

# GEOHERMAL PINWHEEL



## POWER

*At Idaho National Laboratory, scientists and engineers are working to improve the quality of our water supply. The Water Technology Innovation Program at INL is leading the way in water technology innovation by working to find ways to increase water recycling efforts and develop less water-intensive technologies used in the energy, manufacturing, and agricultural industries.*

*One project the WTIP is working on involves geothermic water. Geothermic water has significant value in terms of mineral content and heat, which can be used to drive separation processes to yield valuable products.*

*If you were to dig a big hole straight into Earth, you would notice the temperature getting warmer the deeper you go. This is because the inside of the Earth is full of heat. The heat released is called geothermal energy. In this activity, students will build their own geothermal power plant. The steam made from this activity will turn a toy pinwheel.*

## GRADE LEVELS: 2-6

## VOCABULARY

**Alternative Energy:** any energy source that does not use fossil fuels (coal, gasoline and natural gas). Renewable energy comes from natural sources that don't run out. The alternative energies that are already being used are solar, wind, geothermal, hydroelectric, tidal, biomass and hydrogen.

**Energy:** power derived from the use of physical or chemical resources, especially to provide light and heat.

**Geothermal Power Plant:** a geothermal power plant uses steam to turn a turbine. The turbine is attached to a generator. The generator turns to make electricity.

**Steam:** the vapor into which water is converted when heated, or water in its gas state.

**Sustainable Resource:** a resource that can be continuously replenished, or there is an endless amount of it that can be captured or harnessed. They can be useful towards providing energy without decreasing supply.

# MATERIALS

- Small child's pinwheel\*\*
  - Aluminum foil
  - Saucepan
  - Hot pad (mitten type)
  - Access to a stove
  - Pencil or pen (to punch a small hole in aluminum foil)
- \*\*make your own below



# PROCEDURE

***-This activity involves using heat from a stove and might require adult supervision-***

1. Fill a saucepan half full of water.
2. Cover the top of the saucepan with two layers of aluminum foil. Make sure the foil completely covers the top of the pan. Once the top is covered, wrap the foil around the edges so that it seals the top and no air can escape.
3. Using a pencil or pen, punch a hole through the 2 layers of tin foil cover in the center of your pan. The hole should be about 1/16 inch across, about the size of the pencil lead or the tip of the pen.
4. Put the pan onto the stove and bring the water to a boil.
5. Put on the mitten hot pad.
6. When steam starts coming out of the hole, carefully hold the pinwheel over the center hole. Notice how fast the pinwheel turns.
7. Steam is a sustainable resource. Take pan off the stove, notice what happens to the pinwheel as the water starts to cool.

**\*\*Make your own pinwheel-**

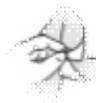


Cut a 4x4 inch square out of a piece of paper.

Fold your paper corner to corner



Cut on the folds of each corner, until you are about 1/3 away from the center



Bring every other point into the center and stick a pin through all four points



Turn your pinwheel around make sure that a pin goes through the exact center.

Stick you pin into a straw or a pencil's eraser.



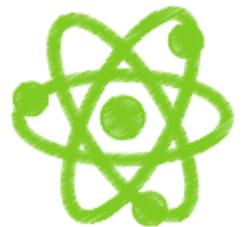
# THE SCIENCE BEHIND IT

*Most power plants, regardless of their fuel (coal, gas, nuclear power, or geothermal energy), have one similar purpose- they convert heat to electricity!*

*Heat (energy) that comes from Earth is called geothermal energy. To understand the word geothermal, it can be broken down into its basic word parts. The word part "geo" means Earth and the word part "thermal" means heat. Geothermal energy is accessed by drilling into the Earth. At a geothermal power plant, wells are drilled 1 or 2 miles deep into the Earth to pump steam or hot water to the surface. These power plants can often be found in an area that has a lot of hot springs, geysers, or volcanic activity. All these places are where the Earth's crust is thinner, such as Yellowstone National Park.*

## EXTENSIONS

- *Take the pinwheel outside. Is the air moving enough to spin the pinwheel? Wind energy is another source of energy. How does wind energy compare to geothermal energy? Why might you want to use steam to drive the pinwheel instead of wind?*
- *Poke bigger holes in the tinfoil, how does this effect the turning of the pinwheel?*
- *Add a new sheet of tin foil, poke the holes in different locations. How does this location affect the pinwheel?*
- *Poke more holes in the tinfoil, how does this effect the turning of the pinwheel?*
- *Make your own pinwheel-does the type of paper make a difference? Does the size of the paper make a difference?*



## RESOURCES

- <https://factsheets.inl.gov/FactSheets/4WaterTechnologyInnovationProgram.pdf>
- <https://www.energy.gov/eere/geothermal/how-geothermal-power-plant-works-simple>
- <https://www.energyarchive.ca.gov/energyquest/projects/geothermal-pp.html>

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