RESIDENTIAL

Qmerit

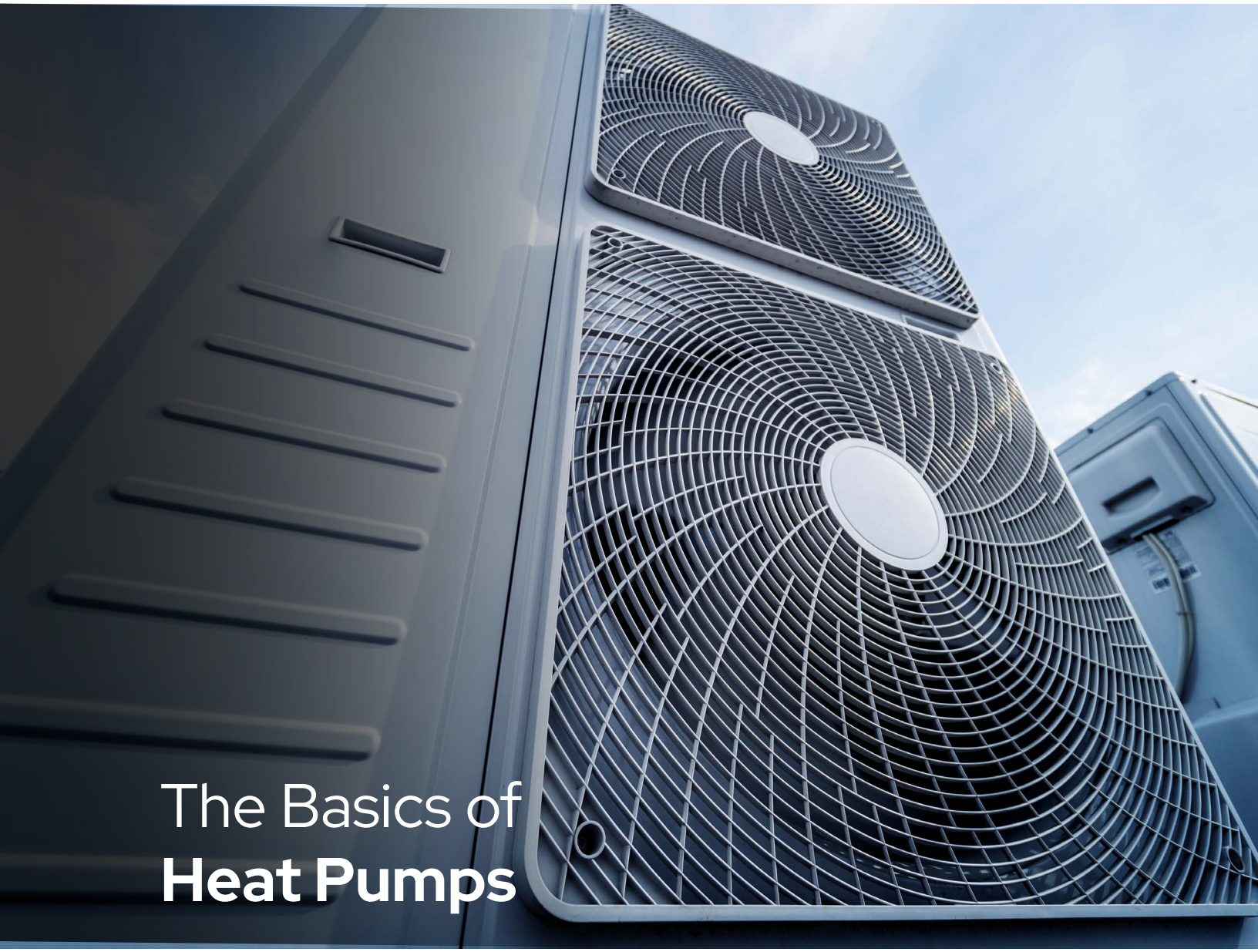
Heat Pumps 101

HOW HEAT PUMPS CAN SAVE MONEY AND THE PLANET

As climate change accelerates globally, many countries grapple with **unprecedented extreme weather patterns.**

Communities mitigate these unusually high or low-temperature challenges by acquiring air conditioning units or installing furnaces. Unfortunately, these solutions only exacerbate the problem because they rely on energy sourced from fossil fuels.

