Gray Design Building – Geothermal Energy

By Mara Morris

Green design has always been important, but especially more now than ever. As designers, we must do our part to consider the way we can make buildings more energy efficient or find alternate sources of power. That is exactly what Jeanne Gang Architects have done in the new home of the College of Design at the University of Kentucky. The U.S. Small Business Administration notes that HVAC accounts for 40 percent of energy usage in commercial buildings. In order to combat this energy expenditure, Jeanne Gang Architects have incorporated geothermal energy in the Gray Design Buildings, which will be used to heat and cool the building.

It is important for young designers to be surrounded by environmentally conscious design, and now with the new Gray Design Building they will be.

Geothermal Energy GDB

- Location: Gray Design Building parking lot
- First building on UK's campus with Geothermal Energy
- 87 wells, 550 ft deep
- Used for heating and cooling the building
- Closed loop vertical Heating and Cooling system
- BTU meter has been included in the geothermal system, allowing for the energy flow to be tracked
    - Estimated about 40% of the buildings energy usage will be consumed by the HVAC system, whose energy is supplied by the geothermal system

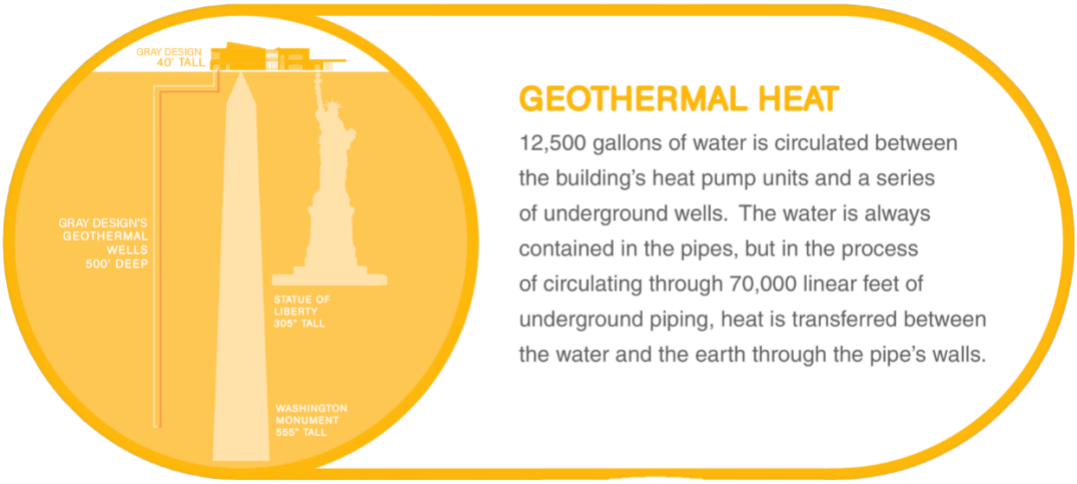
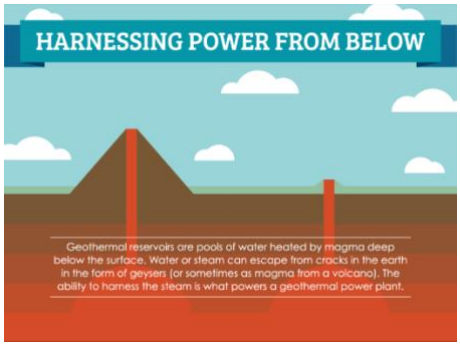


Figure 1 Geothermal Graphic adapted to be about the Gray Design Building.

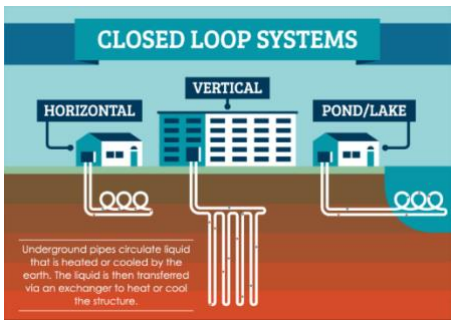
What is Geothermal Energy?

