

QUESTION AND ANSWER GUIDE TO GEOTHERMAL SYSTEMS

Ground Source Heating, Cooling and Hot Water

Q- What is a Geothermal/Ground Source System?

A- A Geothermal/Ground Source System is an electrically powered system that taps the natural heat stored in the earth to heat in the winter and to cool your home or business in the summer. In addition, this system heats your water.

Q- How large are the indoor components of a Geothermal/Ground Source System?

A- The Geothermal/Ground Source System used for most residences is smaller than the typical washing machine.

Q- Does one system both heat and cool?

A- Yes. One of the things that make a Geothermal/Ground Source System so versatile is its ability to be a combination heating and cooling system. You can change from one mode to another with a simple flick of a switch on your indoor thermostat.

Q- How efficient is a Geothermal/Ground Source System?

A- These systems are more than three times as efficient as the most efficient fossil fuel furnace. Instead of burning a combustible fuel to make heat, Geothermal/Ground Source Systems simply move heat that already exists. By doing that, they provide three units of energy for every one unit used to power that system.

Q- Can homeowners afford the investment?

A- The investment requirement for a Geothermal/Ground Source System, unlike other projects, produces a very attractive annual savings and payback, and increases the market value of the home. A typical payback period is eight to ten years. Your dealer/installer and your local utility will be able to advise you about the availability of special financing.

Q- What are the components of a Geothermal/Ground Source System?

A- There are three: the heat pump unit; the liquid heat exchange medium (the closed loop pipe system); and the air delivery system (ductwork).

Q- What is the closed-loop system?

A- The term closed-loop is used to describe the Geothermal/Ground Source System which uses a continuous loop of special buried pipe as a heat exchanger. The pipe is connected to the indoor heat pump to form a sealed, underground loop through which water or an anti-freeze solution is circulated.

Q- Where are these loops located?

A- These closed-loops are laid in trenches, horizontally, or in wells, vertically. Both are placed in yards adjacent to the building. Any area near a home or business with appropriate soil conditions and adequate square footage will work. The design used depends on available space, but neither design is superior to the other.

Q- Will I need separate ground loops for heating and cooling?

A- No. The same loop works for both. Changing from heating to cooling, or vice versa, is very simple. The flow of heat is simply reversed with the flick of a switch.

Q- How effective is this underground system?

A- The buried pipe, or ground loop, is the most recent technical advancement in heat pump technology. The idea to bury pipe in the ground to gather heat energy began in the 1940's. Only recently, however, have new heat pump designs and improved pipe materials been combined to make Geothermal/Ground Source Systems the most efficient heating and cooling systems available.

Q- Are Geothermal/Ground Source Systems difficult to install?

A- Most units are easy to install, especially when they are replacing another forced-air system. This is known as a retro-fit. They can be installed in areas unsuitable for fossil fuel furnaces because there is no combustion, thus no need to vent exhaust gases. Ductwork must be installed in homes that don't have an existing air distribution system. The cost of installing ductwork can be assessed by your dealer/installer.

- Q- Will my existing ductwork function with this system?
- A- Yes, in most cases. Your dealer/installer will be able to determine ductwork requirements and minor modifications needed if any.
- Q- Can I install an earth loop myself?
- A- It's not recommended. In addition to thermal fusion of the pipe, drilling and trenching are procedures best handled by licensed professionals. Nonprofessional installations may result in less than optimum performance, which could cancel out the anticipated savings.
- Q- What kinds of pipe can be used?
- A- Use long-lasting, non-corrosive pipe which has leak-proof joints and does not develop stress cracks when subjected to the pressures of the Geothermal/Ground Source System. In addition, the pipes must be compatible with the circulating fluid.
- Q- How long will loop pipe last?
- A- Properly installed, these pipes will last over 50 years. These pipes are minimally rated for 80 pounds per square inch of pressure, which is four times the maximum operating pressure in the system. These pipes are inert to chemicals normally found in soil and have good heat conducting properties. PVC pipes should never be used.
- Q- How long should the pipe be?
- A- The length and diameter are determined by the size of the Geothermal/Ground Source System, climate, soil type, depth and operating cycle pattern for the installation.
- Q- How far apart should the trenches and vertical bore holes be spaced?
- A- Space trenches four to five feet for single pipe horizontal loops, ten to fifteen feet for vertical bore holes.
- Q- For a horizontal system, how deep and long are the trenches?
- A- Trenches are normally eight feet deep. One of the advantages of a horizontal loop system is the ability to lay the trenches according to the shape of the land. As a rule, 400-600 feet of pipe are required per ton of heat pump capacity. A well insulated 2,000 square foot home may need about a three ton system with 1,500-1,800 feet of pipe.

Q- How long should it take to install a horizontal system?

A- Time is dependent on soil conditions, length and depth of pipe and the equipment required. A typical installation can be completed in one to three days.

Q- What is involved in the use of antifreeze in the pipes?

