



GeoThermal Heat Pumps

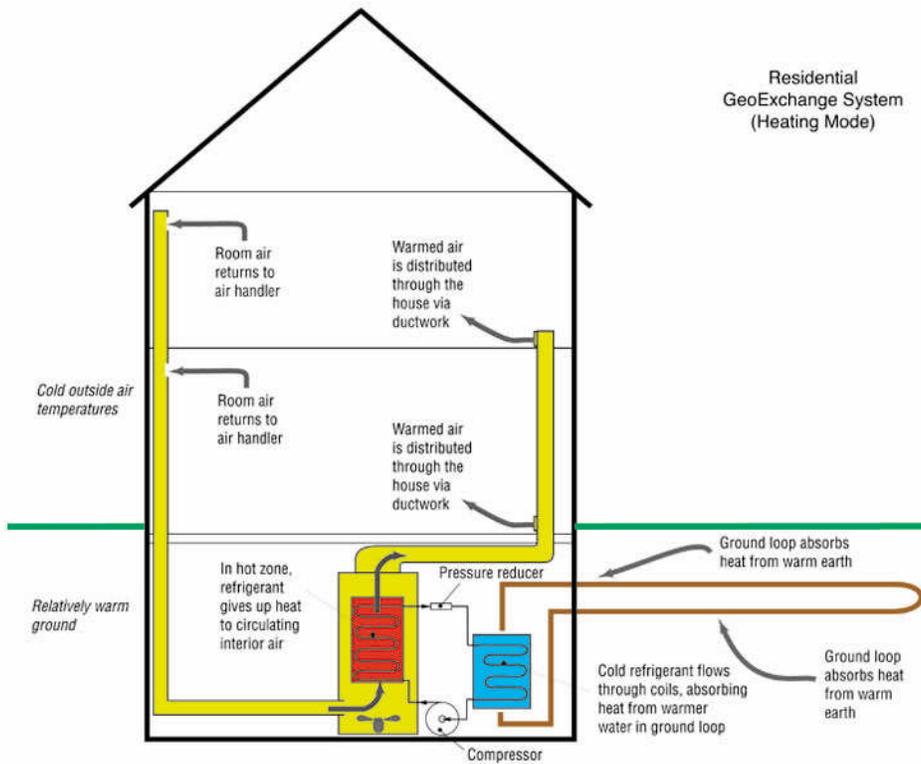
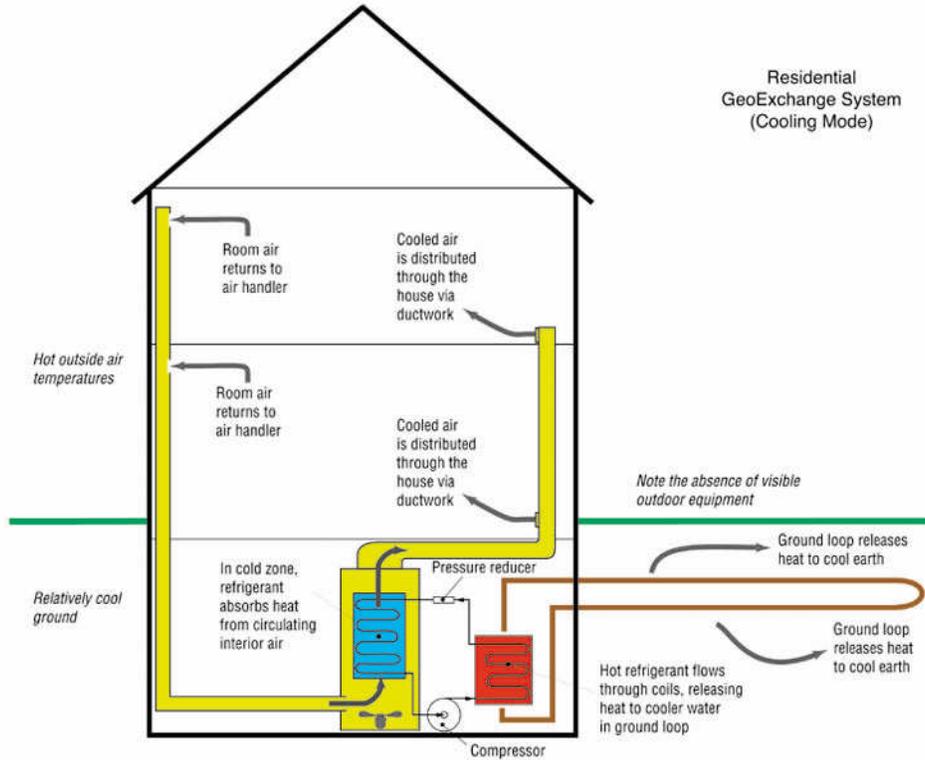
By Greg R. Wayman, NAHI Certified Real Estate Inspector

