



## Unit: Cooking with the Sun and Solar Ovens

### Lesson #9: Let's Build Sun Ovens

**AUTHOR:** Lisa Morgan

**DESCRIPTION:** The purpose of this lesson is to introduce the students to three different styles of inexpensive solar ovens. Students will work together to build a File Box oven, an auto shade/bucket oven and a “Copenhagen” style oven. Students will follow written directions and use what they have learned about the necessary components of a solar oven (reflective material, support, dark cooking pot and dark paper--used only on the file box oven). Students will use the ovens to cook cookies and compare and contrast the effectiveness of the ovens.

**GRADE LEVEL(S):** 3-5

**ACTIVITY LENGTH:** 3 hours

**LEARNING GOAL(S):** Students will follow written directions and use what they have learned about necessary components of a solar oven to build three different ovens in small groups.

#### **STANDARDS MET:**

##### **Common Core:**

- W.3.7. Conduct short research projects that build knowledge about a topic.
- 4.R.1.7 Interpret information presented visually, orally or quantitatively and explain how the information contributes to an understanding of the text in which it appears.
- W.4.7. Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- W.4.8. Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
- W.5.7. Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

#### **Next Generation Science Standards:**

- 4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

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**BONNEVILLE** : 240 SW 1st Avenue  
**ENVIRONMENTAL** : Portland OR 97204  
**FOUNDATION** : 503-248-1905  
: [www.b-e-f.org](http://www.b-e-f.org)

- 4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time or cost.
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved

### Educator Background:

- It is suggested that you build one of each of these ovens first for yourself before you build them with your students.

### Student Background:

- Basic knowledge of solar energy, how heat is transferred and how sunlight can be concentrated through reflection, is absorbed by certain materials and transformed into heat. An understanding of how different materials insulate or conduct heat.

### Other Materials List:

- "The File Box Solar Oven" handout
- "Automobile Shade Solar Oven" handout
- "The Copenhagen Solar Oven" handout

### For File Box Solar Oven:

- A cardboard box, 2" taller than your cooking pot and is large enough it.
- Smaller box that will leave at least 2 inches around sides for insulation
- Large cardboard sheet for making lid
- Heavy duty aluminum foil
- White glue
- Scissors
- Black BBQ spray paint
- Newspaper for insulation
- Plexiglas (or turkey oven bag)
- Lightweight black cooking pot w/lid
- Trivet for air circulation

### For Automobile Shade Solar Oven:

- 5-gallon bucket
- Auto shade cover with reflective material
- Cooling rack
- Two binder clips

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- Oven roasting bag with ties
- Lightweight black pot with lid

**For Copenhagen Solar Oven:**

- (2) Sheets of poster board
- 18-inch aluminum foil
- White glue
- 8x8 piece of sturdy cardboard
- Hammer and a large nail
- Shoelace or sturdy piece of string
- (4) Binder clips
- (4) Binder clips
- Cooking trivet for air circulation
- Light weight black cooking pot with lid
- Oven cooking bag used for baking poultry. Can be found at any grocery store.

**Vocabulary:**

- Solar oven
  - Insulation
  - Heat transfer
  - Greenhouse effect
- .....

**Lesson Details:**

1. Divide students into small groups and assign a different solar oven to each group.
2. Hand out to each group the instructions for the oven they will build.
3. Have students review the instructions in their group and discuss how the oven will work.
  - How will the oven concentrate the solar energy?
  - How will it absorb the sunlight and transform it into heat?
  - How will the heat be retained by the solar oven to cook the food?
4. You may want to have the student groups assign one member to take notes on the group's discussion
5. Once students have had a chance to review the instructions, hand out the materials they will need to build the ovens and have them begin.

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