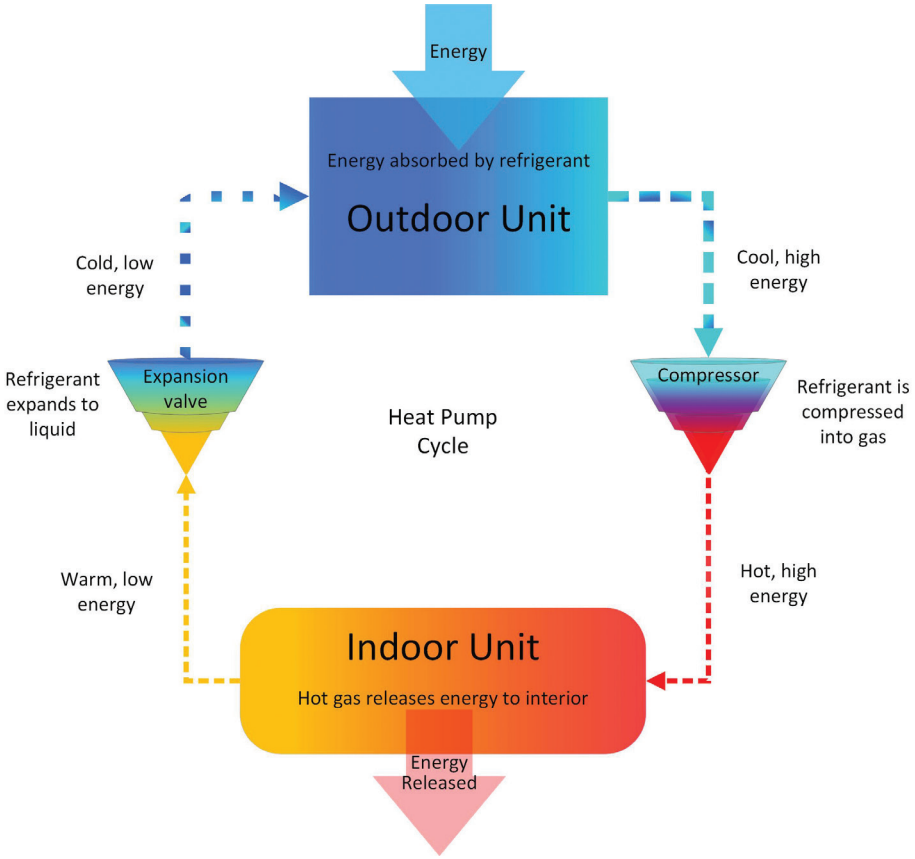
There are two types of heat pumps based on how they release their heat. Some **release heat directly to air** to heat the building, while others **release heat to water**, and that water is used to heat the building.

Describing heat pump systems

To describe a heat pump system, combine the heat source and heat release information. A system that absorbs heat from outside air and releases that heat directly to the air in the building is an air-to-air heat pump. A system that absorbs heat from air and releases it to water is an air-to-water heat pump. This type of system typically uses heat loops in the floor to heat the building. These systems often perform double duty by heating the water used for baths, showers, and other hot-water needs.

HOW DO HEAT PUMPS WORK?

The heat pump cycle transfers heat energy from one area to another. This cycle requires a special fluid, called a refrigerant, to absorb, move, and release energy. A heat pump for home heating and cooling has two main units—an outdoor unit and an indoor unit. They are connected with refrigerant lines that transfer energy between them. The diagram below shows how the process is used to heat a building's interior.



ALASKA TIP: Alaskans are mostly interested in heating, however, heat pumps can provide efficient cooling as well. The units reverse the process shown above, for the purpose of cooling the interior of the building. For most Alaska homes, selecting units with sufficient heating capacity is most important.

ALASKA HEAT PUMP INSTALLATION

For any type of heating system in Alaska, proper sizing is crucial for performance, efficiency, reliability, and durability. This is also true for heat pumps, which should be neither undersized nor oversized. A professional installer must assess the specific heating (and cooling) needs of the home. To do this, the installer considers climate, levels of home insulation and airtightness, building size and layout, and ventilation.