A- A 20% solution is usually adequate. Proper mixing requires the use of a 20 to 30 gallon container with a separate pump.

Q- What changes in performance can be expected at freezing operating conditions?

A- A drop in soil temperature from 40 degrees F to 30 degrees F results in a loss of capacity and efficiency of about 10%. At 30 degrees F, the latent heat of the freezing of the moisture in the soil adds considerably to the capacity of the system, allowing very successful performance of the systems in Sweden and Canada.

Q- Do freezing soil conditions create any problems?

A- This is not a problem if the system is properly designed. The three to four feet depth allows the sun to melt the frozen soil during the summer. Adequate length per ton capacity prevents objectionable soil movement.

Q- What if there's not enough room for the loop?

A- Geothermal/Ground Source Systems can also be vertical. Holes are bored to about 200 feet per ton of heat pump capacity. U-shaped loops of pipe are inserted in the hole. The holes are then backfilled with a sealing solution.

Q- How long does it take to install a vertical system?

A- With the vertical installation, time varies with conditions at the site, such as type and depth of the overburden, type and hardness of the bedrock and presence of aquifers. Typical drilling times are one to two days and the total installation can usually be accomplished in three days.

Q- What are the advantages and disadvantages of the horizontal versus vertical installations?

A- Horizontals are simpler, require lower cost equipment and less training of installers. However, they require longer lengths of pipe due to variations in soil temperature and moisture content, and installations can be affected more by extensive rainy weather. A much larger area is required. Extensive hard rock may dictate a vertical installation. Verticals require more highly trained operators for the drilling machines, but less pipe length is required which offsets much of the higher drilling cost. Vertical installations, however, are ideal solutions where land area is limited.

Q- How can I be sure the pipe is installed properly?

A- Use a reputable contractor. Don't be afraid to ask for references. Reputable dealers and loop installers will be happy to give names and phone numbers for you to call and confirm their capabilities. Also, check with Sioux Valley Energy.

Q- Will an underground loop affect my lawn or landscape?

A- No. Research has proven that loops have no adverse affect on grass, trees or shrubs. Most horizontal loop installations use trenches about six inches wide. Temporary bare areas can be restored with grass seed or sod. Vertical loops require little space and result in no significant lawn damage.

Q- Do Geothermal/Ground Source Systems have outdoor units?

A- No. The equipment goes inside your home, in the basement, garage or crawl space. Because Geothermal/Ground Source Systems are housed indoors, the lifespan of the compressor and major components are greatly extended, most lasting 20 years or more, and you won't have the noise or service problems you have with outdoor units.

Q- My yard contains many shade trees. Will this affect the found temperature and my ability to use it as an energy source?

A- Not at all.

Q- Will I have to add insulation to my home if I install one of these systems?

A- Geothermal/Ground Source Systems will reduce your heating and cooling costs regardless of how well your home is insulated. However, insulating and weatherizing are key factors in gaining the most savings from any type of heating and cooling system.

Q- Are these systems useful in the newer, smaller, highly insulated homes?

A- Yes. A Geothermal/Ground Source System and buried pipe installation will be proportionally lower in cost. As energy costs per BTU increase, the savings will be increasingly more significant and appreciated. The payback and return on investment will be about the same as for larger systems.

Q- Can these systems be used for commercial, industrial or apartment requirements?

A- Yes. Many Geothermal/Ground Source Systems are being installed using a multitude of systems hooked up to an array of buried vertical or horizontal loops. This eliminates most ductwork and greatly simplifies zone control and internal load balancing.

Q- Can a Geothermal/Ground Source System also heat water for my home?

A- Yes. Using what is called a desuperheater, some types of Geothermal/Ground Source System can save you up to 50% on your water heating bill by preheating tank water. Desuperheaters are standard on some units, optional on others.

Q- Is a Geothermal/Ground Source System which is large enough to handle my total heating needs advisable?

A- Your dealer/installer should provide a heating and cooling load calculation (heat loss/heat gain) to guide your equipment selection. Geothermal/Ground Source Systems are sized to meet all your cooling needs. Depending on heating needs, a Geothermal/Ground Source System normally supplies 80-100% of your design heating load. Sizing the system to handle your entire heating needs may result in slightly lower heating costs, but the savings may not offset the added cost of the larger system.

Q- Are Geothermal/Ground Source Systems warranted?

A- Nearly all Geothermal/Ground Source Systems manufacturers offer a warranty for major components that is equivalent to the warranty for conventional heating and cooling systems. Manufacturers of plastic pipe used for ground loops warrant their products for up to 25 years.

Q- So much for economy. What about comfort?

A- A Geothermal/Ground Source System moves warm air (90-105 degrees) throughout your home via standard ductwork. An even comfort level is created because the warm air is moved in slightly higher volumes, and saturates the home with warmth more evenly. This helps to even out hot or cold spots and eliminates the cold air blast common with fossil fuel furnaces.