Amid the climate chaos, heat pumps present a more ecological solution for residential, commercial, and industrial properties. They provide heating and cooling through a highly efficient method that applies renewable and reusable resources. In this article, we will explore the positive impacts of heat pumps on energy bills and the environment.



The Basics of **Heat Pumps**

Heat pump systems can replace air conditioners and furnaces in all climates and ensure efficient energy consumption.

In all climates, heat pumps can now replace air conditioners and furnaces, while also providing homes and businesses with more efficient energy consumption.

Heat pumps have been around since 1856, though their usage has not been as wide as other heating systems. A mere 15% of American households currently use them, and most of these residences are based in comparatively warmer regions. Recent climate upheavals have led to a surge in their popularity. Familiarization with their intricacies will convince you to switch from conventional furnaces, boilers, or electric heaters.

Heat Pumps Use Refrigeration and Heat Transfer

The mechanism of heat pumps is similar to that of refrigerators and air conditioners. To transfer heat from one space to another, heat pumps need an evaporator, a compressor, a condenser, and an expansion valve.

Heat pumps work by using either hydronic systems or forced air to deliver heat. Radiators and under-floor heating are examples of hydronic systems that can create clean water when attached to a tank.

The process involves several steps.

The first step is extracting heat from the surroundings, which can be inside or outside air, the ground, a water source, or waste heat from a factory. The heat is moved as required to provide cooling in the summer and heating in the winter.

When the heat is absorbed within the refrigerant of the evaporator, the pressure transforms the heat from a low-pressure gas to a high-pressure gas.

The next step is condensing the high-pressure gas in the compressor to increase the temperature of the refrigerant and create hot gas.

Then, the compressed hot gas flows into the condenser, which releases the heat into an indoor space or water system.

Because the hot gas has been released, the refrigerant cools down. As a result, the hot gas changes into a high-pressure liquid and passes through the expansion valve. Here, pressure is reduced, enabling the liquid to return to the original low-pressure form.

In the final step, the low-pressure liquid flows back into the evaporator to repeat the cycle. The continuous process allows the heat pump to constantly transfer heat from a specific source to a particular destination. Hence, you receive a steady supply of warmth.

Heat Pumps Are Highly Efficient

Heat pumps are highly efficient due to their ability to move heat instead of generating it. Moving heat from one space to another requires much less energy than heat generation, such as the burning of fossil fuels in furnaces and gas boilers. Heat pumps use the naturally occurring heat in the environment to achieve significant energy savings compared to traditional heating and cooling methods. Not only does this benefit homeowners by reducing energy costs, but it also positively impacts the environment by lowering carbon emissions.

The **clean energy from heat pumps** produce up to four times the amount of kilowatt hours (kWh) they consume, which translates to significant energy savings.

In addition to being highly efficient, the zoned heating and cooling capabilities of heat pumps ensure only specific areas can be heated or cooled as per your requirements. This further reduces energy waste as only the areas in use are conditioned rather than the entire space. By optimizing energy usage, heat pumps can help you save even more on your utility bills while still maintaining a comfortable living and working environment.

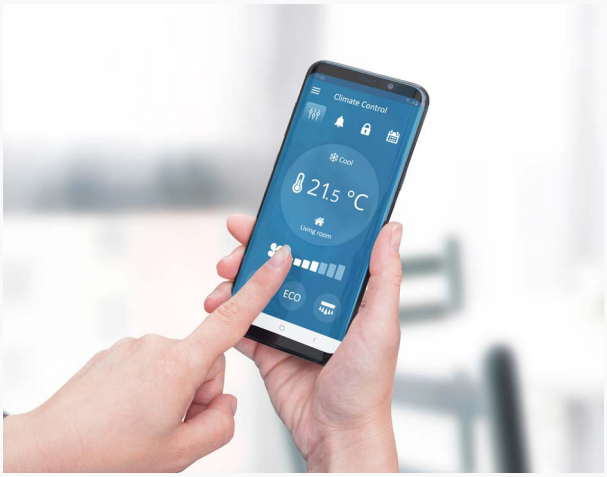
You Can Use Heat Pumps for Cooling

Heat pumps for cooling work on the same principle as for heating — transferring heat from one area to another, and they apply the same principle when providing cool air. Heat pumps provide warmth by transferring heat from one area to another, and it applies the same principle to providing cool air. In cooling mode, these devices absorb the heat from the indoor air and release it outside, effectively cooling down the interior space.

