

## Ground Source Heat Pump Systems

The heat pump unit can be installed anywhere in your home or business. For most residences, the heat pump is smaller than the typical washing machine. Models are available in a range of sizes and configurations to accommodate overhead or underfloor air distribution systems. Because the heat pump is installed indoors, its lifespan is greatly extended, most lasting 20 years or more. The unsightliness and noise of an outdoor unit are eliminated.

### Winter



The earth has sufficient capacity to continually supply this energy over the entire heating season in all climates where heating is needed.

In summer, the process is reversed. Heat is removed from the indoor climate by the GSHP and transferred to the cooler earth.

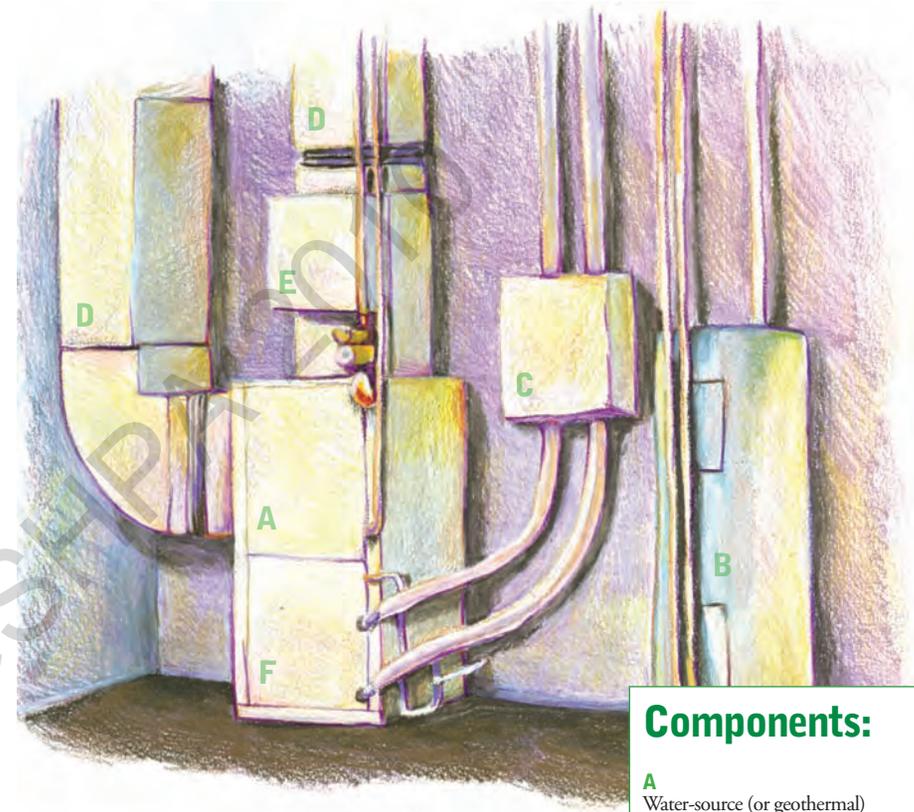
### Summer



The cooler temperature of the earth is what gives the GSHP its efficiency advantage. More simply stated, it takes less energy to cool something with cool water than with hot air.

Domestic potable water can be preheated with the same unit. In the summer cooling period, water heating is at no cost. In the winter, the costs are more than halved.

## Typical Indoor Equipment for a GSHP System



### Components:

- A** Water-source (or geothermal) heat pump
- B** Hot water tank and heat pump desuperheater
- C** Loop pump kit (circulation pump(s), connection hoses, service valves, etc.) to circulate water or an antifreeze solution through the heat pump and ground heat exchanger
- D** Supply and return air duct system
- E** Optional plenum heater for supplemental heating or emergency heat in the event of heat pump malfunction
- F** Air filter assembly

GSHP systems consist of three parts: the ground heat exchanger, the heat pump unit and the air delivery system (ductwork). In the winter, the GSHP removes heat from the ground heat exchanger and pumps it into the indoor air delivery system. In the summer, the process is reversed and the GSHP moves heat from the indoor air stream into the ground heat exchanger.

