

Geothermal Heat Pumps

Geothermal heat pumps (GHPs) are a relatively new technology that can save homeowners money. These ground-source heat pumps use the natural heat storage capacity of the earth or ground water to provide energy efficient heating and cooling. GHPs should not be confused with air-source heat pumps that rely on heat in the air.

Geothermal heat pumps use the relatively constant temperature of the ground or water several feet below the earth's surface as source of heating and cooling. Geothermal heat pumps are appropriate for retrofit or new homes, where both heating and cooling are desired. In addition to heating and cooling, geothermal heat pumps can provide domestic hot water.

How Do They Work?

A geothermal heat pump doesn't create heat by burning fuel, like a furnace does. Instead, in winter it collects the Earth's natural heat through a series of pipes, called a loop, installed below the surface of the ground or submersed in a pond or lake. Fluid circulates through the loop and carries the heat to the house. There, an electrically driven compressor and a heat exchanger concentrate the Earth's energy and release it inside the home at a higher temperature. Ductwork distributes the heat to different rooms.

In summer, the process is reversed. The underground loop draws excess heat from the house and allows it to be absorbed by the Earth. The system cools your home in the same way that a refrigerator keeps your food cool - by drawing heat from the interior, not by blowing in cold air.

Types of Geothermal Heat Pump Systems

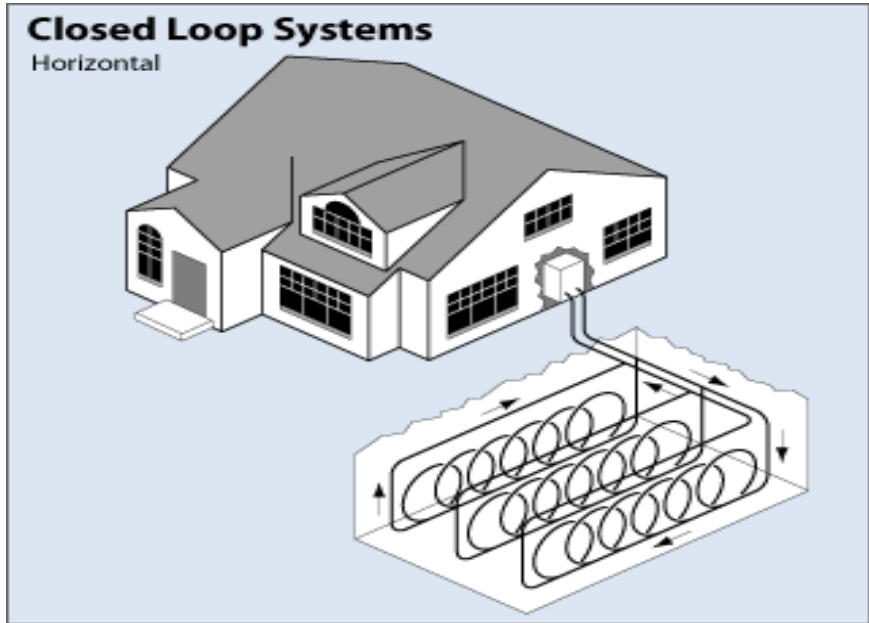
There are four basic types of ground loop systems. Three of these—horizontal, vertical, and pond/lake—are closed-loop systems. The fourth type of system is the open-loop option.

Which one of these is best depends on the climate, soil conditions, available land, and local installation costs at the site. All of these approaches can be used for residential and commercial building applications.

