



# Fact Sheet

Commonwealth of Pennsylvania • Department of Environmental Protection

## GROUND SOURCE HEAT PUMP SYSTEMS (GSHP)

GSHP systems are methods of heating and cooling buildings using the ground as the energy source. GSHP systems have been used for years, but recent advances have made these systems viable alternatives to conventional heating and cooling systems. Also, GSHPs are more environmentally friendly since they can reduce the consumption of fossil fuels, such as oil and natural gas, and the potentially harmful by-products associated with EPA use. The U.S. Environmental Protection Agency (EPA) has concluded that GSHP systems are the most energy efficient and environmentally clean of all the heating and cooling options.

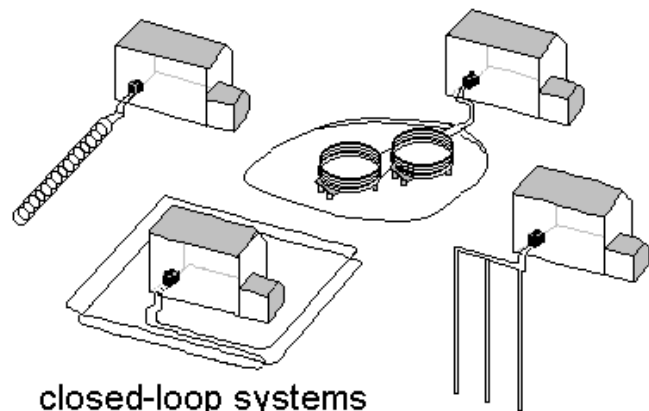
There are two main types of GSHPs, closed-loop systems and open systems. Closed-loop systems circulate an antifreeze fluid through underground loops of pipe. The

loops, installed either vertically in borings or horizontally in trenches or ponds, exchange heat with the ground. Open systems use groundwater from a supply well, which passes through the heat pump and into a discharge area. In both systems, the steady cool temperatures of the subsurface can offset the seasonal temperature variations by serving as a reservoir of heat in the winter and as a drain of heat in the summer.

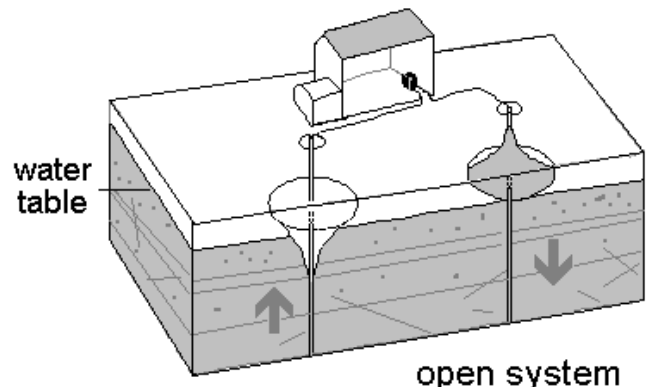
GSHP systems have only a minimal risk of environmental problems from their operation. Their dual nature for both heating and cooling is especially attractive in a state like Pennsylvania, which often has extreme seasonal variations in temperature. GSHP systems are being installed across Pennsylvania in homes and larger buildings such as offices and schools.

### The Many Different Names of Ground Source Heat Pumps

Because of the variety in technology and design, many different names for GSHPs have been used by the industry. These names include direct expansion, geothermal, geo-exchange, groundwater, earth-coupled, slinky coils, ground-coupled, water-source and open and closed-loop heat pump systems.



closed-loop systems



open system

## What are the advantages of a GSHP system?

Properly installed GSHPs can be operated at significantly reduced costs. GSHPs are quieter and less visible than air-source heat pumps. They also have lower maintenance levels because they are not exposed to the weather. GSHPs are safer than conventional systems that use fossil fuels. Also, GSHPs use less energy and do not directly burn fossil fuels.

## What are the disadvantages?

Installation costs are higher. Some types of systems require a large area of land. Most GSHP systems require routine maintenance.

## What are the regulations on GSHP systems?

Currently, no specific state regulations govern the installation of GSHP systems. However, discharge of water from an open loop system to a surface water body such as a stream may require a National Pollutant Discharge Elimination System (NPDES) permit. An EPA reporting requirement exists for injection of water to a return well for groundwater heat pump systems. Also, GSHP systems must be constructed so that they will prevent any contamination from occurring or spreading. Wells must be installed by licensed drillers who are required to submit well logs and locations to the Bureau of Topographic and Geologic Survey, Department of Conservation and Natural Resources. Local ordinances also may affect the installation of systems.

## Are GSHPs safe for the environment?

Generally, yes. Three main practices will help to avoid most environmental problems: (1) proper sealing and backfilling procedures of wells, borings and trenches; (2) in closed-loop systems, the use of a non-toxic, corrosion-inhibited, biodegradable circulating fluid; and (3) in open systems, returning groundwater (unchanged except for the temperature) back to the same aquifer.

General recommendations for the installation of a GSHP system include:

- Carefully choose the type and location of system. The GSHP should be isolated from wells and potential sources of contamination;
- Hire only qualified and experienced contractors. It is recommended that the contractor be certified by the International Ground Source Heat Pump Association (IGSHPA). Ask for references of customers;
- Use only proper materials, testing methods and procedures to install the systems; it is recommended that IGSHPA standards are followed;
- Maintain, monitor and periodically inspect the system; and
- Record the locations and construction details of the underground portions of GSHP systems.

## Where can I get more information?

Public utility commissions, electric cooperatives and contractors may be helpful. In addition, DEP has a GSHP manual which considers the environmental aspects of GSHP systems and presents information on their general design, installation and maintenance. This manual is available on the DEP website. The following are possible sources of additional information:

Bureau of Water Supply Management  
PO Box 8467  
Harrisburg, PA 17105-8467  
717-772-4018

Geothermal Heat Pump Consortium  
701 Pennsylvania Ave., NW  
Washington, DC 20004-2696  
888-255-4436  
<http://www.geoexchange.org>

IGSHPA  
490 Cordell South  
Stillwater, OK 74078-8018  
1-800-626-4747  
<http://www.igshpa.okstate.edu>

This fact sheet and related environmental information are available electronically via Internet. For more information, visit us through the Pennsylvania homepage at <http://www.state.pa.us> or visit DEP directly at <http://www.dep.state.pa.us> (choose directLINK "Drinking Water Publications").



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