In the 1970's, there was a gas shortage. To answer the public's outcry for less dependence on foreign oil, solar power was introduced into the residential market. In colder climates, homes were fitted with large solar panels that heated a water/glycol solution. The solution was piped down around an exchanger and back up to the roof, heat was transferred at the exchanger to potable water that was stored in large tanks. From there, the water either ran to your faucets for drinking or through coils mounted above your furnace blower to provide warm air throughout your home. The shortfall of these systems was you still needed a secondary heating system. On cloudy days or at night when your heated water supply ran out, you needed either an electric or gas furnace to supply the heat until the sun could heat up the water again the next day. Today, there is a system that can supply heating or cooling 365 days a year, day and night, no matter what the outside temperatures! Geothermal systems harness the seemingly endless quantities of energy the earth collects from the sun. These systems circulate water underground warmed by the earth and transfer the heat through the heat pump. According to Gary Jacobs of Hydro Pump Co., they have sold over 40,000 geothermal heat pumps throughout Nebraska and Iowa!

Air Source Heat Pumps

When you think of a heat pump, most people think of an air source heat pump. These systems look similar to your typical air conditioner, except they have a reversing valve in them that allows the units to operate in both the cooling cycle as well as the heating cycle. These systems require a secondary heat source for when the exterior temperature becomes too low for the heat pump to extract "heat" from the outside. They will either have an electric furnace or a gas-forced air furnace for the backup heat. Owners of air source heat pumps reap the benefits of a lower utility bill when comparing to a home that has only a gas forced air furnace. Air source heat pumps operate most efficiently when outside temperatures are nearest the indoor temperatures. In other words, they operate more efficiently the less they have to transfer heat. In the summer, when outside temperatures are in the upper 90's or higher, air source heat pumps are not too efficient. The same applies in the winter when its 20-30 degrees F out. Homeowners generally complain that their homes are cold and drafty. The reason is the air source heat pump is circulating warmer air throughout the ducts than the indoor air temperature, but it feels cold to the human body because the air is cooler than our skin temperature.

How Geothermal Systems Work



Diagrams compliments of Geothermal Heat Pump Consortium, Inc.

Benefits of Geothermal Heat Pumps

Unlike air source heat pumps that operate on drastically fluctuating temperatures, Geothermal systems (also known as GeoExchange systems) have the luxury of operating off of a relatively constant ground temperature of 55 degrees F year round in the Nebraska/Iowa area. (Average ground temperatures vary in the US by location.) It doesn't matter if the outdoor temperature is 20 below zero or a sweltering 110 degrees, these systems can easily heat or cool a building utilizing very little energy. According to the Geothermal Heat Pump Consortium, "today's best GeoExchange systems outperform the best gas technology, gas heat pumps, by an average of 36% in heating mode and 43% in cooling mode!" The EPA found that GeoExchange systems reduce energy consumption by over 40% compared to air source heat pumps and by over 70% when compared to electric furnaces with standard air conditioning units. In addition to the drastic reduction of your utility bill, you no longer need a secondary heating system, an outdoor condenser unit, or a gas line! Geothermal systems require 1/10 the amount of maintenance when compared to a gas forced air furnace and standard air conditioner. There is no longer any threat of CO poisoning and there are no harmful emissions into the atmosphere. The Geothermal Heat Pump Consortium states "Today, there are now more than 1,000,000 geoexchange installations in the United States...The monumental impact of the current use of geoexchange is equivalent to: taking close to 1,295,000 cars off the road, planting more than 385 million trees, and reducing U.S. reliance on imported fuels by 21.5 million barrels of crude oil per year."

