LESSON PLAN: Cooking with the Sun

Description
This activity is meant to extend your students' knowledge of the topics covered in our Simplicity of Electricity lab. Through this activity, your students will deepen their understanding of solar power and the engineering design process behind building solar ovens.

Grade Levels
3-8

Duration
40 minutes building time;
45-60 minutes cooking time

Student Outcomes
Students will:
- Create a working solar oven capable of warming a chosen food item.
- Create a graph showing temperature increase inside their solar oven over a given period of time.

Next Generation Science Standards
- Engineering Design **Grades 3-5:** 3-5-ETS1-1, 2, 3, 4
- **Grades 6-8**: MS-ETS1-1, 2, 3
- Physical Sciences **Grades 6-8:** MS-PS3-3

Common Core ELA Standards
- **Grade 4-5:** Writing W.7; W.8
- **Grade 4:** Speaking and Listening 4.SL.1b-d
- **Grade 5:** Speaking and Listening 5.SL.1b-d
- **Grades 6-8:** Writing W.7; Speaking and Listening SL.1b-e

Materials

- Pizza box or other small shallow box with a lid
- Black construction paper
- Scissors
- Plastic wrap
- Aluminum foil
- Wax paper
- Tape and glue stick
- Ruler
- Oven thermometer

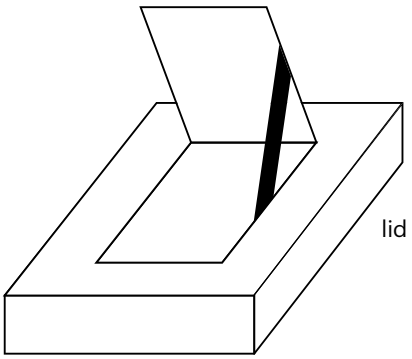
Vocabulary

Familiarity with these terms and concepts will enhance students' experience in the activity.

- **Absorption:** The taking up and storing of energy, such as light, which can then be transformed into a different form such as heat.
- **Green House Effect:** The phenomenon whereby the earth's atmosphere traps solar radiation, caused by the presence in the atmosphere of gases such as carbon dioxide, water vapor, and methane that allow incoming sunlight to pass through but absorb heat radiated back from the earth's surface.
- **Solar Energy:** The radiant energy of the sun that can be converted into other forms of energy, such as heat or electricity.
- **Solar Radiation:** Solar energy transmitted as light waves, in the form of particles.
- **Solar Reflection:** The change in direction of a light or sound wave as a result of the wave hitting a medium within its path (i.e., light reflecting off of a mirror).

Procedure

1. This activity will be done in groups of four. Each group will receive one set of the above materials.
2. *Discussion:*
    a. How do you (or your family) normally cook food at home?
    b. How do those appliances work?
    c. How would you cook food if you didn't have electricity?
    d. How do you think families with little or no electricity cook their food?
    e. Why would using campfires be bad for the environment and/or people?
    f. Are there other natural sources of heat (besides fire) that could be used to cook food and not harm the environment?
3. Introducing the solar cooker: Please watch the following video as a class to see how solar cookers are used in impoverished areas and how solar cookers work: http://video.nationalgeographic.com/video/environment/energy-environment/solar-cooking/.
4. *Building the solar cooker:*
    a. Begin by cutting a flap in the lid of the box. Cut along three sides, leaving about an inch or two between the flap and the edge of the box.
    b. Fold up the flap so that it is sticking out of the top of the box.
    c. Wrap foil on the flap so that it will reflect sunlight into the box. Tape the foil in place on the back of the flap.
        • *Why aluminum foil? How will this help cook our food?*
    d. Remove or open the lid of the box. Inside the box, line all sides with black construction paper. Glue in place.
        • *Why black paper? How will this help cook our food?*
    e. Replace the lid on the box with the flap open. Cover the opening in the lid with plastic wrap and make sure that the wrap is very tight across the opening. You may also try to use multiple layers. Tape in place.
        • *Why plastic wrap? How will this help cook our food?*



    f. The solar cooker is now ready. Place your oven thermometer and food item inside the box and replace the lid. *(We recommend making s'mores in your solar cooker. They are not too messy and will cook within an hour).*
    g. Find a sunny spot on the playground to place your solar oven. Adjust the flap so that the sun reflects off the flap and into the box (for older students, have them use a protractor to measure different flap angles and compare temperature results). Use the ruler to prop open your flap to the correct angle.
    h. Take a start time temperature measurement inside your box. Check back and record the temperature every 10 minutes for an hour.
    i. After taking your measurements and graphing the results, kick back and relax with your sun-cooked s'more!
5. *Discussion:*
    a. Did you enjoy cooking with solar? Would you want to do this every day?
    b. What are the benefits of cooking with solar? What are the benefits of cooking with electricity?
    c. How would you improve your cooker to be more efficient?

Extended Learning

- Without adding food, try leaving the solar cooker out all day and check the temperature throughout the day. When was it the hottest? When was it the coolest? Why? You could also try putting the solar cookers in different areas and compare temperatures with locations.
- Try using different colored paper in the solar cookers. Which color got the warmest? Why? Which was coolest? Why? Students should graph the different temperatures and colors as a comparison.
- How can solar ovens make a difference? Have students read an article or watch a video on how solar ovens are making a difference in refugee camps and within different communities. Are there other possible applications for this technology?

Student Data Table

1. At what point was your solar cooker warmest? Why?

2. What was the peak temperature for your solar cooker?

3. What would you do to your solar cooker to maximize the cooking capability (i.e., heat capture)?

Elapsed Time	Temperature and Observations
Start time (0 minutes)	
10 minutes	
20 minutes	
30 minutes	
40 minutes	
50 minutes	
60 minutes	