Ground heat exchangers for GSHP systems consist of a grid of buried polyethylene plastic pipe (ground loops) through which a liquid heat exchange solution circulates. This circulating fluid is the mechanism by which heat is absorbed from the earth for delivery to the indoor distribution system. As heat is removed from the circulating fluid by the GSHP, the warm earth replaces this energy.

## Pond/Lake Loops



Pond/lake loops depend on the location of a pond or lake near the building. Pond loops run slightly colder in northern regions, but they are less expensive to install.

Loop coils should never be placed in a river or a body of water where fluctuating water levels or flood stage conditions could damage the pipe. Pipe is coiled in a fairly large body of water, at least eight feet deep to prevent freezing.

A supply line buried in a trench runs from the building to the submerged loop; the pond or lake must be fairly close to the building or this supply line will provide the same heat transfer function as a horizontal ground loop.

## Open Loops



In an open-loop system, a well or a surface body of water supplies the fluid that circulates through the GSHP system. Once it has circulated through the heat pump, the water is returned to the ground through one of several methods: a recharge well, a drain field or surface discharge.

This option should only be used where an adequate supply of water is available. A good rule of thumb is as least three gallons per minute for each ton of heating and cooling. During extremely hot or cold weather, the water source must be able to handle the needs of a heat pump running continuously.

The discharge method must also be able to handle an increased capacity during extreme weather conditions. Local codes and regulations should be followed at all times.

## Questions & Answers About GSHPs

### How much does a GSHP system cost?

The initial investment for a GSHP system is greater than that of conventional systems. On average, a geothermal system costs about 50 percent to 75 percent more than other conventional high-efficiency systems. But when you consider the operating costs of a GSHP system, the initial difference in purchase price is quickly offset by energy savings. Many electric utilities offer incentives to make purchasing a GSHP system more affordable.

### Does an operating GSHP system make much noise?

With no exposed outdoor units, GSHP systems provide a calm environment outside and operate quietly indoors.

### Are there any safety hazards associated with GSHP systems?

Because they have no combustion process, GSHP systems are safe. Systems do not risk producing explosions, carbon monoxide poisoning or fires like their conventional counterparts.

### What are the environmental benefits of GSHP systems?

GSHP systems conserve energy and reduce the amount of toxic emissions in the atmosphere. They use renewable energy from the sun, and because systems don't rely on outside air, they keep indoor air cleaner and free from pollens, outdoor pollutants, mold spores and other allergens.