Geothermal energy is a renewable source produced by the natural decay of radioactive elements near the earth's core. The heat then rises to the surface through natural convection. Geothermal energy works by tapping into this heat source by drilling wells. The heat is then used to heat and cool the building.



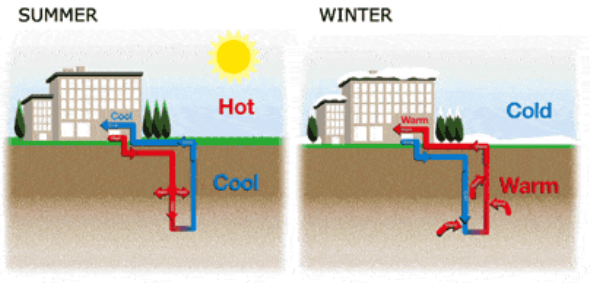
What does "Closed Loop Vertical System" mean?

Vertical systems are more commonly used in commercial settings where space is often premium. The most common layout utilizes holes that are 20 ft apart and up to 500 ft deep. Looped pipes are inserted into the holes and connected to heat pumps in the building.



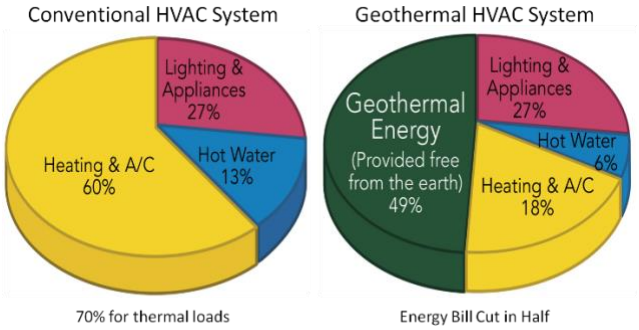
Seasonal System

Water is pumped through the closed loop pipes and the natural temperature of the earth heats and cools the water. During the summer, heat will be removed from the building and put into the earth to be cooled. In the winter, the heat will be pulled from the earth and utilized in the building.



Presumed Cost of Geothermal Energy

Geothermal heat pumps can be expensive. Ground loop heat exchanger costs can vary from $1,200 to $2,000 per ton installed, depending on the drilling conditions and the size of the system. That is approximately $100,000 per bore hole for the Gray Design Building. While it is a huge up front expense, it is an investment in sustainability with a pay back period ranging from 2 to 10 years in a project of this size.



Source: GEOExchange.org

PROS of Geothermal Energy	CONS of Geothermal Energy
Renewable and sustainable: Geothermal energy is a renewable energy source that will exist for as long as the earth exists. It also doesn't produce greenhouse gases or harmful emissions naturally. High efficiency: Geothermal power plants are incredibly efficient. They can produce electricity up to 90% of the time, compared the 59% for wind and 23% for solar. This means that they can convert a large percentage of the heat from underground into useable energy without much waste heat. Reliable and consistent: Geothermal power plants can operate around the clock, regardless of weather conditions, making them a reliable source of energy. Small footprint: Geothermal power plants have the smallest land footprint of any large-scale energy source in the world at just 404 m2 per gigawatt. That is less than 1/3 the amount of an average wind farm.	High upfront cost: The cost of installing a geothermal heat pump is higher than traditional heating systems due to the need for drilling and installing underground piping. Site sustainability: Geothermal heat pumps require suitable geology and land area to install the underground loop system which may not be available in all areas. Installation challenges: Installing an underground loop system requires specialized equipment and expertise, which can pose challenges during installation and maintenance and can lead to high costs.

Suggested Readings –

Commercial geothermal heating and cooling system design | Consulting - Specifying Engineer (csemag.com)
How Much Does a Geothermal System Cost? - Energy Savers (energysaversair.com)
Getting Started with Geothermal Heating and Cooling in Your Home | Greener Ideal
Renewable Energy 101: How Does Geothermal Energy Work? - YouTube