



HANSEL & GRETEL'S SOLAR POWERED OVEN

CHALLENGE ACTIVITY

Hansel and Gretel have to be smart to out-think the wicked witch who wants to throw them in the oven and bake them into yummy treats. They need your help to turn things around, so something else is on the plate for dinner.

Today, your challenge is to make a solar powered oven that will cook a hotdog.

Video link:

GETTING READY

Summary:

Have you ever heard someone say “It’s hot enough to fry an egg on the sidewalk” on a hot summer day? Would this really work? The sun is a wonderful (and free) source of energy. And, if harnessed correctly, this energy can provide us enough heat to cook. In this activity, you will build a simple solar oven to cook a hotdog and take advantage of the power of the sun.

Active Time:

- 15-20 minutes to build
- 20-30 minutes to cook the hotdog

Total Project Time:

- 45-60 minutes

Key Concepts:

Light energy, Heat energy, Solar power, Absorption, Reflection

MATERIALS

You will need:

- Hansel and Gretel’s Solar Powered Oven Log Book pages (download or use your own notebook)
- Cardboard cylindrical container with a lid (such as an oatmeal container or a Pringles can.) A box will work, but not as well.
- Aluminum foil
- Scissors
- *Craft knife or box cutter (optional- please ask an adult for help when using)*
- Tape and/or glue
- Marker
- Ruler
- Skewer (a chopstick or thin dowel will also work)
- Hotdogs (buns, and your favorite hot dog condiments are optional!)

- OPTIONAL for more exploration: thermometer, plastic wrap

BACKGROUND

Solar energy is an important source of power and it can provide light and **heat**. One of the best things about solar energy is that it is renewable (it will not run out). The sun will keep producing energy for over 7 billion years! The sunlight hitting the ground at noon in the summer produces about as much power as a hairdryer, microwave, or small stove. A homemade solar oven won't produce quite this much power, but it can get hot enough to cook small foods such as a hotdog. A solar oven produces approximately 75 watts of solar energy- about as much power as a light bulb. You probably know that a light bulb can get pretty hot. So, you should be able to do a good job cooking your hotdog with 75 watts of **solar power**. (*A watt is a measure of an appliance's power.)

On its own, the sun's light won't cook things that are outside. The sun's energy is too spread out as it hits the earth. In order to cook, this solar energy must be captured and concentrated into a small area, like in an oven. Then, it can be collected and harnessed and used for cooking.

Before you make a solar oven, it is important to understand a few concepts related to heat. **Heat energy** is the form of energy transferred by a difference in temperature (heat wants to move from a hotter area to a cooler one). To change sunlight into power for a solar oven, you will need to take the sunlight, change it into heat, and then transfer it to your oven. First, the oven must be able to absorb the light and convert it to heat by a process called **absorption**. During **absorption**, the light does not pass through or reflect (bounce away) from a material. It remains in the material as another form of energy, like heat. Next, the oven must be able to hold and contain the heat so it cannot escape. Remember, that heat energy wants to move heat from the hotter area to a cooler area, so the heat will want to spread out into the air if it can. A small oven size will help keep the heat inside, allowing more heat to get to your food. Another process taking place inside your solar oven is **reflection**. **Reflection** is the throwing back of light, heat, or sound by a surface, like a mirror. By using a reflective surface, the oven will reflect the sun's light and heat to help it move around inside and increase the temperature, making it hot enough to cook.

INSTRUCTIONS

Follow the directions below to make your solar oven.

1. Line the inside of your container with aluminum foil. The shiny side of the foil should be facing out. Try to keep the surface of the foil as smooth as possible. Use glue or tape to help the foil stick to the inside of the container. **If your container is already lined with silver (such as a Pringles can, then you can skip this step.*
2. Using a ruler, draw a rectangle on the side of the container. The rectangle should be about 5-6 inches long and 2-3 inches wide (depending on the size of your container), large enough for a hotdog.
3. Use a craft knife, box cutter or scissors to cut out the rectangle. Save the piece that you cut out for later. **Please ask an adult to help you with this step.**
4. Poke a hole through the center of the plastic lid. You can use your skewer or the tip of a knife or scissors. **Please ask an adult to help you with this step.** **If you are using a box for your oven, poke a hole in the center of one of the short sides of the box.*
5. Take the skewer out and put plastic lid on the bottom of the can.
6. Use a marker to mark where a hole should go on the center of the bottom of the can.

7. Poke a hole where the mark is on the bottom of the can. You can use your skewer or the tip of a knife or scissors. **Please ask an adult to help you with this step.** **If you are using a box for your oven, poke a hole on the side of the box opposite the side where you made your first hole. You want your skewer to be able to thread through the middle of the box.*
8. Thread the skewer (or chopstick, dowel) through the lid, the center of the container, and the bottom hole.
9. Use the rectangle piece you cut out earlier to make a stand for the container so your oven does not flip over. You can use glue or tape to attach it. Play around to find the best position for the rectangle to make your oven stable.
10. Be sure that when the solar oven is set down on a table, it will be angled at the sun, not straight up or straight forward. Remember that the sun moves across the sky all day. You may need to use another thin piece of cardboard or something to prop the oven towards the sun. Play around with your ideas.

Your oven is ready for cooking. To cook the hotdog, from the lid side of the can, pull the skewer out about halfway so that one end is free in the rectangle opening of the oven. Carefully, thread the hotdog lengthwise onto the skewer so that the skewer goes through the middle of the hotdog. Then push the end of the skewer back through the hole on the end of the can to hold the hotdog in place.



It's time to cook. Be patient. It may take 20-30 minutes to cook and heat your hotdog. Add a bun and your favorite condiments. Enjoy!

EXPLORE

💡 Why won't a hotdog on a plate in the sun cook?

The problem is that when sunlight is not focused, its energy is not easy to use. For example, a hot dog lying on a plate in the sun will collect only about 5 watts of energy. With only 5 watts the hotdog won't get much hotter than a stick lying on the ground. But, when the light is captured and concentrated in a small area, it produces much more power.

💡 Why does a cylinder shape container make a better oven than a box shaped one?

Consider the concept of reflection. The curved surface allows for more area for the sunlight to hit directly, which then allows more light and heat to be bouncing around inside the oven.

💡 Why should the oven be angled towards the sun and not facing straight up towards the sky?

 Try using plastic wrap to cover the top of your oven while the hot dog cooks. Does this change the time it takes to cook the hotdog? Does adding the plastic wrap make the hot dog cook better?

 Use a thermometer to measure the temperature inside your oven. Try cooking a hotdog on a hot sunny day, a cloudy day, and a cool sunny day and measure the temperature of the oven in each situation. Does the weather make a difference in the temperature of the oven?

EXPLAIN

Your solar oven works because it collects (or **absorbs**) light particles, called photons, and turns them into heat. On its own, sunlight is not very hot because it is spread over a large area. The warm feeling you get from the sun on your skin on a sunny day is not from the light directly. Instead, the heat you feel is created as your skin absorbs the light and converts them to heat. Skin is not very reflective, so the light and heat do not bounce off.

A similar process is happening inside your oven. The rectangle opening lets the sunlight into the oven where they are absorbed, converted to heat and trapped. The shiny silver surface of the aluminum foil inside the oven makes the light and heat bounce off its reflective surface. Finally, the trapped heat energy collects around the hotdog. And, because heat energy moves from the hotter area to a cooler one, the heat inside the oven is directed towards your food and is able to cook the hotdog.

Learn more about inventing and find more activities on our website: www.fuelthespark.org.