

# **Leader's Guide Learning About Solar Energy, Second Edition**

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# LEARNING ABOUT SOLAR ENERGY

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## **Program Summary**

*In Learning About Solar Energy*, students are introduced to: the earth's most important energy source, plants, food chains and solar energy, terms 'photosynthesis', 'fossil fuels' and 'renewable energy' and a range of solar applications.

### **Pre-screening Preparation:**

- Preview the program before screening it for the students; this allows you to establish any pause points for discussion
- A pre-screening activity has been included for students to prepare them, and give you an understanding of their prior knowledge in order to build upon it.
- The post-screening science activities further extend students' understanding.
- These activities could also be used as an assessment tool. Background information is also provided to assist with explanations if required.

## **Pre-screening Activity**

What do your students already know about the subject of solar energy? Determining students' current level of understanding will guide how you present the program and post-screening activities. Ask students to write down everything they know about solar energy or any questions they may have. Have students work in teams to refine their lists; afterwards have the teams work in small groups to further refine their lists. The groups should then report back to you. You can use their data to create a class list of statements and questions regarding solar energy. By discussing students' responses you can build on their existing conceptual ideas.

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## Post-screening Activities

### **What Stores Solar Energy Best?**

#### Materials

One cardboard box with a lid  
Black paint  
Four small metal cans  
Four thermometers  
Sand  
Table salt  
Water  
Shredded paper

#### Getting Started

Talk about the reasons and methods for keeping a home warm in winter and cool in summer as examples of energy storage. Introduce the concepts of materials that may help to cool or warm a home. Now generalise the concept that all materials can be categorised as to how they store energy or retain heat.

#### Begin Your Experiment

- Paint the cardboard box and lid black
- Place the cans into the box
- Fill one can with sand, one can with salt, one can with water and one can with shredded paper
- Insert a thermometer in each can
- Put the lid on the box and place in the sun for half an hour
- Remove the cans and observe the temperature of each can
- Stir the contents of each can occasionally and watch to see which temperature falls the fastest and which falls the slowest. Which material stores the sun's heat best?

## Extension activities

**This project is for older students or for younger students with adult supervision.**

A reflective grill for cooking hot dogs can be built from a cardboard box, tinfoil, and poster board. Sunlight hits the reflective surface and focuses on the hot dog held in the center. Students can work in pairs or individually if there are enough materials. Safety consideration: The cardboard box for the grill is to be cut with a utility knife; you may choose to cut the boxes yourself rather than ask students to do this.

#### Materials (for each student, or pair of students)

cardboard box  
tinfoil  
poster board  
utility knife  
scissors  
ruler  
tape  
glue  
metal coathanger  
hot dog

#### What to do

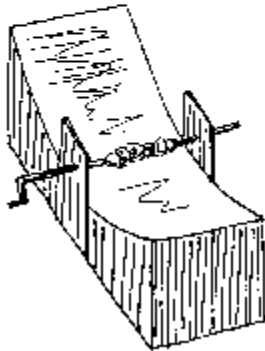
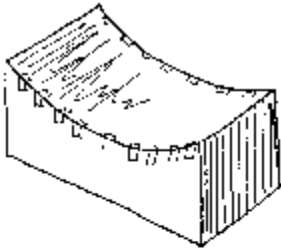
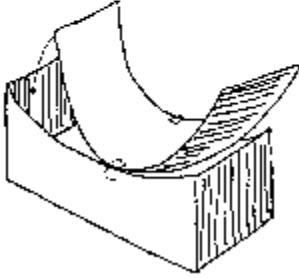
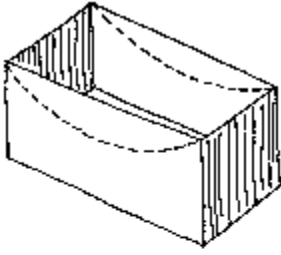
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1. Select long narrow boxes; the longer the box the more heat collection is possible. Choose a focal length between 5" and 10" and design a parabolic curve as seen in the illustration. One template could be used for all the grills. Trace the curve on the open end of the box so that it is centered and straight.
2. Cut out the curve with a utility knife. Stress the importance of being exact. Measure and cut a piece of poster board that will fit flush against the opening to the box. Attach this with tape, beginning at the center and working toward the edges.
3. Cover the curve with glue and apply tinfoil shiny side out. Start in the middle and smooth toward the edges. Try not to wrinkle or fold the foil; you want it as smooth as possible.
4. Use two scraps of cardboard taped to each side as supports. Using the sun or a projector light, test the focal point. There should be a bright spot where light is concentrated; mark this spot and punch a hole for the skewer. Use a section of a coathanger from which the paint has been removed for a skewer.
5. Enjoy your hot dog!