Consider the following for Alaska heat pump installations:

1. Site Assessment: A heat pump installation professional evaluates the space and assesses factors such as building insulation levels, layout, and outdoor space. They determine the most suitable location for the outdoor and indoor units based on accessibility, noise, and other factors.

ALASKA TIP:
Safety: The outdoor unit creates water that drips to the ground beneath. In winter, this water can freeze and can create dangerous conditions for walking. DO NOT locate outdoor units near walkways, driveways, patios, or other areas where people typically walk.

2. Mounting and Connection: The outdoor unit must be secure and stable. The indoor unit is typically installed in a central location to optimize airflow. The refrigerant lines and electrical connections between the indoor and outdoor units are carefully connected following manufacturer guidelines and applicable building codes.

ALASKA TIP:
Clearance: Because the outdoor unit requires sufficient airflow, it must be installed to minimize blockage by accumulating or drifting snow.

Examples of snow-protected outdoor units—under roof, on elevated blocks, and wall-hung units

3. Electrical: Heat pumps require a dedicated power supply, so it will be necessary to evaluate the building's electrical system and the local utility's capacity. A licensed electrician can ensure the correct wiring and electrical connections are in place.

4. System Startup and Testing: Once installation is complete, the system must be thoroughly tested to ensure that it is functioning properly. This includes checking refrigerant levels, verifying proper airflow, and testing the heating and cooling modes. Programming and calibrating the thermostat is also required.

5. Customer Education: The installer provides the homeowner with information about how to operate and maintain the heat pump system effectively. They explain the thermostat settings, filter cleaning and replacement, and any specific maintenance tasks required. They also address any questions and/or concerns the homeowner may have to make sure they understand their new heat pump system.

ALASKA TIP
Operation: For comfort and performance, heat pumps work best when the temperature settings remain constant. Because different parts of the house are often heated by different indoor units, each unit can be set to a different temperature.

CONSIDERATIONS IN RURAL ALASKA

- **Generation capacity of electrical plant:** Check with your electric utility to determine whether a heat pump will work at your location.

- **Home load capacity:** Consult with an electrician to assess your home's electrical service when planning to install a heat pump. The largest mini-split systems need a dedicated 30 amp circuit.

- **Service availability:** Support and repair options may be very limited or not available. In these areas, it is especially important to perform routine and scheduled maintenance.

- **Outdoor unit site location:** Careful consideration must be paid when choosing a site for the outdoor unit due to drifting snow, seawater spray, etc.; see ALASKA TIPS p. 7.

MINI-SPLIT SYSTEMS

Mini-split heat pumps (also called "mini-splits") are a style of air-source heat pump and are the most common type of heat pumps installed in Alaska homes. They are used mostly in coastal Alaska communities, and their usage is spreading. "Mini-split" refers to the size of the heat pump and the fact that they are "split" into two units—one indoor and one outdoor. Mini-split heat pumps are either air-to-air or air-to-water depending on their application. Both types are used in Alaska. Generally, air-to-air systems are simpler and less expensive to install, especially in existing homes.

Ductless mini-split systems are air-to-air heat pumps that have no ducts. Refrigerant lines from the outdoor unit extend to one or more indoor units. The indoor units release heat to the air and move warm air around the home. There are several types of indoor units including wall units (most common), floor units, and ceiling cassettes.

ALASKA TIP:
A common strategy in smaller coastal Alaska homes is to install a single indoor unit in a central location to serve the majority of heating needs. Wall-mount resistance heaters are installed in back bedrooms to supplement the heat pump during cold snaps. Because the heat pump is meeting most of the heating requirement, it is efficient and cost-effective.

Concealed duct mini-split systems are air-to-air heat pumps that have refrigerant lines extending to the indoor unit in a small, remotely located air handler. The air handler contains a fan that blows hot air into short ducts to heat nearby rooms.

Hybrid mini-split systems use different types of indoor units to heat different areas of the house (see figure, top of page 10.) As is the case with most heating systems, keeping them simple will reduce cost and improve performance and durability.

Mini-split versatility. Ductless and compact ducted mini-splits can be added to any home regardless of the type of heating system already in place. They can be used for whole-house heating, to heat portions of the house, or at all times with the original heating system acting as a backup on the coldest days.

