# Geothermal Heating & Cooling

State Headquarters for the Indiana Chapter of
The Nature Conservancy

Our earth's interior—like the sun—provides energy in the form of heat. This ***geothermal energy*** yields warmth and power we use to heat and cool the Efroymson Conservation Center without polluting the environment.

We employ a variety of sustainable, energy-saving techniques to heat, cool, and light our new headquarters as well as power our computers, create hot water, and ring our phones. The most significant of these is the system we will use to heat and cool the building. We are making the most of advanced geothermal technology.

What is a geothermal heating and cooling system? Although mechanical and engineering diagrams for a geothermal heating and cooling system may look complicated, the concept is simple: we use the natural heat-storing capacity of the earth to heat or cool water depending on the time of year. The earth's temperature below the frost line remains a constant temperature of about 55 degrees year round. Heat can be transferred in during winter months to warm our space, and can be transferred out during the summer to cool it, significantly lowering energy costs and emissions.

## Our system design

The Efroymson Conservation Center uses a vertical closed loop system in conjunction with twelve strategically placed heat pumps throughout the building. Our system uses 38 wells each dug 300 feet deep below our landscaping on the north side of the building. A "U-shaped" loop of piping was inserted into each of these wells. These "U-shaped" pipes are all connected together and run into the building itself. The system of looped piping is filled with a solution of water and biodegradable antifreeze and then sealed.

These wells give us year round access to 55 degree temperatures. A fluid much like a car's antifreeze circulates through pipes inserted into the wells, and is cooled in the summer and warmed in the winter by the constant temperature of the soil and water below the surface. In the summer, we always have 55 degree fluid available to convert to 55 degree air to cool the building. In the winter, if it's 20

BELOW: DRILLING THE GEOTHERMAL WELLS ON NORTH SIDE OF EFROYMSON CONSERVATION CENTER
INSET: SCHEMATIC OF A TYPICAL CLOSED LOOP GEOTHERMAL SYSTEM

## Why Geothermal?

There is a variety of reasons that geothermal technology presents a sustainable energy source for our building.

First and most important, ground-source heat is a naturally **renewable energy source** and very environmentally friendly. The list of benefits, however, goes far beyond our primary reason for using geothermal and includes:

Experience (over 25 years) shows that heat pumps that are self-contained and housed indoors are both reliable and require little maintenance.

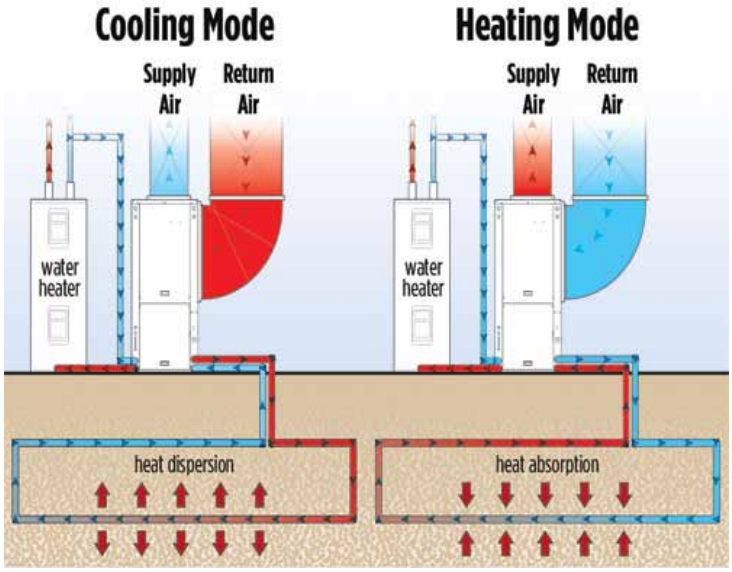
Ground loop piping is designed for a long life, often up to 50 years.

The system avoids noisy and unattractive outdoor condenser units, keeping the neighborhood quieter for people and wildlife, particularly birds.

There are no "on" and "off" cycles and thus no cyclical fluctuations in internal temperatures.

The use of multiple heat pumps allows us to transfer heating and cooling from one zone to another based on the current use of space to gain even greater energy savings.

Lower energy use from the electrical "grid" means lower energy bills. Studies have shown 50% reductions in heating bills and up to 30% reductions in cooling costs.




## Heating and Cooling the New Building

The system we refer to as a "heat pump" has a variety of names in the field: geoexchange, geothermal, water exchange, water furnace systems. All refer to systems used to convert geothermal energy. As seen above, the looped system has an intake and outtake into the heating/cooling system that works much like a radiator. In cooling mode, the liquid brought in from the looped system at 55 degrees is used to accept rejected heat from the refrigeration cycle that passes through coils in the HVAC system to absorb heat from intake air and thereby reduce its temperature. In heating mode, this process is reversed and allows cold air drawn into the building to be heated before being supplemented with an electric heating unit to achieve the desired interior temperature.

degrees outside, we have access to that same 55 degree fluid to bring our air up to 55 degrees. We supplement this heat with radiant heat to gain an additional 15 degrees of temperature.

The intake and outtake pipes in the building are connected to a series of "heat pumps" which heat or cool the solution through the looped system of pipes to assist in either heating or cooling the building. The primary benefit is that the heat pump compressors are more efficient, exchanging heat with the constant 55 degree earth temperature rather than with outdoor ambient temperatures that range from below freezing to 90 degrees or more.

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