What's Cooking?

Student Objective
The student:
- understands how the Sun's radiation, as heat, can be captured and used
- given a solar cooker, can explain what makes it work and how to improve on the design.

Materials (construction)
- *Pringles* can (1 per student)
- wooden kabob skewer, 14" (1 per student)
- transparency film (1 per student)
- tape
- Science Journal

Key Words:
conduction
convection
glazing
radiation
reflector
solar collector
solar thermal

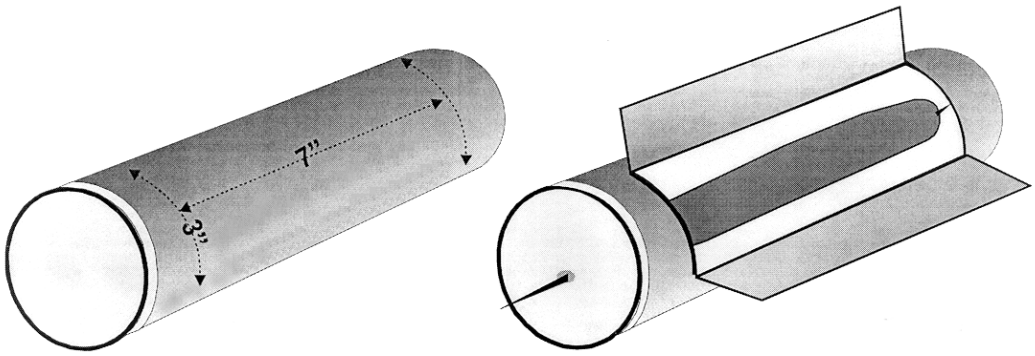
Time:
1 class period to build oven
1 class for cooking

Background Information
1. A solar cooker is a type of solar thermal collector. It 'collects' and traps the sun's thermal (heat) energy. For example, on a sunny day your car with the windows rolled up becomes a collector. The glazing lets in the sun's energy, traps the thermal (heat) energy, and the air inside your car becomes hot. As more light enters the car, the air gets even hotter, until we say that it feels like an oven inside!
2. Solar ovens are improving the quality of life for many people around the world. Solar ovens have been introduced in parts of South America, Africa and India. In these areas, it is typical for a woman to spend nearly half her workday looking for and collecting firewood. Also, respiratory problems in the children of these areas have been linked to fumes created by the burning of poor quality wood. The use of solar ovens helps to reduce dependency on firewood. In addition, some women have turned their talents for building cookers into businesses–building and selling cookers for added income.
3. Besides cooking, solar ovens can be used to purify water. This is beneficial for areas where obtaining safe drinking water is a problem.
4. There are many types of cookers, and ways to build them. Cookers generally have 3 elements or components:
   - Glazing to allow heat to enter (glass, clear plastic wrap, etc.)
   - Insulation to retain heat and maintain temperature (feathers, styrofoam, cardboard, paper, etc.)
   - Reflectors to concentrate more sunlight into the cooker (foil, mirrors, etc.)

5. There are three basic types of solar ovens on the market today–box, parabolic reflector and multi-reflector (truncated cone or pyramid). Box ovens produce lower temperatures, but are the least expensive and the most portable. Parabolic reflector ovens produce the highest temperatures but must be constantly adjusted to focus directly on the sun. Multi-reflector ovens combine a good temperature range and can be designed to have a large cooking capacity.

Procedure (prior to class)

1. Cut openings in the Pringles cans (see diagram).
2. Make small holes in the center of the metal end of the can and in the plastic lid (a hammer and nail is the easiest way).
3. Cut the transparency film into pieces 8" x 3 ½".
4. Make an finished example to show the class as you explain the construction process.



Procedure (during class time–construction)

1. Explain the construction procedure (refer to diagram):
   - bend the flaps open on the can. These will serve as reflectors to collect more of the solar radiation into the cooker
   - tape the transparency film over the opening. This will serve as glazing to let the sun's energy in but not let the heat out.
2. Pass out the materials.
3. Help the students as necessary during the construction process.

Procedure (during class time--cooking & follow up)

1. Explain the cooking procedure (refer to diagram). The hot dog will be put in the cooker so it is suspended in the middle on the skewer. (Cooker can also be used for kabobs)
   - Remove the plastic lid
   - Put the hot dog on the skewer, slide the skewer into the can poking the end of the skewer out through the hole in the metal end.

- Thread the hole of the plastic lid onto the other end of the skewer and push it up to seal the can. The hot dog should be suspended in the center of the can.

