



GEOHERMAL HEATING

The Earth: An Energy Saver!

A geothermal heating system controls the temperature of the Camp Kawartha Environment Centre. This system is more than three times more efficient than conventional heating systems and, because it does not burn any fuel, it does not contribute to global warming.

The Earth has been absorbing and storing heat from the Sun for millions of years. Geothermal systems use the Earth's ability to retain heat to control the temperature of homes and buildings.

The top surface of the ground is the same as the air temperature, and so in the summer it is hot and in the winter it is frozen. Below the surface, however, the temperature becomes more and more stable until, at a depth of about 7 meters, the temperature remains the same year round - approximately 10°C.

An important component of a geothermal system is the coil of copper pipe that is buried in the ground below the frost line. This pipe is called the **ground loop**.

Did you know...?

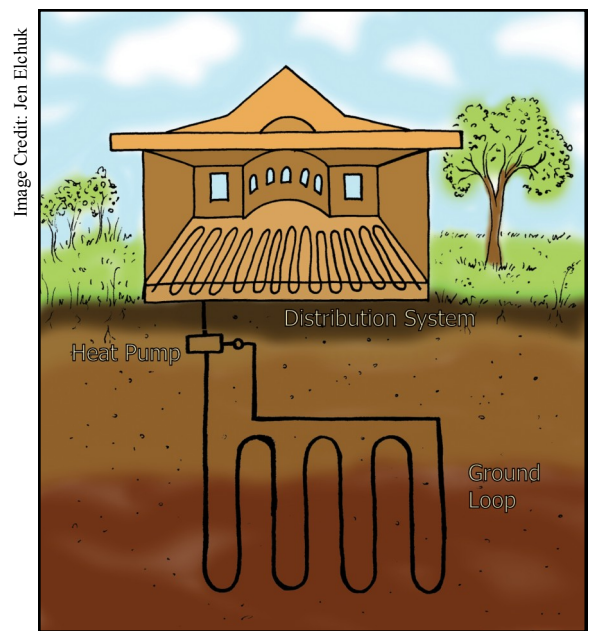
The ground loop in the Environment Centre goes down vertically 33 meters into the earth. The copper piping is inserted into two holes no more than 4 inches in diameter.

The Geothermal Circulation System

Your body controls its temperature by circulating blood between your core and your extremities; a geothermal system works similarly. In a geothermal system, a substance called a **refrigerant** is circulated through the ground loop where it is heated (or cooled) to the Earth's temperature. It then comes out of the ground and enters the heart of the geothermal system, the **heat pump**.

All heat pumps, air conditioners and kitchen refrigerators function in the same way. They move

heat from one area to another. A refrigerator moves heat from the inside (where you keep your food) to the outside (the coils at the back). The coils outside of a refrigerator are warm because they give off heat taken from the inside. The heat pump in the Environment Centre is like a refrigerator in reverse. It moves heat from the ground loop into the tubing running through the centre's floor.



Everyone who has ever boiled a kettle knows that when you add heat to a liquid it becomes a gas (water, for example, becomes steam). In a geothermal system, the cold refrigerant becomes a gas when it collects heat in the ground loop.

The heat pump pushes this gas into a heat exchanger. All of the heat the refrigerant collected in the ground gets pushed together to create a very hot vapour. Think of the heat in the refrigerant as feathers in a pillow: if you take all the feathers from a large, soft pillow and push them into a much smaller pillow case, you get a much harder pillow. Similarly, the 10° C gas that enters the compressor comes out as a much hotter 70° C liquid.

Heat is then transferred to the liquid flowing through the many tubes snaking through the Environment Centre's floor. Heat always moves from hot to cold. Since the liquid in the tubes is warmer than the floor, heat moves into the floor which in turn warms the air. When the liquid has completed its journey through the floor and it has cooled off it returns to the heat pump to pick up more heat transferred out of the ground loop and the process begins again.

Did you know...?

The geothermal system in the Environment Centre has the highest CoP (Coefficient of Performance) of any North American made heat pump.



Geothermal Fun Facts

- A geothermal system can reduce home heating costs by as much as 70%.
- An average home in Ontario emits 6 tons of carbon dioxide a year as a result of running mechanical heating and cooling systems. The same house with a geothermal system will emit only 2 tons of carbon dioxide a year. Over the span of 20 years that's 80 fewer tons of greenhouse gases!
- Ground loops can be installed horizontally, vertically or diagonally.
- The same principles of geothermal heating can be applied to extract heat from deep lakes or ponds. In this case, the ground loop runs underwater rather than underground.

Did you know...?

Although the geothermal system at the Environment Centre is only configured for heating, these systems are capable of cooling buildings as well! In the summer months, properly configured systems are able to work in reverse and transfer heat from inside the building into the ground.



For more information on how geothermal systems work and the benefits of using them check out these resources,

- <http://www.gogeothermal.ca/index.php>
- <http://www.renewableenergyworld.com>
- <http://www.digtheheat.com/>
- <http://re.pembina.org/sources/geothermal>

Bibliography:

- <http://www.hydro.mb.ca/earthpower/index.shtml>
- <http://www.geo-exchange.ca>
- <http://www.cangea.ca/>
- Residential Earth Energy Systems: A Buyer's Guide – Natural Resources Canada
- <http://re.pembina.org/home>