The three types of indoor units for mini-split systems are wall unit, ceiling cassette, and concealed duct air handler. The simplest and most common systems use one or more wall units; but, combinations of unit types can also be used.

ALASKA TIP: Avoid routing ducting for heat pumps in the attic. Doing so results in poor performance, unsatisfactory heating, and the possibility of leaking air into the attic, leading to moisture problems.

Air-to-water mini-split systems are often used to heat the home through a series of tubes in or under the floors. Because these systems typically heat water to no more than about 130°F, high efficiency distribution systems are usually installed. Some of these systems are designed to supply hot water for baths, showers, and faucets.

Examples of outdoor and indoor units of air-to-water systems

DUCTED HEAT PUMPS

Ducted heat pump systems are air-to-air systems that use ductwork to distribute warm air around the building. Often, a heat pump can replace a furnace and use the existing ductwork for distribution. In this application, the indoor unit is located within a cabinet that also contains a fan. This unit is referred to as an "air handler" or an "air handler unit." The energy released at the condenser is blown by the fan into ductwork and throughout the building.

Just like a furnace, this indoor air handler blows warm air throughout the home through ducts. The refrigerant lines (paired white lines in this photo) connect the air handler to the outdoor unit.

Ground-source and water-source systems: There are some ground-source heat pumps in Southeast, Southcentral, and Interior Alaska. There are also some water-source heat pumps in the state—for example, the SeaLife Center in Seward uses cold seawater for heating! Details for these systems are not included in this booklet. For more information on these systems, contact a heating professional in your area with specific knowledge of heat pumps.

RETROFITTING YOUR HOME WITH A HEAT PUMP

A heat pump can be an excellent choice for retrofitting an existing home. A mini-split can be added to heat certain areas or an addition without changing the existing heating system. In some applications, a heat pump can replace a furnace and use the existing ductwork with some modifications. Discuss heating/cooling needs with a heat pump professional to outline the best strategies for a given situation. There are many considerations when retrofitting a heat pump. Some issues a homeowner and contractor should discuss include:

- Where are the best locations for the installation of the indoor and outdoor units?
- If considering a ducted system, is the existing ductwork sufficient for the heat pump or are modifications to the ductwork required?
- What electrical system work or upgrades are needed?
- Will other energy efficiency upgrades (for example, insulation, air sealing) result in better performance or comfort?
- How much will the project cost?
- Has the contractor determined the appropriate size of heat pumps for the project?
- Is a permit from the local building department needed for the work?

ALASKA TIP:

Heat pumps in Alaska homes with boilers or furnaces: In most of Southeast Alaska, a heat pump can provide required heat for a home. Currently, heat pumps do not have sufficient performance to meet the entire heating requirements in most other parts of the state. However, a heat pump can be an effective supplement to a boiler or furnace system in these climates, and it is likely that they will become more popular as the technology continues to advance. A common strategy is to install a mini-split heat pump system to provide heat for most of the heating season and use the existing boiler or furnace on the coldest days and as a backup. This strategy is cost-effective, high performing, and reduces fossil fuel consumption.

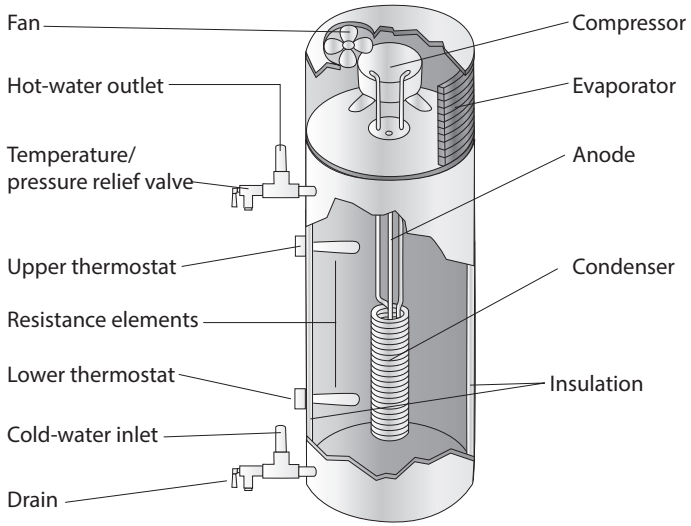
OPERATING AND MAINTAINING A HEAT PUMP

To maximize the performance and efficiency of an installed heat pump, consider the following tips:

