

SUN CENTRAL

OBJECT

Students gain insight into saving energy by using solar power.

GRADE LEVEL

Middle school

OBJECT

To demonstrate the power of the sun, students will construct a simple solar oven that gets hot enough to warm up cookies and other treats, like s'mores.

MATERIALS (for each group of 3 or 4 students)

- One cardboard pizza box from a local pizza delivery store
- Newspapers
- Tape and glue
- Scissors
- Marker
- Black construction paper
- Clear heavy-duty plastic wrap
- Aluminum foil
- A pencil or pen
- A ruler
- 2 thumbtacks
- A piece of string or yarn 15" or so, long



DISCUSSION

In developed countries, cooking only makes up a small percentage of daily energy use, but this is because people in these countries consume enormous amounts of energy for other purposes (driving, lighting, air conditioning, etc.). Solar cooking and drying clothes outside on a line are the simplest, least expensive ways to use solar energy to offset some of this high energy consumption. Introducing students to solar cooking is a good way to show them that they can integrate alternative energy into their lives. Ask students if they can suggest other ways of using alternative energy.

Millions of people in developing countries around the world, however, still cook over a smoky fire. To find wood for the fire, they have to walk many hours every day. Other poor city dwellers don't have access to wood, so they have to spend up to half of their income on cooking fuel. In these countries, solar ovens are a true engineering marvel.

ACTIVITY

Tip: give each group a copy of these instructions. Remind them that just as engineers work as part of a group to design, build, and test a product, each student group here is a project team.

1. Make sure the cardboard is folded into its box shape and closed. Measure a 1 1/2" border around the lid, on top of the box. Carefully cut three sides of the rectangle that you just traced on the lid of the box, forming a flap of cardboard. Leave the side of the square that is along the box's natural hinge untouched.

2. Gently fold the flap back along the uncut edge to form a crease. This flap will become your reflector panel. Wrap the underside (the side that was inside the box) face of this flap with aluminum foil. Tape it on the other side so that the foil is held firmly. Try to keep the tape from showing on the foil side of the flap. The foil will reflect the sunlight into the box.

3. Close the flap and open the box. Cut a piece of aluminum foil to fit the inside bottom of the box, and glue in place. Glue black construction paper to the bottom of the box, on top of the aluminum foil. This will help to absorb the sun's heat.

4. Roll up some newspaper, and fit it around the inside edges of the box. This is the insulation that helps hold in the sun's heat. It should be about 1" to 1 1/2" thick. Use tape or glue to hold the newspaper in place, but only tape it to the bottom of the box, not the lid.

5. With the box still open, cut a piece of heavy-duty plastic wrap an inch larger than the flap opening on the box top. Tape the piece of plastic wrap to the underside of the box lid and pull it tight over the opening in the box top. Be sure to tape down all four sides so the plastic is sealed against the underside of the cardboard. This creates a layer of air as insulation that helps keep the sun's heat in the box.

6. Close the box and pull the flap open. Push one thumbtack into the top of the flap on the back side (the side without the foil). Use a slipknot to tie one end of your string to this thumbtack. Push the other thumbtack into the back side of the box. You will wrap the other end of the string around this tack to adjust the angle of your reflector so that the sun is reflected down through the clear plastic and in to your oven.



Next step: (Depending on time, weather, and classroom policy, you might need to leave the solar oven behind for the students to try later.) On a sunny day, pick a treat to warm up and carry it and the box outside to a sunny spot. If it's cold outside, put a towel or blanket under the box so the bottom doesn't get cold. Open the box, put the treat in the center and close the box. Now open the flap and turn the box so the foil is facing the sun. The shadow of the flap should go straight back from the back of the box. Move the flap up and down and note how it reflects the sunlight. Use a tension on the string to prop up the flap so that it bounces the sunlight into the box.

Wait about a half hour for the box to warm up in the sun. Then enjoy your warmed-up treat!

This activity, courtesy Tacoma Power, is from the DVD Discover Engineering. See www.discoverengineering.org, a project of the National Engineers Week Foundation.