CHESTER COUNTY
Sustainability
SUMMIT & EXPO

Making Sustainability Simple:
Everyday Actions for a Lasting Impact

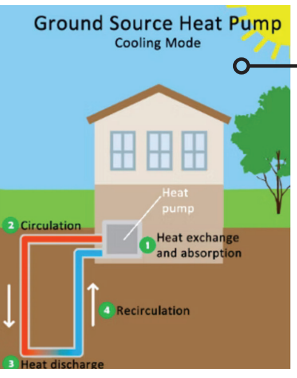
Geothermal Basics

Geothermal heat pump (GHP) systems use the thermal properties of the earth, in conjunction with electricity, to provide space conditioning and water heating to facilities.

It's important to note that Geothermal Heat Pumps are also referred to as Ground Source Heat Pumps or Geo Exchange Systems. These names are often used interchangeably within the industry but refer to the same technology.

GHP technology transfers heat between the steady temperature of the earth and a building to maintain the building space conditions. Below the surface of the earth the temperature remains relatively constant. This stable temperature provides a source for heat in the winter and a means to reject excess heat in the summer. In a GHP system, a fluid (typically water) is circulated between the building and the ground loop piping buried in the ground. In the summer the fluid picks up heat from the building and moves it to the ground. In the winter the fluid picks up heat from the ground and moves it to the building. Heat pumps in the building make this transfer of heat possible.

This exchange of thermal energy makes the system efficient. Rather than creating heat by burning fuel on site, the GHP system moves thermal energy between the ground and the building, using heat pump technology. The relatively constant temperature of the ground makes this energy transfer efficient throughout the year, even during the coldest weather. On the contrary, alternative systems must move energy from the building to the hotter outdoor air, while the GHP system gains efficiency by transferring the energy to the cooler ground.

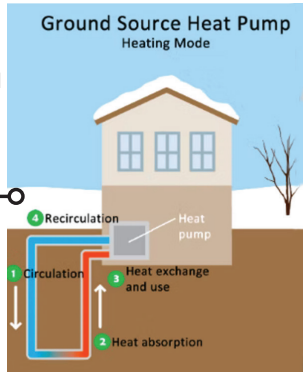


Cooling Mode

When the building needs heating, the system extracts energy from the ground and pumps it into the building where it is concentrated by the heat pump.

Heating Mode

When the building needs cooling, the heat from the building is concentrated by the heat pumps and the system removes heat from the building and pumps it into the ground.



Geothermal Heat Pump Benefits

- **Low Operating Cost** - The efficiency of the heat pumps operating under moderate loop temperatures provide the basis for high efficiency and low operating cost. The cost to move energy around the building is also low, as heat pumps are placed at each space.
- **Simplicity** - The distributed nature of the system makes it easy to understand. A heat pump located at each space will provide independent heating and cooling. The operation of one heat pump does not affect any other heat pump. Control simply requires turning the unit on or off in response to the area that needs heating or cooling.
- **Low Maintenance** - The heat pump itself is a packaged unit no more complex than typical residential air conditioning equipment. The components are the same as those used for outdoor applications that have much wider operating ranges and exposure to the weather.
- **No Supplemental Heat Required** - Heat pumps can meet all of the space loads, including ventilation loads. Ventilation air can be tempered by separate heat pumps and/or conditioned with heat recovery equipment.
- **Low-Cost Integrated Water Heating** - Heat pumps can be dedicated to meet hot water loads. These heat pumps become particularly attractive when there is a large cooling load relative to the heating load. By extracting some of the heat from the ground loop for water heating, the ground heat exchanger size and cost can be reduced.
- **Low Environmental Impact** - No fossil fuels need to be consumed on site. As the efficiency of electricity production or renewable power generation increases, so does the environmental efficiency of the heat pump system.
- **Longer Life Expectancy** - Both the American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE) and the Electric Power Research Institute have concluded, based on independent research studies, that the appropriate service life value for geothermal heat pump technology is 20 years or more. This benchmark is the current industry standard.

PA-GEO

Pennsylvania Geothermal Heat Pump Association (www.pa-geo.org). For more info email Jack Dienna, Executive Director of the Geothermal National & International Initiative & Vice President of PA-GEO (jdienna@geo-nii.org)

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