One of the advantages of using a heat pump for cooling is its energy efficiency. Unlike air conditioners, which use large amounts of electricity to generate cool air, heat pumps simply transfer heat from the inside to the outside. Minimal energy use results in lower energy consumption and reduced utility bills.

Recommended Temperatures for Heating and Cooling in All Climates

Finding the right temperature settings for your heat pump is important to enhance your comfort and the machine's energy efficiency. The right balance for heating and cooling will vary according to the climate of your specific location.



FOR COLDER CLIMATES

It is best to set the thermostat to a lower temperature in colder climates during winter. Doing so ensures your heating system does less work, translating to lower energy consumption and utility bills. The U.S. Department of Energy suggests that the best heat pump temp setting is 68°F (20°C) during the day while your living or working spaces are in use.

Reducing the temperature when you are not actively using the space, such as lowering the temperature by 10 to 15 degrees when you are away or sleeping, can save on energy costs without sacrificing comfort.

The recommended temperature for cooling in warmer climates is around 78°F (25°C) during summers. At this level, you can maintain a pleasant living environment and still save on energy. You can further supplement your heat pump system with electric fans or natural ventilation.

FOR MODERATE CLIMATES

Meanwhile, you should adjust your thermostat settings accordingly in more moderate climates where heating and cooling are required throughout the year. The recommended temperature range for these areas is 68°F (20°C) to 78°F (25°C), depending on the season and individual comfort preferences. These recommended temperature ranges are merely a starting point. The more important factors to consider are your personal ease and predilection. Experiment with different settings to find the right balance that meets your needs while sustaining energy efficiency.

BENEFITS OF PROGRAMMABLE THERMOSTATS

You can also opt for programmable thermostats to optimize energy usage and save money. Such thermostats allow you to set different temperature schedules throughout the day, ensuring your space is cozy when you're around and saving energy when you're not. Combining the right temperature balance for heating and cooling with programmable thermostats helps you achieve optimal comfort while minimizing energy consumption.

Heat pumps already provide significant energy savings compared to orthodox methods and augmenting them will further enhance their efficiency.

Exploring the Different Types **of Heat Pumps**

Various types of heat pumps are available, each offering unique benefits and suitability for different environments. Understanding their distinctions will allow you to decide the best option for your home or business space.

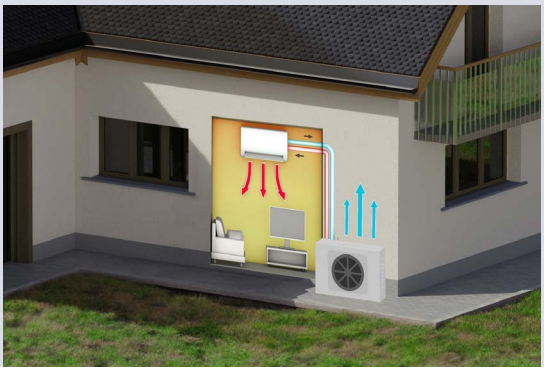
Air Source Heat Pumps (ASHP)

Air source heat pumps are the most common type used in residential applications. These devices extract heat from the outside air and convey it to the interior of your space, providing both heating and cooling functions.

An ASHP consists of an outdoor and an indoor unit. The former absorbs heat from the outdoors, and the latter distributes either heated or cooled air indoors. It is a preferred choice for many homeowners owing to its affordability, ease of installation, and versatility.

Current models of ASHP offer advanced technology for utilization in subfreezing temperatures, even for long periods. The high-efficiency versions provide greater dehumidification than standard central air conditioners, consuming less energy with more cooling in warm seasons.

Compared to electric resistance heating systems, such as baseboard heaters and furnaces, modern ASHPs can reduce electricity usage by up to 50%. They produce up to three times more heat than the amount of electricity they consume.

