Lincoln Electric System

QUESTIONS? CONTACT US:

402.475.4211
energyservices@les.com
LES.com

GEOTHERMAL HEAT PUMPS

The most energy-efficient, environmentally clean and cost-effective space conditioning system available.

Geothermal Heat Pumps

Home and business owners throughout America and in Lincoln are discovering the benefits of geothermal heat pumps:

- Lower heating and cooling costs
- Dependability
- Excellent comfort

The geothermal heat pump is the most efficient heating and cooling technology available today. Geothermal heat pumps, using the natural heat of the earth, heat and cool homes and businesses up to three times as efficiently as the most efficient natural gas and propane heating systems on the market today.

In addition, geothermal heat pumps:

- Provide quiet performance with low maintenance and easy operation.
- Are environmentally friendly and safe…no soot, fumes or carbon monoxide.
- Enhance landscape appearance…no unsightly outdoor unit. The indoor unit fits easily into a basement, garage, crawl space or closet.
- Can provide hot water for homes and businesses.

The Geothermal Heat Pump is the most energy-efficient, environmentally clean and cost-effective space conditioning system available, according to the Environmental Protection Agency.

Questions & Answers

Q: What is a geothermal heat pump?

A: A geothermal heat pump is an electrically powered piece of equipment that takes heat from the earth during the winter and moves it into a building; in the summer, it takes heat from the building and moves it into the earth.

Q: How does the geothermal heat pump work?

A: Geothermal heat pumps move heat rather than create it. This is done either by circulating well water to extract and absorb heat or by using a piping system installed in the earth to circulate a fluid that extracts or absorbs heat through the wall of the pipe. Below about 6 feet, well water and the earth typically maintain a year-round temperature of about 55 degrees Fahrenheit (ºF) in the Lincoln area. At this temperature, plenty of heat energy is available for extraction in the winter; in the summer, that temperature is low enough to allow absorption of heat from indoor air, with temperatures typically in excess of 75ºF.

Geothermal systems provide up to three units of heating energy for every unit of electrical energy used for power.

Natural gas and propane furnaces deliver less than one unit of usable heat for each unit of natural gas or propane burned. In the cooling mode, geothermal systems normally exceed the efficiency of even the highest efficiency air conditioners.

Q: Will a geothermal heat pump provide all of my heating and cooling needs?

A: A geothermal system can provide complete heating for a home or business; however, systems are usually sized to meet cooling rather than heating needs. This is done to reach the proper balance between cooling and dehumidification to ensure adequate comfort during the cooling season. For this reason, a geothermal heat pump, while providing full cooling needs, normally supplies about 80% of seasonal heating requirements and uses a supplemental heating system to provide the remaining 20%.

Oversizing a heat pump to handle the entire heating load of a home or business is not recommended. Doing so may produce slightly lower heating costs, but the savings will usually not offset the added cost of the larger heat pump unit. An oversized unit can also cause dehumidification problems during cooling operations. A qualified heating and air conditioning contractor should perform a heating and cooling load analysis of the home or business to ensure proper sizing of the geothermal heat pump.

Q: Are geothermal heat pump systems easy to operate?

A: Yes. Changing from the heating mode to the cooling mode is done with a simple flick of a switch on the temperature control thermostat. The geothermal heat pump system is designed for ease of operation and provides automatic management of the supplemental heating system during the winter.

Q: What about comfort?

A: A geothermal heat pump system provides steady, even heating and cooling, which helps a home or business avoid uncomfortable temperature swings. The temperature of air discharged from heating registers is typically 90–105°F from start to finish during a heating cycle. This reduces room temperature swings common with older natural gas and propane furnaces, which normally have initial air discharge temperatures well above 105°F.

Q: Can a geothermal heat pump also heat water for a home or business?

A: Yes. Some geothermal heat pumps include a preheat feature to preheat water before it is goes to the regular water heater. Other geothermal heat pumps integrate the complete water heating system into its design and operation. These systems provide all the hot water needs for a home or business. These features are standard on some units and optional on others. Water heating costs can typically be reduced by up to 50% compared to conventional water heating equipment.

Q: Is a geothermal heat pump difficult to install?

A: Most units are easy to install, especially when they are replacing another forced-air system. They can be installed in areas unsuitable for natural gas and propane furnaces because there is no combustion, hence no need to install flues and chimneys to vent exhaust gases. As with other central heating and cooling systems, ductwork must be installed in homes that don't have an existing air distribution system. Existing ductwork should be evaluated by the geothermal heat pump contractor to ensure adequate air handling and distribution.

Q: Can natural gas or propane furnaces be used as supplemental heating systems?

A: Yes. Although the electrical resistance furnace is the most common supplemental heating source, "dual-fuel" systems that use either a natural gas or propane furnace can be used. Operation for all types of supplemental systems is integrated with the heat pump thermostat so that operation of both the heat pump and the supplemental furnace is automatically controlled via the thermostat.

Q: Do geothermal heat pumps have outdoor units?

