Build a Solar Oven from Recycled Materials

Science Film Festival — Knowledge Through Entertainment

Science Film Festival Film

nine-and-a-half – Your Reporters: Scrap Everything?

Introduction

Have you ever cooked something outside, like for a BBQ or while camping? It can be a lot of fun to be outdoors and enjoy eating the fruits – or burgers – of your cooking labors. Did you know that you can directly use solar power to cook food? This can be done using a solar oven, which is a low-cost, ecologically-friendly technology that seems to have everything going for it. In this science activity, you will build your very own simple solar oven out of a pizza box to gather the sun's rays and cook a tasty treat for you!

Solar ovens use solar energy – light and heat emitted from the sun – to cook food, pasteurize water, or even sterilize instruments. How does a solar oven work? The simple answer is that it is designed to absorb more heat than it releases.

The solar oven you build in this activity is a relatively simple one made out of a pizza box, aluminum foil, plastic wrap, and a sheet of black paper. You cut a flap out of the pizza box's lid and line this flap with aluminum foil so that sunlight can be reflected off of the foil and into the box. You also seal the opening with plastic wrap to create a plastic "window" that works like a greenhouse roof, allowing (direct and reflected) sunlight to pass into the box, while also retaining heat. At the bottom of the box, you placed black paper to create a "heat sink." This heat sink works by absorbing direct and reflected sunlight to become warm so that it can then heat up food placed on top of it.

Key Objectives

- To understand how solar oven works.
- To appreciate that waste can still be reused for other purposes.

Materials

- Pizza box or similar. The larger the box, the better the oven should work.
- Pencil or pen
- Ruler
- White school glue
- A sheet of black paper
- Utility knife or cutter
- Aluminum foil
- Plastic wrap
- Shipping tape or black electrical tape
- A wooden skewer or pencil
- To do some cooking with your solar oven, you will need sunlight and fairly warm outside temperatures (above 25 degrees Celsius is recommended, and the hotter it is the better). It should also not be windy.

Guiding Questions

1. **How well does your solar oven cook on a sunny day versus an overcast day?**
2. **How hot can your solar oven get?**

Intermediate

Resource Type
Project

Topics
Energy | Recycling

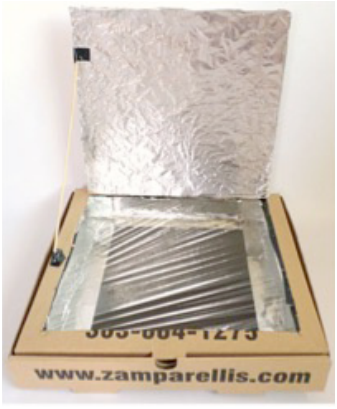
Subjects
Physics | Engineering | Design

Keywords
Solar Power | Sun | Heat Sink | Cooking

Time For Activity
45 – 60 minutes

Safety Instructions

Use caution when using the cutter. Take care that the inside of the solar oven will get hot.



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Tasks/Steps

Prep Work

1. If needed, clean out the pizza box so it is ready to become a solar oven. Remove any cardboard liner that the box came with.
2. Adult assistance is recommended for using the utility knife. Use caution when cooking with the solar oven as it can get quite hot!

Procedure

3. On the top of the pizza box's lid, draw a square that is about one inch inward from each edge.
4. Use a cutter (and the ruler as a straight-edge) to carefully cut along each side of the square you just drew except for the side that runs along the hinge of the box. Cut all the way through the cardboard on those three sides of the square. Then fold the flap back slightly along the attached side.
5. Line the inside of the cardboard flap with aluminum foil. Fold the edges of the foil over the flap to help hold the foil in place and glue the foil onto the flap. Keep the foil as smooth as possible.
6. Cover the opening made by the flap (in the lid) with a layer of plastic wrap. Attach the plastic wrap to the opening's edges using shipping tape or black electrical tape. Make sure there are no holes in the plastic wrap, and that all of its edges are completely closed onto the lid. Why do you think it is important to make sure the plastic wrap completely seals the lid's opening?
7. Line the inside of the box with aluminum foil so that when you shut the box, the entire interior is coated with foil. It is easiest to do this by covering the bottom of the box with foil, and then the covering the inside part of the lid (going around the plastic-covered opening) with foil too. Glue the foil in place. Why do you think you should coat the inside of the box with foil like this?
8. Glue or tape a sheet of black paper to the bottom of the box, centered there. This will act as your solar oven's heat sink.
9. Lastly, use a wooden skewer or pencil (and some tape) to prop the solar oven's lid up, at about a 90 degree angle from the rest of the box. Your solar oven is ready to do some cooking!

In this activity, you built a simple box-type solar oven that should have been able to cook for example a s'more in sunny, warm conditions. In some trials using this type of solar oven, at about 30 degrees Celsius on a sunny afternoon it took about 30 to 35 minutes for the marshmallow to get warm enough to become soft and melt some of the chocolate, and make a tasty, solar-powered treat! In ideal conditions, this solar oven can easily heat up to about 70 to 90 degrees Celsius. Using full, direct sunlight is important for heating this solar oven.

Authors/Source

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https://www.sciencebuddies.org/stem-activities/solar-oven#summary