Geothermal Energy: Consistent, Comfortable, and Cost Effective Heating and Cooling for your Home

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Extracting low-grade geothermal energy stored in the upper layer of the earth's crust is becoming an increasingly popular and cost effective way to heat and cool your home. This free renewable energy is provided by the sun and the earth's core, and making use of this natural resource is an environmentally and financially responsible choice.

Geothermal is the perfect energy source for anyone who is looking for consistent, comfortable heating and cooling that pays for itself via reduced energy bills in only a short number of years. Unfortunately, there is a lot of misinformation about geothermal energy and how it can benefit residential homes. To combat this, we've compiled answers to the three questions we get asked the most:

1. *How exactly do Nordic® heat pumps work?*
2. *How can homeowners choose the right heat pump?*
3. *How much can they expect to save?*

How Does Geothermal Energy Work?

A geothermal energy system is an innovative way to access the free, renewable heat that is in the earth's crust, efficiently and effectively transferring it into your home. The result is an even and comfortable temperature inside your home throughout the year, regardless of the conditions outside.

The heat pumps designed by Maritime Geothermal Ltd. are one of the three main parts of a geothermal system, which also consists of the ground loop, the heat pump itself, and the hot air or water distribution system.

The ground loop is a series of plastic pipes buried in proximity to your home approximately 6 feet underground or alternately in vertical boreholes typically 100 to 300 feet in depth. During the heating season, an antifreeze fluid colder than the surrounding ground is circulated from the heat pump in your home through the underground closed loop. Low-grade energy is picked up by the heat pump via a refrigeration process. The heat pump then concentrates the low-grade energy bringing it up in temperature, and distributes the heat into your home via air ducts or an in-floor heating system.

Simply adjust the temperature using a thermostat and your heat pump will do the rest!

In the summer the process is reversed. Heat from the air in your home is removed by your heat pump, and deposited into the ground loop fluid. The resulting cold air is blown back into your home as air conditioning. As the warm fluid circulates through the underground pipes, the earth absorbs the heat, and the cool fluid is cycled back into your home to repeat the process.

Because geothermal energy is a low temperature heat source, your home will always be at a comfortable temperature. Unlike conventional heat sources, such as oil, you won't have spikes in temperatures or have to actively manage how warm or cool you'd like your home. You also won't find any pockets of heat or blasts of cold air, so everyone can enjoy a steady and even in-home climate.

Where Exactly Does Geothermal Energy Come From?

In its most simplified definition, geothermal energy is the energy stored in the earth's crust. This energy has two main sources: the earth's core, and the sun. The earth is like a large solar panel, storing more energy than we'll ever need to heat our homes. Earth's temperature below the surface remains at approximately the average of the mean annual air temperature, even in the dead of winter. These stores of energy are then harnessed, allowing us to use a heat pump to raise and lower the temperature of your home.

Geothermal energy can be confused with geothermal electricity, however these are two different things. Geothermal electricity is generated from high temperature geothermal energy, like the type found near magma conduits, hot springs, geysers, water wells or other similar circulating fluids. The extremely high temperature heat from this liquid is captured in a power station and used to heat water or similar fluid. That fluid is what turns the turbine in the generator, thereby producing electricity.

How Do I Choose a Pump?

When you are considering a heat pump, there are three main decisions to be made. First, you'll choose which type of loop will suit your property, home, climate and needs. The loop system is located outside to capture the heat in the winter or expel heat in the summer. Then you'll choose how you'd like to distribute your heating and cooling within your home, and the appropriate system to distribute the warm or cool air. Finally, depending on your choices for the previous two decisions, you'll choose your heat pump.

Choosing a Loop

There are three choices when it comes to ground loops. Each one has clear benefits for particular property types or locations, and all contribute to the savings you can expect with a Nordic® heat pump.

Open Loop

An open loop system uses an existing or a freshly drilled well. The well must have depth of 75 feet or more, have a diameter of at least 5" to accommodate a submersible pump, and must have enough water flow to meet the requirements of not only the heat pump but the other demands of the residence. This type of loop can be the least expensive to install, because the excavation required is minimal. Heat pumps that use open loop systems are slightly more efficient, because well water is slightly warmer than the ground surrounding the pipes in a vertical or horizontal closed loop, which also helps to keep costs down.