- **Maintain a consistent temperature.** Frequent temperature adjustments reduce the efficiency of heat pumps. They work best and most efficiently when they run for long periods without starting and stopping. Use the “program” function on the unit’s thermostat.
- **Clean/replace air filters.** Dirty filters restrict airflow, reduce efficiency, and strain the system. Clean or replace them, if applicable, every one to three months or as needed.
- **Properly insulate and air seal.** Reducing heat loss allows the selection of a smaller heat pump that will run more efficiently, save money, and keep the home more comfortable.
- **Zone your system.** Using multiple indoor units allows the homeowner to adjust the temperature in different areas of the home. This improves comfort and efficiency and reduces operating costs.
- **Regular maintenance.** A maintenance schedule plays a vital role in preserving the performance and longevity of a heat pump. Professional inspections at least once a year are essential. A trained technician will inspect and clean the indoor and outdoor units, check refrigerant levels, examine electrical and mechanical connections, and ensure optimal system performance.
- **Read the manual.** Manufacturers are very knowledgeable about their products. Refer to the manual to understand how to best operate and maintain a heat pump.

HEAT PUMP WATER HEATERS

Heat pump water heaters are more energy-efficient alternatives to conventional electric or gas water heaters. These units use an air-source heat pump—that is, they take energy from the surrounding air—to heat water in the tank. They are self-contained units; the heat pump, refrigerant lines, and tank are all part of the water heater. These units also have heating (resistance) elements similar to a conventional electric water heater, which assist in meeting the need when there is high demand for hot water and provide a backup in case the heat pump fails.



ALASKA TIP:
There are some considerations prior to installing a heat pump water heater in an Alaska home. First, they cool the space in which they are located; this can result in your home's heating system working to heat a space your water heater is cooling, an inefficient situation. A possible solution is to install insulated ducting from the water heater to exhaust cold air to the exterior. Second, the heat pumps in these units do not show strong performance at low temperatures, so it is best to use them in spaces that have warm air (furnace or boiler room, for example). Alternatively, if these water heaters are placed in a relatively cold space (like a garage), they can be used as electric water heaters (they have electric heating elements) during the coldest months and as heat pump water heaters the rest of the year. Most heat pumps have been installed in temperate areas of Southeast Alaska. Be sure to discuss your situation with a professional experienced in heat pump water heater applications.

OTHER HEAT PUMP APPLICATIONS

Because the technology can be adapted to many processes, heat pumps are becoming more common in high efficiency devices and appliances. Further, more efficient and environment-friendly refrigerants are constantly being developed. A few products using this technology are included below:

- **Clothes Dryers:** Heat pump dryers are far more efficient than conventional electric or gas dryers. Because they do not need to be vented, they are space efficient, especially for small homes and apartments. The downside? They take considerably longer to dry clothes than conventional dryers.

- **Washer/Dryer Units:** Combination heat pump washer/dryers are an excellent choice if space is limited and/or energy efficiency is important to you. They need no venting and use much less energy than conventional units. Their dry cycle is quite long and may not be the best option for all situations.

- **Refrigerators and Freezers:** The original heat pump appliances, refrigerators and freezers have been using heat pumps for 100 years to keep our food cold. Newer, environmentally friendly refrigerants have resulted in greener, more efficient appliances.

- **Ventilation Systems:** Ventilation systems with integrated heating/cooling via heat pump technology can be used to heat and cool small, energy efficient homes or portions of larger homes. These units ensure fresh air is supplied to the building and provide thermal comfort to the occupants. Currently, these systems are expensive, but lower-priced options are anticipated as more manufacturers enter the market. Stay tuned!

RESOURCES

Visit these sites for additional information:

ENERGY STAR

www.energy.gov/energysaver/heat-pump-systems

AMERICAN COUNCIL FOR AN ENERGY-EFFICIENT ECONOMY

www.aceee.org

U.S. DEPARTMENT OF ENERGY

www.energy.gov

U.S. DEPARTMENT OF ENERGY'S OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY

www.eere.energy.gov

ALASKA HOUSING FINANCE CORPORATION

www.ahfc.us