HEATING WITH A Ground Source Heat Pump

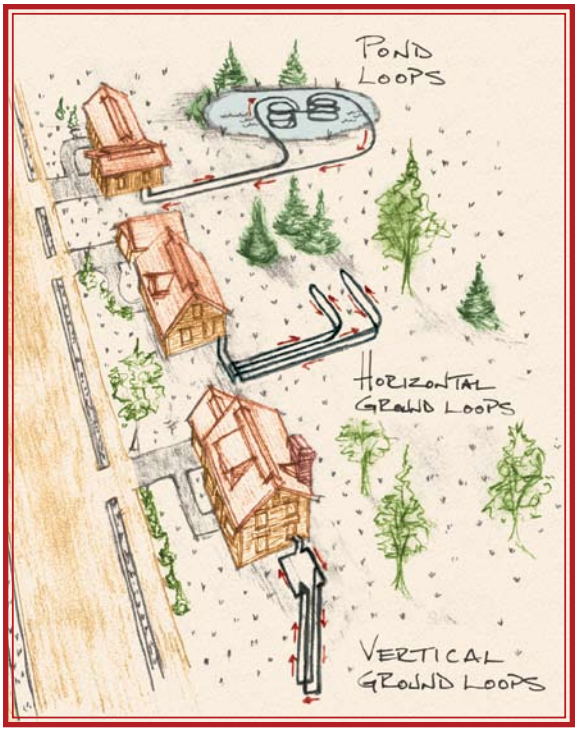
Overview of Geothermal Heating Systems

by Brian Hanlen

➤ ONE HAS ONLY TO LOOK TO THE ESCALATING prices of fossil fuels to validate the relevance of a geothermal heating system. Ground Source Heat Pumps (GSHPs) have increased in efficiency and availability while the price of natural gas has continued to escalate. Now you can install a GSHP system that appeals to your environmental consciousness as well as your pocket book.

Ground source heat pumps are electrically powered mechanical systems that use the 50°-60° ambient ground temperature stored in the earth no matter what the time of year. Our mountain climate actually enhances the heat contained within the earth as the blanket of snow acts as a layer of insulation. Heat pumps extract the stored temperature of the earth to provide a maximum of 127° water temperature that can be used to heat, cool and create hot water for residential and commercial uses. While GSHP's are able to run both radiant and forced air systems they are not recommended for hot water baseboard or radiator systems as supplemental heat would be required due to the high operating system temperatures (180°).

There are two types of GSHP systems: the closed loop and open loop. The type of soil, the acreage of your site and the capacity requirements of your system will determine the most effective system for your project.



GROUND LOOP SYSTEMS ➤ The three types of systems for geothermal heating; (from top to bottom) pond loops, horizontal ground loops, and vertical ground loops. Diagram courtesy of Brian Hanlen

Closed Loop Systems

Closed loop systems are the most common. These re-circulate the same fluid medium, such as a mixture of water and glycol (antifreeze), through a series of looped pipes. The loops can be installed one of three ways: vertically in drilled wells, horizontally through pipes in trenches 4 ft. to 6 ft. below ground, or horizontally through a series of loops in the bottom of a large pond or running body of water.

Open Loop System

An open loop system is operated with a renewable source of water, such as a river or stream, and provides enough consistent volume to run the system on a year round basis. There are some municipalities that actually allow the user to have a return loop on a city water source, where no water is removed from the loop, but the ambient temperature from the water is utilized.

System Design & Rate of Return

We strongly recommend hiring a mechanical engineer and/or loop field engineer before installing a system. A professional engineer can examine the project to provide heat loss calculations and equipment design as well as a cost analysis for your heating system investment. By using a professional up front, you ensure that you install a system that is appropriate for your project. A system that is too small will not function adequately. A system that is too large may perform effectively, but you will not recoup on your initial investment with an excessive loop field.

When installing a system for an average residence (approximately 2,750 sq. ft.), the interior mechanical equipment should be similar in price to that of a conventional system. Additional cost for the interior equipment is in the difference between a natural gas boiler and a ground source heat pump. The major additional costs arise from the exterior loop field. When your mechanical investment is applied to a project in the city, where the cost of the vertical wells (due to spatial constraints) are offset by

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BUFFER TANKS ➤ Pump with the storage tanks for domestic hot water and hydronic hot water. Photo courtesy of Brian Hanlen

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the reduced natural gas bills; this should yield a "pay-back" of the system in about five to six years. For a project located in a rural location, the lesser cost of installing a horizontally trenched loop field, combined with propane bills (which is less efficient and more costly than natural gas), a "pay-back" should be realized in as short as two to three years.

System design can vary greatly from engineer to engineer and contractor to contractor. Try to get a feel for the types of systems that each company typically provides. Some systems can become overly elaborate. Take careful note at additional cost(s), and look at where they originate. A common misconception is that it is the geothermal aspect that has increased costs, when it can be due to the (overly) elaborate mechanical design. The delivery systems (i.e. the ducts and tubes in the floor) are no different in a conventional versus a geothermal heating system. Each piece of equipment should add efficiency and/or reliability. Discuss with your engineer and contractor how necessary is a particular piece of the system.

Exterior Snow Melt

We would advise the use of a gas fired flash heater or condensing boiler that can serve as both a back-up for the main system as well as supplying on-demand heated water for exterior snow melt. Increasing the size of the ground loop field is an inefficient way to melt snow. Use an exterior pavement snow

sensor rather than depending on a simple interior on/off switch. The additional cost for the switch is quickly paid for through the efficient use of the system. It is important to recognize the incredible amount of energy it takes to melt snow. It is not uncommon for the exterior snow melt system for a small driveway to have an energy demand equal to, or greater than, that of the residence.

As GSHP's become more common place, contractor's costs will continue to drop and apprehension about dealing with an unknown product will also diminish. Check with your local utility company to see if loop field installation incentives exist in your area. There are many grants and rebates already in existence in many counties around the United States.

BEHIND THE SCENES ▸ Pumps, valves and controls for the individual room zones in the home. Photo courtesy of Brian Hanlen

Further Information

Architectural Engineering Associates	*(970) 748-8520*	*www.aec-vail.com*
International Ground Source Heat Pump Assoc.	*(405) 744-5175*	*www.igshpa.okstate.edu*
Major Heating and Plumbing	*(800) 707-9479*	*www.majorheating.com*
Quantum Engineering	*(208) 523-8068*	*N/A*
Simply Radiant Heating	*(970) 846-2445*	*N/A*
Snipps Steamboat Mechanical	*(970) 879-8786*	*N/A*
Sound Geothermal	*(435) 722-5877*	*www.soundgt.com*

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Brian Hanlen is president of Brooks Design/Build, Inc. located in Steamboat Springs, CO. Brooks has been involved with the installation of 9 geothermal systems. They have done extensive research into building methods and alternative heating systems.