Horizontal Closed Loop

In a horizontal closed loop system, U-shaped pipes are laid below ground, approximately six feet under the surface, beside the home. Trenches to accommodate the pipes are typically 250 feet long and the pipes are laid inside the trenches four feet apart. A small pump is used to circulate fluid through the pipes and into the heat pump. The fluid captures and disperses heat throughout the year.

Vertical Closed Loop

In a vertical ground loop, two pipes are installed in a vertically drilled borehole with a U-bend at the bottom linking them together. Usually there are between two and five boreholes drilled for the average sized home. A vertical loop system is a great option for homeowners who don't have much outdoor space. Functioning like the other types of loops, as the fluid travels through the pipes, it absorbs or diffuses the heat in the ground.

Choose your Indoor Distribution System

Once the heat pump absorbs heat from the loop, it delivers it into your home in the form of either hot air or hot water. You have three choices of how you'd like the hot air or water distributed: ducted systems, in-floor systems, or all-in-one systems.

Ducted Systems

A ducted system delivers heating and cooling via forced air ductwork. The heat is diffused via a network of ducts that are installed throughout your home. If your home already has a duct network, it can be slightly modified to accommodate this new home heating source.

If you choose a ducted system, the Nordic® heat pump that accompanies this system is known as a water-to-air heat pump. This system works zon an open or closed loop, is specially designed to work with forced air ductwork, and offers distribution of both hot and cold air throughout the home.

In-Floor Systems

In-floor heating is one of the most popular choices for new home construction, and lends itself very well to geothermal energy. With this system, warm water is circulated through piping in the floor to deliver heat. This results in warm floors and a warm house throughout the heating season.

The companion heat pump to this heat distribution system is called the water-to-water heat pump. This unit is designed to work specifically with in-floor heating. This heat pump will ensure your home stays warm during the cooler months, but will not provide any air conditioning capabilities in the summer.

All-in-One Systems

If you'd like the comfort of in-floor heating but don't want to sacrifice air conditioning, you can combine a ducted system and an in-floor system for an all-in-one system that is the best of both worlds.

Maritime Geothermal Ltd. has created a heat pump that can do both: the triple function heat pump will satisfy the requirements of a home using radiant in-floor heating in the winter and air conditioning in the summer. These units are highly efficient and ideal for new homes.

How Much Can I Save?

Once you've chosen your loop and heat pump, you'll probably wonder when you'll start to see the savings adding up. Heat pumps are very efficient: for every watt of energy used to power your heat pump, three or more are extracted from the earth. That means it takes significantly less energy to power a heat pump than it would to use a conventional energy source, like oil, which typically requires a 0.8:1 ratio of energy used to energy extracted.

Although heat pumps do cost more to install than conventional sources of heating or cooling, the pumps have an average life span of 20 years and the ground loop will typically function for the life of the home. Heat pumps also have the capacity to preheat domestic hot water as a standard feature, leading to substantial savings each month.

But how much can that impact your bottom line? To use one simplified example, if we look at an average 1,775 square foot home in Nova Scotia, taking into account local temperatures, performance coefficients of the heating and cooling systems involved, and the cost of energy, we can see that a geothermal heat pump will be less expensive than electric baseboard heat:

Heating Method	Calculation	Total Savings/yr
Electric Baseboard Heat		
Electricity Required x Electric Rate	24,750 kwh x $0.16	**$3,960**
Hot water for 4 people x Electric Rate	5,650 kwh x $0.16	**$904**
Total Cost	$3,960 + $904	**$4,864**
Air Source Heat Pump		
Electricity Required x Electric Rate	12,375 kwh x $0.16	**$1,980**
Hot water for 4 people x Electric Rate	5,650 kwh x $0.16	**$904**
Total Cost	$1,980 + $904	**$2,884**
Ground Source Heat Pump		
Electricity Required x Electric Rate	7,071 kwh x $0.16	**$1,131**
Hot water for 4 people with a 35% cost saving	5,650 kwh x 0.65 x $0.16	**$588**
Total Cost	$1,131 + $588	**$1,719**

Heat pumps are highly efficient but do run on electricity, so you can expect a slight increase in your monthly electricity bill. However, as you won't have a bill for conventional sources, like oil or electric baseboard heating, you'll see a tangible financial benefit each month. Therefore, most homeowners find that their heat pump can be paid for in 5 to 7 years, providing free heating and cooling for many, many years!

Ready to Get Started?

Get a quote for your own Nordic® Heat Pump today! Call to **speak with one of our experts** or **find your local dealer** today.