Types of Loops

Horizontal Loop



Vertical Loop



Diagrams compliments of Geothermal Heat Pump Consortium, Inc.

GeoThermal systems can operate off of "closed-loop" systems or "open-loop" systems. A closed-loop system uses a fixed volume of 20% propylene glycol/water solution pumping through polyethylene pipe buried under the ground. An open-loop system utilizes well water or a large lake. The water must be abundant and never run out. The closed-loop can be installed

horizontally or vertically. For the horizontal layout, a trench needs to be dug 5' -7' deep, which is deep enough to be below the frost line and maintain a relative ground temperature of 55 F. For the vertical layout, a well drilling company will need to drill down in the ground approximately 205 feet. The number of holes drilled will depend on the tonnage required. For calculations, figure 1 ton per hole. On a 3-ton heat pump, you would need 3 holes drilled. Vertical loops can be installed in as little as 10' apart, making this a universal system to be installed just as well on an acreage in the country as on small parcel of land within city limits.

Investment

When contemplating installing one of these environmentally friendly systems, you need to see this as an investment, not a cost. As an investment, you'll be reducing your utility bill by 60% or more! Over the long-term, these systems will be the best economical investment you'll ever make. Figures vary on cost, but the quick response is a geothermal heat pump will cost you approximately the same as if you installed a high-efficiency furnace and high-efficiency air conditioner. To figure it out to the penny, you would need the installer to visit your home to perform a heating and cooling load calculation. This allows them to determine the exact size of unit your home needs. They would also be able to determine what type of loop best suits your landscaping and the costs involved. (Note: if you decide to have a vertical loop installed, you may have the extra cost of a drilling permit.) A vertical loop will cost approximately \$1,500 each. A horizontal loop will cost approximately \$1,300 each. You can also install a slinky loop. These are horizontal loops that utilize overlapping coils that are set 8'-10' apart and run 3' to 7' below ground. For every 80 feet of horizontal trench you dig, the slinky loop fits in 1,000 feet of piping. For new construction, these systems can be written off 100%!

OPPD Discounts

There is an energy credit OPPD offers to any customer who installs a high-efficiency electric heat pump with a SEER rating of 10 or higher. OPPD will pay \$120 per ton. For example, if you have a 4-ton heat pump, they will pay you \$480. For geothermal heat pumps, OPPD pays an additional \$200 on a new system. Installing these systems may also qualify your home for a lower winter electric rate between Oct 1 and May 31. (These figures are effective as of July 1, 2005.)

2006 Tax Credits

Under the Energy Policy Act of 2005, federal tax credits are available for consumers who make specified energy-efficiency upgrades to their homes. These tax credits apply to improvements placed in service (after the installation) from Jan 1, 2006 to Dec 31, 2007. You can receive a 1-time tax credit up to \$500 for installing efficient heating and cooling equipment in your home. (Must be your principal residence.) Installing an electric heat pump will qualify you for a \$300 credit on the full purchase price. Note: there are specific requirements. To find out more, go to: www.ase.org/content/article/detail/2654.

For more information about Geothermal heat pumps, I found the Geothermal Heat Pump Consortium, Inc.'s website: www.geoexchange.org to be packed full of information.

Many thanks to Gary Jacobs of Hydro Pump Co. from Omaha, NE for taking the time out of his busy day to share his in-depth knowledge on the subject! He can be reached at 402-333-2039.

Greg Wayman is a Board Member of The National Association of Home Inspectors, Inc., NAHI Certified Real Estate Inspector, Heat Exchanger Experts Certified Inspector, Nebraska State Licensed Radon Measurement Specialist, Past President of The Nebraska Chapter of NAHI from '04-'07, Board Liason to NAHI's Marketing/PR Committee and NAHI's Website Committee, and serves on NAHI's Conference Committee. He is also a guest speaker every month at Family Housing Advisory Services Home-Buyer Workshops.



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