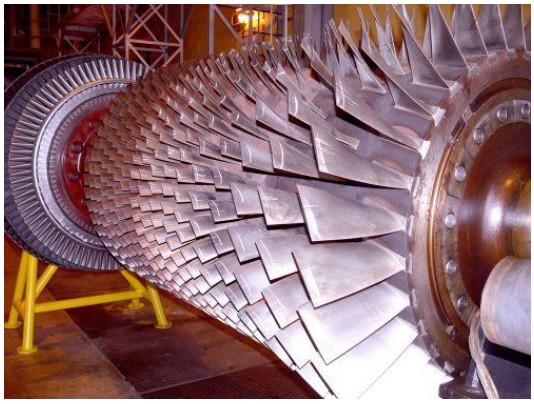
GEOTHERMAL ENERGY

Have you ever soaked in a steamy hot spring or watched a **geyser** erupt? A geyser is a hot spring under pressure that shoots boiling water or steam into the air. Old Faithful in Yellowstone National Park is probably the most famous geyser. These amazing natural features are examples of **geothermal energy** in action.

The Blue Lagoon, Iceland

Old Faithful geyser, Yellowstone National Park

The word **geothermal** comes from the Greek words **geo**, meaning "earth," and **thermal** meaning "heat." **Geothermal energy** gets its power from the high temperatures and limitless heat energy found beneath the Earth's surface. The interior of the Earth is hot. Really hot. Temperatures inside our planet can reach 9,000°F! That heat can be safely harnessed and used to generate electricity. When geothermal energy turns the blades of a **turbine** (a machine that uses pressure from water, air, or steam to spin its blades), the rotation can run a generator which converts that power into electricity.



Turbine

Geothermal power plant

Geothermal energy is **renewable energy**, which is a form of energy that doesn't get used up. Other types of renewal energy include solar, wave and wind power. They are alternatives to the fossil fuels industry, which has been our main source of energy for the past 150 years.

Geothermal power has been used for all kinds of activities for more than 10,000 years. Ancient Romans, Chinese, and Native American tribes used volcanic hot springs for bathing, cooking, cleaning, and as a source of warmth and healing minerals.

ACTIVITY: Heat energy can make a pinwheel spin (NOTE: For this activity, you will need help from a grown-up!)

Materials

- permanent marker
- pinwheel*
- clean metal soup, coffee, or similar sized can with one end removed
- hot plate or stove top
- aluminum foil
- small to medium-sized cooking pot
- small nail
- duct tape or rubber bands
- 12 inch wooden ruler
- oven mitts
- timer
- paper or notepad (optional)
- pen or pencil (optional)

CAUTION: You will be working with heat and steam. Stoves, hot plates, and seam can cause painful burns. Please be careful! Let your grown-up help!

1. Use the permanent marker to make a mark on one fin of the pinwheel, so you can see when the pinwheel has made a full circle around. Set the pinwheel aside for now.
2. Add enough water to the cooking pot to fill it half full.
3. Cover the top of the pot with a layer of aluminum foil, making sure to wrap and crimp the edges under the lip of the pot to limit the amount of steam that can escape.
4. Add a second layer of foil on top of the first layer and also crimp it under the edges of the pot.
5. Use the nail to carefully poke a small hole in the center of the foil, making sure it goes through both layers of foil.
6. Place the pot on top of the hot plate or stove top and turn it on medium heat. You want the water to boil but not splash the foil cover.
7. Wait for the water to boil. When you see steam coming out of the nail hole and the foil puffs up a bit, move to the next step.
8. Put on the oven mitts, grasp the handle of the pinwheel, and hold it horizontally over the pot with the pinwheel blades directly over the steam coming out of the nail hole.

9. Hold the ruler to next to the pot and use it to measure the height from the pot to the pinwheel. Adjust the pinwheel height and hold it 3 inches above the steam, then 6 inches, 9 inches and 12 inches.
10. Set a timer for 20 seconds and look for the mark you made on the pinwheel. See how many times the pinwheel spins around at each height.

*If steam from the pot doesn't make the pinwheel spin, try making a homemade version using thicker paper, cardboard, or pieces cut from an aluminum pie pan.

What did you see?

Notice how the distance the pinwheel is held above the steam affects the spinning of the blades. At which height did the blades spin fastest? Slowest? Did you observe any other differences?

The steam that was created through the boiling water represents geothermal energy, and the pinwheel displays how geothermal energy can cause it to spin.

ADDITIONAL RESOURCES:

Alternative Energy: A True Book by Christine Petersen

Energy from Earth's Core: Geothermal Energy by James Bow

Geothermal Power by Neil Morris

Geysers by P.M. Boekhoff and Stuart A. Kallen

Geysers: When Earth Roars by Roy A. Gallant

Renewable Energy: Discover the Fuel of the Future with 20 Projects by Joshua Sneideman and Erin Twamley

Sustainable Energy by Vic Parker

Wind, Solar, and Geothermal Power: From Concept to Consumer by Steven Otfinoski

Yellowstone National Park by M.C. Hall

Videos

BBC Earth News, "How Geothermal Energy Revolutionised Iceland's Greenhouses"
https://youtu.be/3KepmDQfEHg

National Geographic, "Geysers and Springs of Yellowstone - ASMR | Yellowstone Live"
https://youtu.be/A3x65YP7rkQ

PBS LearningMedia, "Geothermal Energy: Harnessing the Power of the Earth"
https://knpb.pbslearningmedia.org/resource/kqedcl11.sci.ess.geothermalenergy/geothermal-energy-harnessing-the-power-of-the-earth/

Websites

International Geothermal Association, Geothermal for Kids
https://www.geothermal-energy.org/education/geothermal-for-kids/

National Geographic, Resource Library, Geothermal Energy
https://www.nationalgeographic.org/encyclopedia/geothermal-energy/

National Park Service, Yellowstone National Park, Hydrothermal Features
https://www.nps.gov/yell/learn/nature/hydrothermal-features.htm

U.S. Energy Information Administration, Energy Kids, Renewable Geothermal
https://www.eia.gov/kids/energy-sources/geothermal/