2. Take the cookers out into the sun. Make sure that the cookers are facing directly towards the sun so that the sun is shining/reflecting directly onto the hot dog. (Avoid areas with ants!)
3. Check the cookers frequently and adjust their position to match the path of the sun.
4. In a bright sunny day with minimal breeze, the hot dogs will be ready to eat in 30 - 45 minutes.
5. Students should complete their Science Journal.
6. Lead a discussion about solar cooking. Some points to help bring out:
   - the importance of this method of cooking for areas that depend on firewood
   - different types of solar cookers
   - recreational uses of solar cooking, (i.e. camping and fishing)
   - benefits of solar cooking in times of power interruption (i.e. after a hurricane).

Further Research

1. There are several different types of other solar cooking devices. What do they have in common? Why are these features important?
2. Research food preparation in other times and in other places. Was the sun used in food preparation and food storage? How? Where? When? What were the advantages and disadvantages to this culture of using the sun's energy for cooking?
3. Would insulating the outside of the can increase the temperature inside? Conduct an experiment to determine the effect of insulation on the cooker's performance.
4. Borrow a large box cooker from the Florida Solar Energy Center and use it to cook a classroom snack. How is this cooker the same as the ones you made in class? How is is different?

Related Reading

- ***Cooking With The Sun: How to Build and Use Solar Cookers*** by Beth Halacy and Don Halacy
  A classroom resource for those who want additional cooker designs and recipes.

Internet Sites

http://solarcooking.org/

Solar Cooking International, solar cooking archive includes solar cooking plans, documents and a list of resources and manufacturers.

http://www.sunoven.com/

Sun Ovens International. Includes solar oven history, recipes, and photos.

EnergyWhiz

Submit your favorite recipes to the EnergyWhiz website at **http://energywhiz.com/** . Include your school name, grade level and teacher's name

What's Cooking?

			.1	.2	.3	.4	.5	.6
Energy	**Standard 1**	**SC.B.1.2-**		**X**	**X**	**X**		**X**
	Standard 2	**SC.B.2.2-**						
Processes that Shape the Earth	**Standard 1**	**SC.D.1.2-**						
	Standard 2	**SC.D.2.2-**	**X**					
Earth and Space	**Standard 1**	**SC.E.1.2-**			**X**			
	Standard 2	**SC.E.2.2-**						

Benchmark SC.B.1.2.2 - The student recognizes various forms of energy.
Grade Level Expectations
The student:
Third
- knows different forms of energy.

Benchmark SC.B.1.2.3 - The student knows that most things that emit light also emit heat.
Grade Level Expectations
The student:
Third
- knows that the Sun provides energy for the Earth in the form of heat and light.

Benchmark SC.B.1.2.4 - The student knows the many ways in which energy can be transformed from one type to another.
Grade Level Expectations
The student:
Fourth
- knows ways that energy can be transformed.

Benchmark SC.B.1.2.6 - The student knows ways that heat can move from one object to another.
Grade Level Expectations
The student:
Fifth
- understands that convection, radiation, and conduction are methods of heat transfer.

Benchmark SC.D.2.2.1 - The student knows that reusing, recycling, and reducing the use of natural resources improve and protect the quality of life.

Grade Level Expectations

The student:

Third

- knows that reusing, recycling, and reducing the use of natural resources improve and protect the quality of life

Fourth

- knows ways in which people can conserve natural resources
- knows ways misuse of natural resources affects the quality of life for all species

Fifth

- extends and refines knowledge of ways people can reuse, recycle, and reduce the use of resources to improve and protect the quality of life.

Benchmark SC.E.1.2.3 - The student knows that the Sun is a star and that its energy can be captured or concentrated to generate heat and light for work on Earth.

Grade Level Expectations

The student:

Fourth

- knows how the energy of the Sun can be captured as a source of heat and light on Earth.

What's Cooking?

conduction - the movement of heat or cold through materials that are solid

convection - the movement of heat through air or in liquids

glazing - the clear material (for example glass or plastic wrap) that lets in light and traps heat

radiation - the way we receive heat from the sun each day. The Sun's energy is emitted in the form of waves/particles, and can move from one object to another without heating the area in between.

reflector - shiny device used to alter the path of light

solar collector - a device that collects and traps solar energy

solar thermal - using the Sun's energy to heat something

What's Cooking?

1. Why is the opening of a solar cooker covered with clear plastic? _____

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2. Why is the inside of the solar cooker shiny? _____

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3. Why is it good to use the sun 's energy to cook? _____

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4. What are some problems with using the sun's energy to cook? _____

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