### What other costs are there besides the GSHP system?

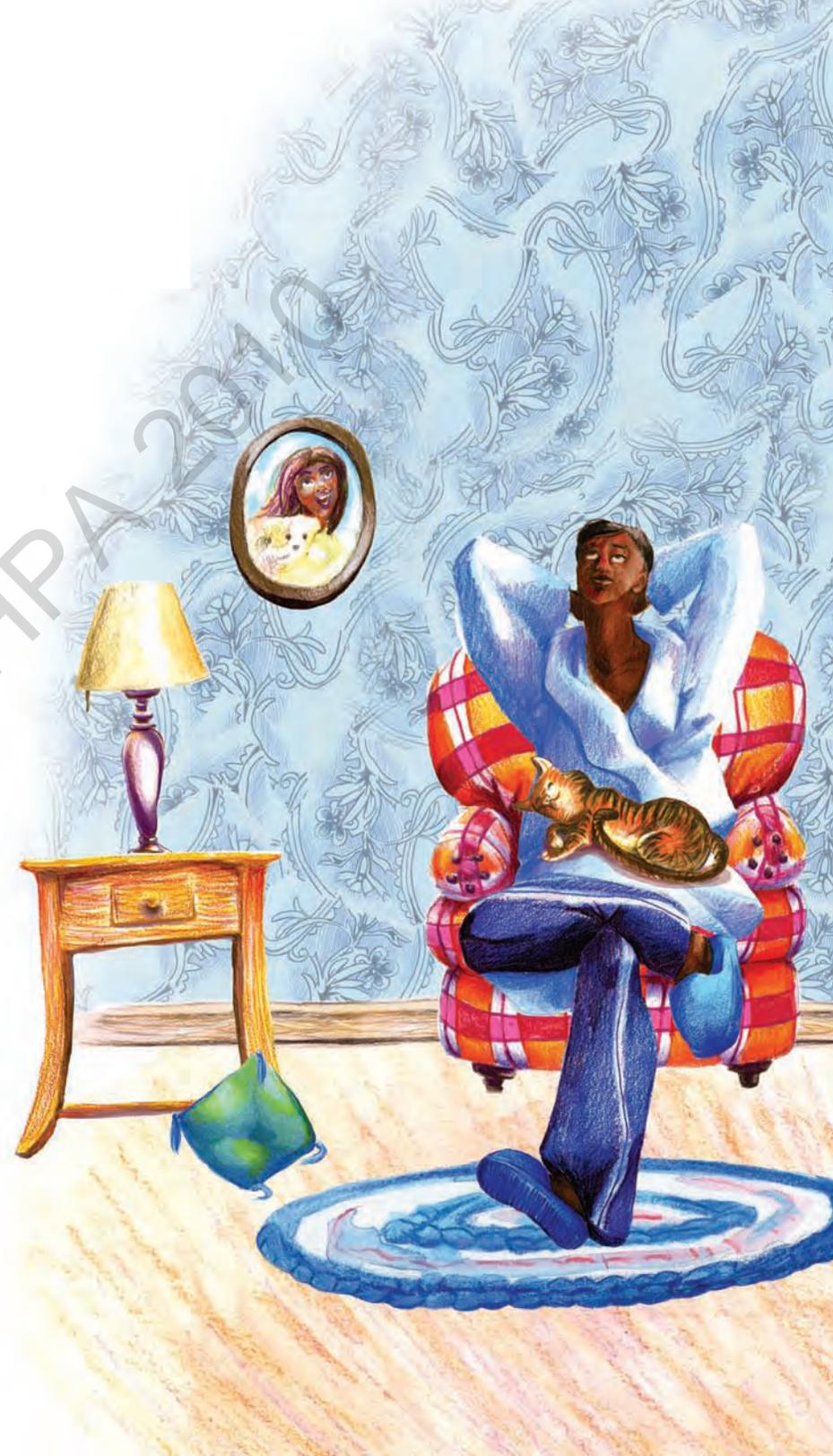
You can expect an installation charge for any electrical work, ductwork, water hook-up and other provisions or adaptations to your home that are required. These costs can be estimated in advance by your installer.

### What about comfort?

A GSHP system moves warm air (90-105°F) throughout your home or business via standard ductwork. An even comfort level is created because the warm air is moved in slightly higher volumes and saturates the building with warmth more evenly. This evens out hot or cold spots and eliminates cold air blasts common with fossil fuel furnaces.

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

Using what is called a desuperheater, GSHPs turn waste heat to the task of heating hot water. During the summer, when the system is in a cooling mode, your hot water is produced free as a byproduct of the thermal process. In winter, with the heating mode, the desuperheater heats a portion of your hot water. Desuperheaters are standard on some units, optional on others. Stand-alone systems, which will heat water all year around, can be purchased.





### **Are GSHP systems difficult to install?**

Most units are easy to install, especially when they are replacing another forced-air system. This is known as a retrofit. GSHPs can be installed in areas unsuitable for fossil fuel furnaces because there is no combustion and, therefore, no need to vent exhaust fumes. Ductwork must be installed in homes without an existing air distribution system. The cost of ductwork can be assessed by your dealer or installer.

### **Can I install a ground heat exchanger myself?**

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 anticipated savings.

### **How long does it take to install a horizontal system?**

This depends on soil conditions, length and depth of pipe and equipment required. A typical installation can be completed in one to two days.

### **Are GSHP systems guaranteed?**

Nearly all GSHP system manufacturers offer a warranty that is equivalent to the warranties for conventional heating and cooling systems. Manufacturers of plastic pipe used for ground loops warrant their products for 25 to 50 years.

### **Who do I contact for more information?**

First, contact your local utilities to find out about incentives, local installers, local dealers and contractors. For more specific information about GSHP systems, research, case studies, and installation training workshops, contact the International Ground Source Heat Pump Association at 800-626-4747 or at [www.igshpa.okstate.edu](http://www.igshpa.okstate.edu).