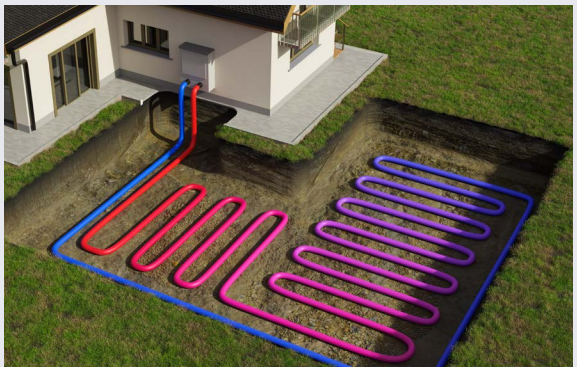


Ground Source Heat Pumps (GSHP)

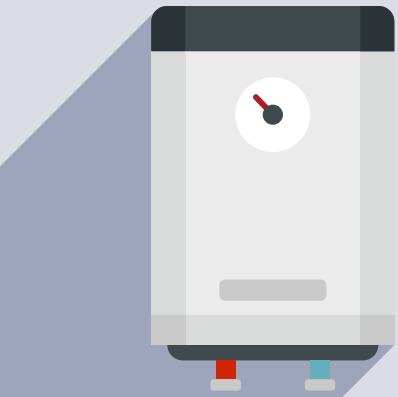
A ground source (or geothermal) heat pump uses a relatively stable ground temperature or an adjacent water source to provide heating and cooling. It is a preferable option to ASHP in locations with extreme climates. Their mechanism consists of a series of underground pipes (ground loops) that circulate a heat transfer fluid. It extricates heat from the ground in winter and dissipates it into the ground in summer.

GSHPs are highly efficient and can provide remarkable energy savings over time. They require more complex installation and involve higher upfront expenses than ASHPs.

Since ground and water temperatures are more consistent than air temperatures, it results in higher efficiency. Hence, if initial fees are not a concern, you could choose a GSHP over an ASHP to benefit from low operating costs over time. Note that GSHPs may not always be appropriate for your location. Consult a professional to determine whether the landscape, subsoil, and lot size support this type of heat pump.



The Benefits of **of Heat Pumps**



Heat Pumps are

3x

more efficient
than gas-powered boilers

Heat Pumps Are Highly Energy Efficient

You can measure heat pump efficiency by coefficient of performance (COP) — the ratio of the amount of heat generated or removed to the amount of energy consumed. A higher COP signifies more efficient heat transfer and greater energy savings.

Heat pumps typically possess COP values ranging from 2 to 5. For every unit of energy consumed, they can generate or remove two to five units of heat, making them three times more efficient than gas-powered boilers.

One factor contributing to their efficiency is the ability to transfer heat rather than generate it.

Unlike conventional methods that prescribe heat production through combustion or electrical resistance, heat pumps simply displace heat from one location to another. They therefore require significantly less energy to operate, resulting in lower energy consumption and reduced utility bills.

Additionally, heat pumps take advantage of the naturally occurring heat in the environment. In heating mode, they extract it from the outside air, ground, or water source, depending on the type. Thus, even in colder temperatures, heat pumps will acquire enough heat to transfer and provide warmth to your home or workplace. Utilizing these free and renewable energy sources achieves substantial energy savings compared to traditional heating methods.

The refrigeration cycle applied in heat pumps also allows for the recycling and reuse of energy. Due to the continuous sequence, no heat is wasted, making heat pumps highly efficient in converting energy into heat.

Heat Pumps Have Versatile Applications

The dual-functionality of heat pumps presents a year-round solution, eliminating the need for separate heating and cooling systems. They circulate air efficiently to provide both functions consistently and evenly. In comparison, traditional air conditioners often result in hot or cool spots as they struggle to distribute cool air evenly.

Heat pumps also dehumidify an indoor space while cooling it. High humidity levels can contribute to the growth of mold and mildew. In contrast, low humidity prevents temperature fluctuation and filtering. Heat pumps remove excess moisture from the air, helping create a more comfortable and healthier living and working environment.

Technically considered an appliance, heat pumps are acceptable in residential areas, multifamily property electrification, and commercial zones. In fact, in April 2022, the Washington State Building Code Council overwhelmingly voted in favor of a mandate requiring heat pumps in all new commercial and multifamily structures.

Various industries use large-scale heat pumps to heat spaces with hot water, air, or steam and to apply heat directly to materials. These pumps source heat from wastewater, data centers, and waste heat from factories. Their applications range from industrial and commercial to district heating networks.

