



## Renewable Energy Solutions

# Geothermal Energy – Ground Source Heat Pumps

## 2. Technical Information

*The earth is a wonderful source of heat. In fact, the earth stores lots of solar energy that reaches us, making it a natural source of heat for hotels. Geothermal heating and cooling systems move the heat from the ground into your hotel using the same technology your refrigerator uses to remove heat from food.*



### How efficient is a GSHP Ground Source Heat Pump?

Ground Source Heat Pumps are one of the most efficient cooling systems available today, with heating efficiencies up to 70% higher than other heating systems and cooling efficiencies up to 40% higher than available air conditioners.

### Can the installed system provide both space heating and cooling for my hotel?

Yes. A GSHP can be a combination heating/cooling

### And what about heating hot water?

Yes. A GSHP can be used for heating your hotel water.

### How does a GSHP system heat water for my hotel?

During the summer your hotel hot water is produced free as a byproduct of the thermal process. In winter the GSHP system heats a portion of your hot water.

### How much space does a GSHP unit require?

Most of a GSHP installation is underground. Inside the hotel, the heat pump units are about the same size as a traditional heating or cooling unit

### How long will my GSHP system last?

GSHPs are durable and highly reliable. The GSHP contains fewer mechanical components, and all components are either buried in the ground or located inside the hotel, which protects them from outside conditions.

### What are the key elements of a ground source heat pump?

1. The ground loop – this comprises of lengths of pipe buried in the ground, either in a borehole or a horizontal trench. The pipe will be filled with a mixture of water and antifreeze, which is then pumped around the pipe and absorbs (winter) or releases (summer) the heat from the ground.
2. The heat pump – a heat pump works by using the evaporation and condensing of a refrigerant to move heat from one place to another. Heat pumps are a very familiar and widely used technology in freezers and air conditioning units.





3. The heat distribution system –GSHPs work with under floor heating systems or traditional wall mounted radiators. The hot water produced can also be stored in conventional hot water cylinders to reduce additional energy input for hot water supply.

### How do I get the heat from the ground into my hotel?

There are several types of systems that gather the heat from the ground. The most commonly used are horizontal and vertical systems.

#### What is a horizontal-loop system?

A horizontal loop is usually the most cost effective when adequate yard space is available and trenches are easy to dig. Using trenchers or backhoes digging trenches below the ground, you then lay a series of parallel pipes. The trench is then back filled, taking care not to allow sharp rocks or debris to damage the pipe.

#### What is a vertical-loop system?

Vertical loops are preferred in many installations where yard space is insufficient and where preservation of existing landscaping is desirable. Each hole contains a single loop of pipe with a U-bend at the bottom. The hole is then backfilled or grouted to improve the thermal conductivity. Each vertical pipe is then connected to a horizontal pipe underground to and from the heat pump. Vertical loops are generally more expensive to install, but require less piping than horizontal loops.

### How far apart are trenches and vertical boreholes spaced?

Trenches are spaced one to two meters apart while boreholes are spaced three to five meters apart.

### What are the advantages and disadvantages of the horizontal and vertical installations, respectively?

Horizontal installations are simpler, requiring lower-cost equipment. However, they require longer lengths of pipe. Since a horizontal heat exchanger is laid out in trenches, a larger area is usually required than for a vertical system. Where land is limited, vertical installations can be ideal. If regional soil conditions include extensive hard rock, a vertical installation may be the only available choice. Vertical installations tend to be more expensive due to the increased cost of drilling versus trenching, but since the heat exchanger is buried deeper than with a horizontal system, vertical systems are usually more efficient and can require fewer pipelines.

### Does my hotel need an additional heat source?

Even if GSHPs can provide all the heat necessary even in the coldest weather, all systems require an emergency backup.

- The heat pump itself (here with hot water tank) takes no more space than a conventional boiler.





## BENEFITS FOR THE HOTEL



### COST REDUCTION

Once installed, the heat pump produces 3 to 5 times more heat energy than would be produced by an electrical heating with the same amount of electricity. It requires no fuel and will therefore reduce your monthly energy bills!



### STAFF INVOLVEMENT

Train your staff as guides to show guests the heat pump system you have applied and explain them how it works, you can both attract more tourists and further involve your staff in order to get them feeling more responsible for their working place!



### GUEST INVOLVEMENT

Install a demonstration diagram to show your guests how the heat pump is providing energy to the hotel. By motivating your guests, they will also feel more responsible and involved in taking care of your hotel! Guests will value the fact that your hotel is environmentally friendly.

## BENEFITS FOR THE ENVIRONMENT



### CARBON EMISSIONS REDUCTION

The carbon emission reduction will depend on your current heating system, on the performance of the heat pump system and on how the electricity you purchase is produced. Experiences show that electrically driven heat pumps can reduce the CO<sub>2</sub> emissions by 45% compared with an oil boiler and 33% compared with a gas fired boiler.

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