LESSON GOALS
Middle school students love to go outside and love to eat. Little do they know that they can learn something along the way. Energy can be a difficult concept of the students to learn since it is not tangible like many of the other concepts in physical science. Students know that they need energy and energy is important in the world, but they do not understand exactly how it can be used to help them. Along the same line, they forms of heat transfer are difficult for students to distinguish. However, if they eat a hot dog, they’ll know!

In this activity, students will first be required to analyze what they know about energy in the world and how they use it. Then, they will conduct research to learn how a solar cooker works and its important elements. They will also examine three different types and analyze what elements could be changed to make each more effective. Students will choose their design and actually make a solar cooker. They will test it by trying to cook a hot dog. Students will need to plan how to best use radiant and thermal energy from the sun as well as maximize the heat transfer taking place in their cooker to cook their hot dog.

Solar cookers can be used in the energy unity of physical science. Through the investigation, performance standards of science habits of mind will be practiced, allowing students more exposure to scientific inquiry and thinking like scientists. It could be integrated with social students as an extension into the use of solar cookers in third world nations.

MATERIALS
- Cardboard boxes
- Aluminum foil
- Black paint
- Tape, scissors
- Hot Dogs

POSSIBLE STUDENT-DRIVEN QUESTIONS
Questions to lead the students:
- How does your oven cook your food?
- What makes your oven get hot?
- How can the sample solar cooker be improved?

Student questions:
- Where does the electricity come from to turn on the oven?
- How can we use thermal energy from the sun?

Questions for investigation:
- Will a smaller box cook faster?
- Will a black box absorb more heat?
• Does a thick or thin pot cook food faster?
• Will plastic wrap keep more heat in the box?
• Will a parabolic cooker cook a hot dog quicker?
• Will a Dr. Pepper can cook faster than a Sprite can?

PROCEDURE
Setting up the Investigation:
Students will write at least two paragraphs on where they think their electricity and water comes from and how it gets to their house. Ideally, this will be used in conjunction with a field trip to the Georgia Nature Center that includes a demonstration on solar energy.

Students will then be shown a solar cooker. The class will go outside to investigate how it works and how long it takes to cook. Using the internet, students will research three different types of solar cookers: panel, box, and parabolic.

Sample Hypotheses for Investigation:
• A panel cooker will cook faster than a box or a parabolic.
• A black panel cooker will cook the fastest.
• Increasing the amount of foil will cook the hot dog faster.
• The hot dog will cook faster in the afternoon than the morning.

Procedures:
• Sampling Sites: For best results, this experiment should be done on a warm sunny day.
• Methodology:
  o Teacher preparation: Gather materials that the class decides on. Build a sample solar cooker.
  o Before performing the investigation:
    ▪ Teacher will review the scientific process, emphasizing the need for good questions and hypotheses that can be investigated and only test one variable.
    ▪ Students will research solar cooker designs and methods on the internet.
    ▪ The class will brainstorm what supplies they will need to build their solar cookers.
    ▪ Student groups will decide on their question, hypothesis, and experimental design and have this approved before going outside for investigation.
  o Student investigation
    ▪ Build a solar cooker and draw a model of their cooker.
    ▪ Set up a solar cooker outside with a hot dog inside.
    ▪ Record how long they allow the hot dog to cook.
    ▪ Analyze results by eating hot dog.

Predictions:
• If a parabolic cooker is the most effective, then it will cook the hot dog the fastest.

Analysis and Communication
Students will record how long it took their hot dog to reach a specified temperature. Students will describe the differences between their solar cooker and the sample cooker shown and determine which was more effective. In addition, students will describe what types of energy were involved in their experiment and how the three types of heat transfer worked to cook their hotdog.
Students will present their results to the class by providing an illustration of their cooker on chart paper. The posters of each project will be used to compare the effectiveness of the different cookers and each class will decide which cooker was the most effective.

RESOURCES

- Solar Hot Dog Cooker
  <http://energyquest.ca.gov/projects/solardogs.html>
- Introduction to Solar Cooking
  <http://solarcooking.wikia.com/wiki/Introduction_to_solar_cooking>
- Solar Cooking
  <http://solarcooking.org/>

TEACHER NOTES

Students can conduct research on how solar cookers can be used in third world nations where electricity is limited or not available as an extension to this project. Students would apply their results to propose what type of cooker would be best and the limitations of using one.