Even electric vehicles (EVs) can benefit from heat pumps for heating and cooling their interior space, particularly in extremely cold weather. Cabin heating drains 41% of an EV's range in freezing temperatures. Rather than consuming energy from a standard electric resistance heating system,

> EV drivers can warm up using heat pumps, similar to those in the Tesla Model Y and Ford Mustang Mach-E.

Heat Pumps Positively Impact the Environment

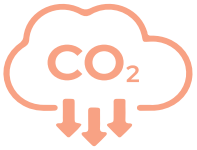
By utilizing renewable heat sources instead of burning fuel like traditional heating and cooling systems, heat pumps produce 20% lower greenhouse gas emissions than gas boilers. You can lower your carbon emissions by up to 7.6 tons each year, depending on the type of heating system you use.

In 2001, the US Department of Energy launched the Residential Cold Climate Heat Pump Technology Challenge with the aim to advance technologies associated with cold climate heat pump development. As of 2023, industry leaders Bosch, Carrier, Daikin, Johnson Controls, Lennox, LG, Midea, and Mitsubishi have participated and are ready with their prototypes.

Heat Pumps are Efficient and Enviromentally Friendly

50–52%
relative humidity
maintained in variable speed mode on summer days.

20%
lower
greenhouse gas emissions than gas boilers.



7.6
tons
lower carbon emissions

The Financial Savings of Heat Pumps

Factors such as the size of your home and the climate in which you live determine the exact amount of savings. The US Department of Energy estimates that a household using a heat pump can save an average of $500+ per year.

As for longevity, many HVAC contractors have observed that heat pumps provide a longer operational service of 10-15 years compared to furnaces. Geothermal types can last up to 50 years. That translates to less maintenance and replacement expenses.

A significant reason for savings is the more stable cost of electricity compared to the volatile price of gas, which is beyond the government's control. The good news is that tax credits are within their jurisdiction.

Federal tax credits through the Investing in America Plan by President Biden include up to 30% on the total cost of purchase and installation of a residential heat pump, including models that meet the standards of efficiency set by the Consortium for Energy Efficiency (CEE). As per the Inflation Reduction Act (IRA), these federal incentives can cover up to $2,000 and are effective until 2032.

You can expect more governmental support for heat pumps in the manufacturing sector, which could further lower equipment costs.

Senator Ed Markey's Installing Clean Efficient Energy Hastens Our Transition (ICEE HOT) and Senator Amy Klobuchar's Heating Efficiency and Affordability through Tax Relief Act (HEATR) are just two of several bills creating tax incentive programs for manufacturers.

A number of rebates are available as well. In fact, the largest state-administered rebates in the IRA are for heat pumps, including $8,000 for space heating and cooling and $1,750 in water heating savings.

Rebates are based on your household income in relation to your state's median household income: 80% receive a 100% rebate, while 80-150% are eligible for 50%.

Even local utility companies offer rebates to heat pump users. The rates differ by state, so contact your provider to determine if you are entitled to any. Remember as well that rebates on federal, state, local, and utility levels regularly change. Keep abreast of announcements on the latest values in your location.

$500+

average money saved using a heat pump

The US Department of Energy estimate

More Efficient Warming and Cooling **with Low Carbon Footprint**

Homeowners can reduce 50% to 80% of heating and cooling costs when replacing air conditioners and furnaces with heat pumps. Heat pumps are highly efficient because they can transfer heat, utilize renewable sources, recycle and reuse heat, and provide zoned heating and cooling. Their efficiency not only benefits households by way of reduced energy costs but also positively impacts the environment through reduced carbon emissions. Each type of heat pump offers unique advantages and considerations. It is recommended to study them to determine the one that best suits your specific needs and budget.

Air source heat pumps are popular for many homeowners because they are cost-effective and easy to install. Ground source heat pumps provide higher efficiency but require more complex installation and can be more expensive. Ductless mini split heat pumps boast zoned heating and cooling capabilities even in spaces without ductwork, allowing for greater temperature control and energy savings.

Heat pumps guarantee substantial financial savings by significantly reducing your energy bills. When you combine this long-term financial benefit with potential incentives and the available tax credits, they become an investment that pays off.

Are you ready to take advantage of heat pumps' even temperature distribution, dehumidification, and year-round comfort? Contact Qmerit today to learn more about your options and how a heat pump can benefit your home or business.