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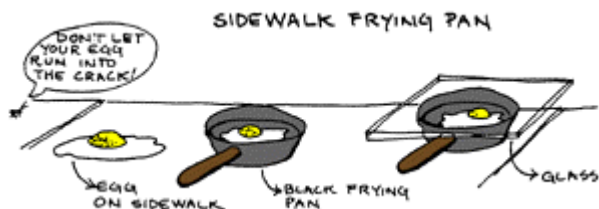
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## Hot Enough to Fry an Egg

NB: You can use the heat of the sun on a sidewalk or on black asphalt.

- Take three eggs, two black cast iron frying pans, and one piece of thick glass to cover one of the frying pans.
- Crack one egg directly onto the sidewalk; crack one into the pan without the glass cover, and one into the pan with the cover. Which one do you think will fry the quickest? Make sure you clean up afterwards!



## Background Information

### Types of Energy

Energy is the power we use for transportation, for heat and light in our homes and for the manufacture of all kinds of products. There are two sources of energy: renewable and nonrenewable energy.

### Nonrenewable Sources of Energy

Most of the energy we use comes from fossil fuels, such as coal, natural gas and petroleum. These are nonrenewable source of energy. Uranium is another nonrenewable source, but it is not a fossil fuel. Uranium is converted to a fuel and used in nuclear power plants. Once these natural resources are used up, they are gone forever.

The process of gathering these fuels can be harmful to the biomes from which they come. Fossil fuels are put through a process called combustion in order to produce energy. Combustion releases pollution such as carbon monoxide and sulphur dioxide, which may contribute to acid rain and global warming.

### Renewable Sources of Energy

Renewable sources of energy can be used over and over again. Renewable resources include solar energy, wind, geothermal energy, biomass and hydropower. They generate much less pollution, both in gathering and production, than nonrenewable sources.

- Solar energy comes from the sun. Some people use solar panels on their homes to convert sunlight into electricity.
- Wind turbines, which look like giant windmills, generate electricity.
- Geothermal energy comes from the Earth's crust. Engineers extract steam or very hot water from the Earth's crust and use the steam to generate electricity.
- Biomass includes natural products such as wood, manure and corn. These materials are burned and used for heat.
- Dams and rivers generate hydropower. When water flows through a dam it activates a turbine, which runs an electric generator.

Solar energy is needed by green plants for the process of photosynthesis, which is the ultimate source of all food. The energy in fossil fuels (e.g. coal and oil) and other organic fuels (e.g. wood) is derived from solar energy. Difficulties with these fuels have led to the invention of devices that directly convert solar energy into usable forms of energy such as electricity.

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### Vocabulary

Photosynthesis, nonrenewable, renewable, solar energy

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### Useful Websites

<http://www.azsolarcenter.com/index.html>

Arizona Solar Center - Explore various technologies, including photovoltaics, solar cooking, solar water heating, solar architecture, wind power, and hands-on activities for the classroom

<http://www.solarnow.org/pizzabx.htm>

Activity - Make a Pizza Box Solar Oven!

<http://www.eere.energy.gov/roofus/>

Roofus' Solar and Efficient Neighborhood.

[www.sunspot.org.uk](http://www.sunspot.org.uk)

This website has instructions for building solar cookers. (Solar cooker photograph courtesy of Ed Norman/Quinton Stowell.)

Length

14 Minutes

Audience level

Grades 5 – 8

Subject Area

Science

Catalog Number

#2950-EN-VID

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