

# UNDERGROUND

# HEAT

Harnessing the World's Hottest New Energy Source!

Did you know that there is energy below Earth's surface? It's true! The temperature gets hotter the deeper you go. That's because the inside of Earth is full of thermal energy. So how can we capture and use this thermal energy?

## Evaporating Energy

Energy can neither be created nor destroyed, but energy resources can eventually run out. The United States and the rest of the world still rely a lot on energy resources, such as coal, oil, and natural gas to power and heat their homes. However, these resources will eventually be gone. So it is up to scientists and engineers to develop technologies that allow us to harness energy from other resources.

## What is Geothermal Energy?

The word *geothermal* comes from the Greek words meaning 'Earth' (geo) and 'heat' (thermos). In other words, "heat from Earth". But won't this energy source also eventually run out? Actually, no it won't. Earth will never use up all of its heat. It's always making more! For this reason, geothermal energy is called a renewable energy resource.

**Geysers release geothermal energy from underground.**

## Harnessing Heat

Engineers have developed a way to harness this energy that is trapped underground—geothermal power plants. To build these power plants, people drill several miles into Earth. Sometimes they go as far as the length of 91 football fields (830 meters)! They keep drilling until they reach a geothermal reservoir, or underground lake. The water in these lakes can reach temperatures up to 371°C (700°F)!



Once they hit the lake, pipes are used to pump the hot water to Earth's surface. Because of the pressure changes, when the water reaches the surface, it becomes steam. This steam is used to turn large fans, or turbines. As the turbines spin, they produce electricity. This electricity is then transferred to homes and businesses through wires.

## Geothermal Heat Pumps

Whew! That sounds like a lot of work! Is it worth it? And is there a way to use geothermal energy on a smaller scale? Why yes, there is! Engineers have also created smaller geothermal energy systems. Some people have them built right into their homes!

### HEATING AND COOLING WITH GEOTHERMAL ENERGY

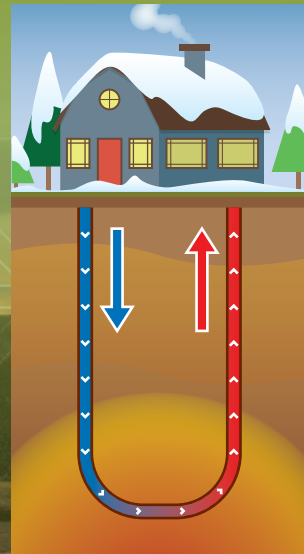
#### WINTER

1. Water is pushed through pipes just below Earth's surface. Here, the temperatures are 10–15°C (50–60°F).
2. Thermal energy from the ground heats the water.
3. The water is pumped through the house where the thermal energy from the warm water heats the air.

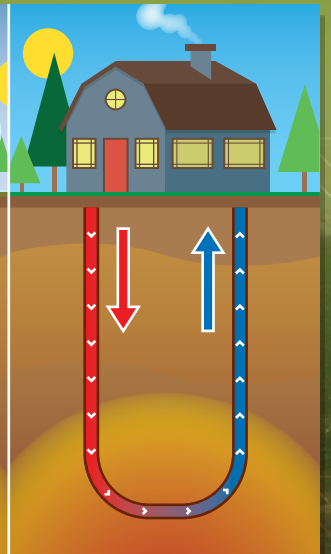
#### SUMMER

1. Thermal energy from the hot air in the house is transferred to the cool water in the pipes.
2. The water is pumped into Earth. Here, the thermal energy moves to the ground, cooling the water.
3. The cool water is pumped into the house.

#### WINTER



#### SUMMER



# Geothermal Energy for Everyone!

Since there is so much energy trapped below Earth's surface, you would think that geothermal power plants would be found everywhere, right? Unfortunately, geothermal technology can only be used in specific locations. Geothermal power plants are also very expensive to build.

Most of the world's geothermal power plants are located in countries that lie on the "Ring of Fire." The Ring of Fire is shown in red in the map at right. It surrounds the Pacific Ocean. This ring has a lot of volcanoes and therefore a lot of underground thermal energy. In the United States, geothermal power plants are largely located in the west. These states have the ability to supply 20 percent of the United States' electricity. What if every state had one of these power plants?

This geothermal power plant is located in southern California.



## GEOTHERMAL POWER PLANT LOCATIONS

Geothermal power plants are located in places where the thermal energy below Earth's surface is easy to reach.

## Engineering in Geothermal Energy

1. How can geothermal energy both heat and cool your home?
2. Research locations of geothermal energy plants. How can we use this information to design facilities in other locations?



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