

## Geothermal Heat Pump

*GeoExchange, earth-coupled, ground-source heat pumps*

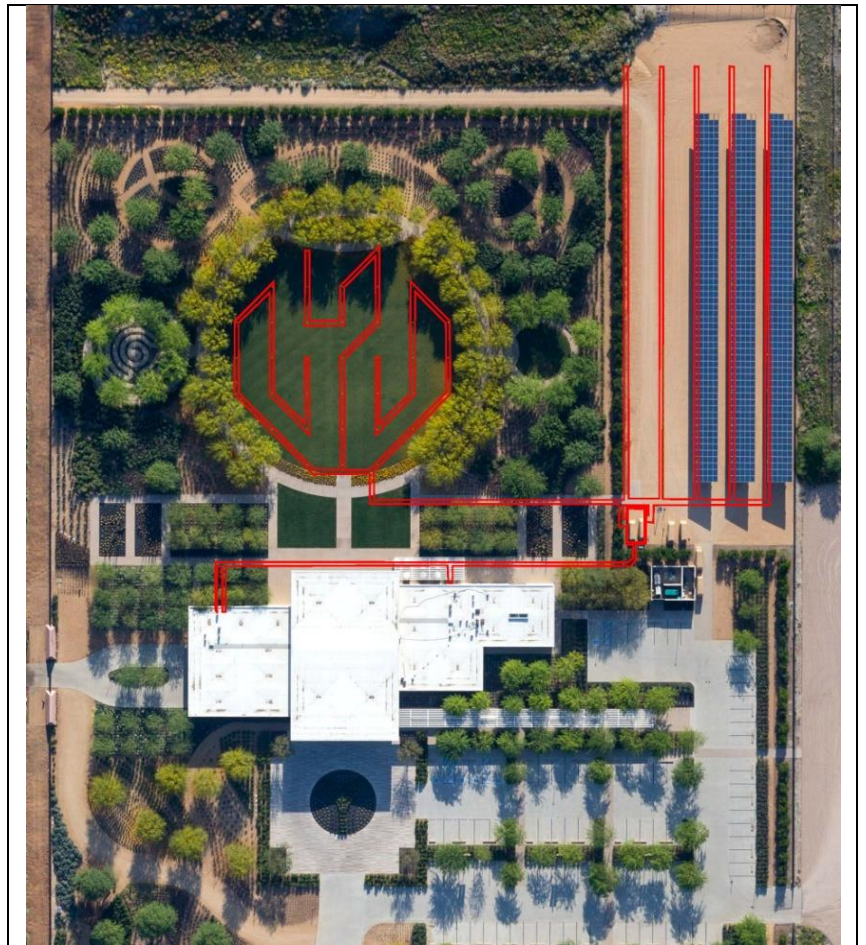
“Geo”: Earth

“Thermal”: Heat

**Basic Description:** *Using the Earth’s constant temperature to help reduce the amount of electricity used for air conditioning and heating systems.*

### Site Specifics:

- Located under the great lawn and the solar field
- 96 vertical boreholes ( narrow holes created by large drills during the installation of the system) that go over 350 feet deep
- 13 ground source heat pumps
- Vertical closed loop system



**Description of process:** The geothermal heat pump on site is a vertical closed loop system. A mixture of water and non-ozone depleting fluids flow constantly through the system. The Earth’s core, which is a constant very hot temperature, radiates heat out from the core to the outer layers of the earth’s surface. Consequently, just a few feet below the surface temperature remains constant. This system circulates water through the series of 96 bore holes carrying the fluids down 350 feet and then back into the Center. The temperatures in the atmosphere, unlike that under the Earth’s surface, vary greatly. During the summer when the atmospheric temperatures greatly exceed those of the temperatures under the Earth’s surface the fluids in the system act to absorb heat from the atmosphere and carry it back and release that heat under the Earth’s surface and the fluid returns to the Center cooler. During the winter when the atmospheric temperatures are significantly lower than those under the Earth’s surface the fluids in the system carry heat into the Center and release it helping to warm the Center.

**Incentives:** There are a variety of federal and state incentives, grants and loans that are provided for individuals and businesses that install geothermal systems. These systems will often also help to meet efficiency standards and to gain points needed for certification programs such as LEED.

**Problems/Warning:** There are some significant environmental and potentially financial benefits to installing a geothermal heat pump system, but before any individual or business considers making the investment there are a few things that they need to consider. Expectations for the system need to be realistic. While the use of a geothermal system can help to reduce the amount of energy consumed by air conditioning and heating there is still electricity required to operate the system. There is no one-size-fits-all system that will work efficiently on every site. It is important to research and take into consideration characteristics of the individual site before deciding on the type and size of a system.

**Resources:**

US Department of Energy (energy.gov)

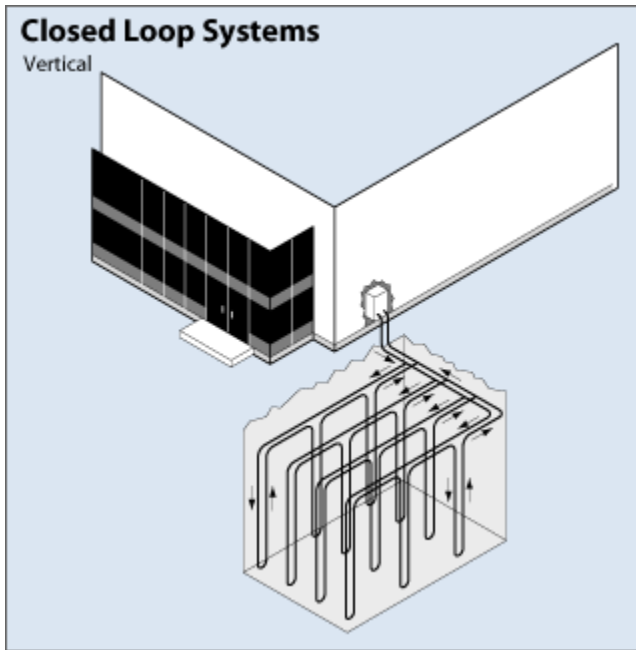
Geothermal Energy Association (geo-energy.org)

Geothermal Education Office (geothermal.marin.org)

*Geothermal Energy- Clean Power from the Earth's Heat*, Wendell A. Duffield and John H. Sass  
(<http://pubs.usgs.gov/circ/2004/c1249/>)

DSIRE: Database of State Incentives for Renewable Energy (dsireusa.org)

Vertical Closed Loop System:



*(Image from energy.gov)*

Vertical closed loop systems are completely enclosed with a fluid inside that flows through the tubing. When a system is in good working order there is no additional fluid needed and there is no leakage. The tubing loops for this system go down vertically underground 350 feet as depicted in the image above.