Closed-Loop Systems

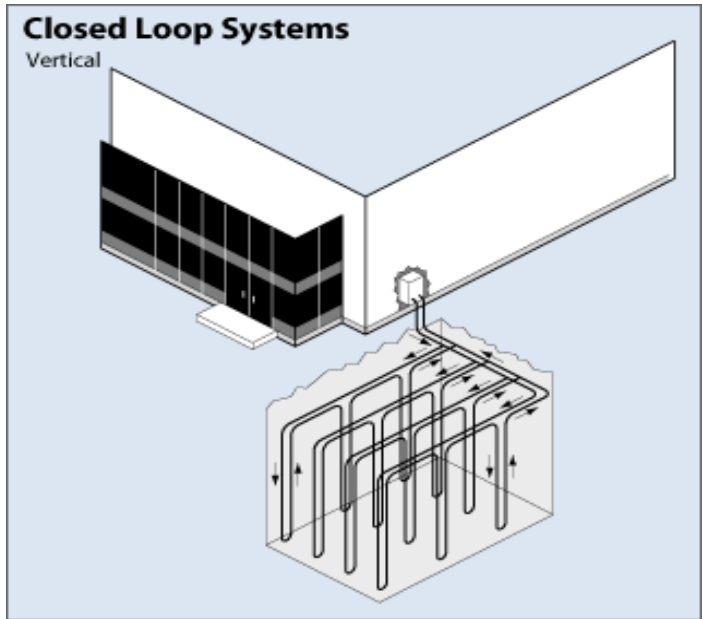
Horizontal

This type of installation is generally most cost-effective for residential installations, particularly for new construction where sufficient land is available. It requires trenches at least four feet deep. The most common layouts either use two pipes, one buried at six feet, and the other at four feet, or two pipes placed side-by-side at five feet in the ground in a two-foot wide trench. The Slinky™ method of looping pipe allows more pipe in a shorter trench, which cuts down on installation costs and makes horizontal installation possible in areas it would not be with conventional horizontal applications.



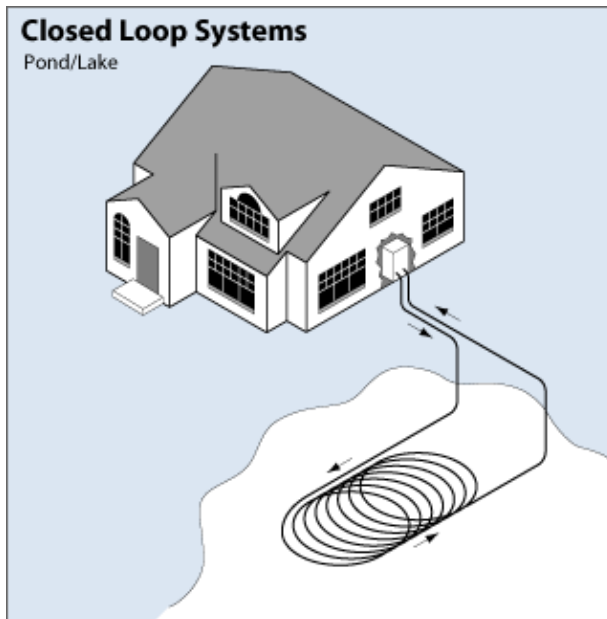
Vertical

Large commercial buildings and schools often use vertical systems because the land area required for horizontal loops would be prohibitive. Vertical loops are also used where the soil is too shallow for trenching, and they minimize the disturbance to existing landscaping. For a vertical system, holes (approximately four inches in diameter) are drilled about 20 feet apart and 100–400 feet deep. Into these holes go two pipes that are connected at the bottom with a U-bend to form a loop. The vertical loops are connected with horizontal pipe (i.e., manifold), placed in trenches, and connected to the heat pump in the building.



Pond/Lake

If the site has an adequate water body, this may be the lowest cost option. A supply line pipe is run underground from the building to the water and coiled into circles at least eight feet under the surface to prevent freezing. The coils should only be placed in a water source that meets minimum volume, depth, and quality criteria.



Open-Loop System

This type of system uses well or surface body water as the heat exchange fluid that circulates directly through the GHP system. Once it has circulated through the system, the water returns to the ground through the well, a recharge well, or surface discharge. This option is obviously practical only where there is an adequate supply of relatively clean water, and all local codes and regulations regarding groundwater discharge are met.