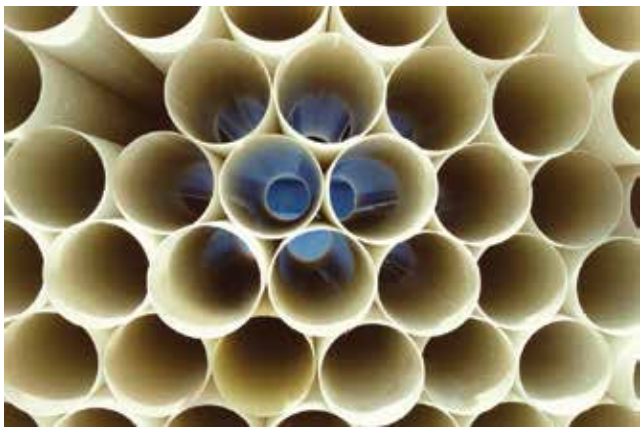
A: While the water wells or the underground loop system is, of course, located outdoors, there is no above ground outdoor equipment needed for the geothermal heat pump. The heat pump itself is installed inside, usually in a basement, garage, crawl space or closet, typically close to the supplemental furnace. Being indoors increases the life span of the heat pump compressor and other major components, and makes the systems easier to work on when maintenance is required. The indoor location also simplifies the geothermal heat pump design compared to air-source heat pumps that require a defrosting system for winter operation. Most geothermal systems have expected life spans of 20 years or more.

Q: Do I need to increase the size of my electric service to accommodate a geothermal heat pump in my home or business?

A: A 200-ampere service generally provides adequate capacity. Smaller services may be sufficient in some cases. A heating and air conditioning contractor should determine whether an existing electric service panel will support a geothermal system.

Q: What about cost?

A: The "up front" cost for geothermal systems is higher than that for lower efficiency equipment. Most of the additional cost is for the open-loop well or the closed-loop piping system. The cost difference between geothermal heat pump systems and other equipment is offset by substantially lower annual heating and cooling bills, as well as lower maintenance costs due to the indoor location of the heat pump and long life of the loops.



Geothermal Heat Pump System Types

OPEN-LOOP SYSTEMS

Open-loop geothermal heat pump systems use groundwater from a conventional well as the heat source.

Because groundwater in the Lincoln area has a year-round temperature of about 55ºF, it is an excellent heat source. In the winter, groundwater is circulated through the heat pump, which extracts heat from the water. The heat pump then transfers this heat to air that is distributed throughout the home or business through a duct system. The groundwater is returned to the earth. In the summer, groundwater circulated through the heat pump system absorbs heat that has been removed from the warm room air in the home or business and transfers it to the earth.

There are several ways to return the groundwater to the earth after it is circulated through the heat pump. Open discharge involves releasing the water into a nearby stream, river, lake, pond or ditch when allowed by state and local regulations. Another method of water discharge is the return well, a second well that returns the water to the groundwater aquifer.

Water requirements for an open-loop heat pump are specified by the heat pump manufacturer. A thorough evaluation of a well's performance and overall water requirements should be done by the geothermal heat pump contractor before the heat pump is installed. The contractor should also test the water for hardness, acidity and iron content to ensure adequate water quality. In new construction installations where domestic water is to be supplied from a well, the well is normally sized to supply the water needed by the heat pump in addition to domestic water requirements. Water from a spring, pond, lake or river as a source for a heat pump system is not recommended.

CLOSED-LOOP SYSTEMS

Closed-loop systems use multiple loops of interconnected plastic pipe buried in the earth as a heat exchanger. The pipe is connected to the indoor heat pump to form a sealed, underground loop through which an environmentally friendly antifreeze solution is circulated. Unlike an open-loop system that uses a continuous flow of groundwater to and from the earth, the closed-loop system recirculates the same fluid continuously through its underground network of pipe.

Closed-loop systems can be installed in vertical or horizontal configurations depending on land availability and terrain. As a rule of thumb, 500-600 feet of pipe laid horizontally is required per ton of system capacity. Vertical loop systems require about 180-200 feet of vertical pipe loop per ton of system capacity.

Horizontal trenches are normally about six feet deep and up to 400 feet long, depending on how many pipes are in a trench. One of the advantages of a horizontal loop system is being able to lay the trenches according to the shape of the land. Normally, a run of pipe is laid at the bottom of the trench, then looped back over itself about two feet higher in the trench once the bottom pipe is covered with soil. This allows more length of pipe to be put in one trench and has no adverse effect on system efficiency. Other loop designs use four or six pipes and allow for shorter trenches if land area is limited. Closed-loop holes are bored to about 180-200 feet per ton of heat pump capacity. U-shaped loops of pipe are inserted in the holes. The holes are then backfilled with a sealing solution.

Properly installed, closed-looped systems using high-density polyethylene pipe will last 25-75 years. They are inert to chemicals normally found in soil and have good heat conducting properties. Closed-loop pipe sections are joined by thermal fusion. Pipe connections are heated and fused together to form a joint stronger than the original pipe.

Closed-loop systems can also be installed in ponds if they are deep enough and large enough. A minimum of six feet in depth at its lowest level during the year is needed for a pond to be considered. In pond loops, copper or polyethylene pipe can be used.

If you are building a new home or facility or replacing a heating or cooling system, a geothermal heat pump may be just the technology you need to get the most out of your heating and cooling investment.

LES can help you decide whether a geothermal heat pump system is right for you. If it is, LES offers cash incentives to make your investment in a qualifying geothermal heat pump system even more attractive. For more information visit **LES.com** or contact an LES Energy Services Specialist at **402.475.4211** or **energyservices@les.com.**