

# TRAPPING ENERGY: BUILDING A SOLAR OVEN

## Grade 7, Science and Technology

Source: Adapted from *Trapping Energy: Building a Solar Oven, Grade 7 Integrated Unit: Heat in the Environment, TDSB 2009*

### DESCRIPTION

In this activity, students construct a pizza box solar oven and use it to bake a snack. The activity needs to be done on a sunny day, in a place that receives direct sunlight. The purpose is to help students understand the greenhouse effect by experiencing the basic idea of heat being trapped. The activity leads to discussion about greenhouse gases and the consequences of their increase.

### CURRICULUM LINKS – SCIENCE AND TECHNOLOGY, GRADE 7

*Understanding Earth & Space Systems– Heat in the Environment*

Overall Expectation: 2

Specific Expectations: 2.1, 2.3, 2.4, 2.5

### PLANNING NOTES

#### Materials (per group)

- Clean, used pizza box
- Black construction paper
- Aluminum foil or inside-out potato chip bags
- Clear plastic (heavy plastic laminate works best)
- Wooden dowel or stiff straw
- Non-toxic glue
- Tape
- Scissors
- Ruler
- Markers
- *How to Make Your Pizza Box Oven* (Appendix 1)
- *Pizza Box Oven Summary* (Appendix 2)

#### Learning Skills & Work Habits

Initiative, collaboration, organization

#### Recommended Class Time

- 2-3 periods

#### Prior Learning

A common analogy to explain global warming is the greenhouse. Anyone who has ever walked into a greenhouse, or entered a car parked in the sun on a hot day has felt the greenhouse effect. Why is it hotter inside the car than outside? Because the air inside the car cannot circulate with the outside air and get dispersed, the heat inside the car increases. That's why opening all the windows cools the car. This is exactly how a greenhouse works.

A greenhouse admits the sun's energy, and then reduces or eliminates cooling by cutting off air circulation that would allow for the cooling process. As a result, the greenhouse heats up. This idea of heat being trapped is the basis for the comparison of the greenhouse to the Earth's atmosphere. Although the actual process is quite different, the analogy helps people understand the basic idea of heat being trapped, which is what building the solar oven will allow students to do.

The outputs of many human activities are gases such as carbon dioxide and methane. Once in the atmosphere, these gases (greenhouse gases) block heat from escaping into space. They are increasing the temperature on our planet. The consequences for ecosystems and societies may be severe.

## TEACHING/LEARNING STRATEGIES

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1. Introduce the activity by asking students why a Thermos works and why car interiors get really hot in the summer. Then ask how they think a pizza box could be transformed into a solar cooker or oven.
2. Organize students into their groups and hand out copies of *How to Make Your Pizza Box Oven* (Appendix 1). Review the instructions with them and then invite them to construct their ovens. Circulate to assist as required.
3. Invite students to think of improvements they could make to the basic design to increase the inside temperature of the pizza box to make it more effective for baking.
4. Expect cooking times to be at least twice as long as normal cooking times. While the food is cooking, have students complete the *Pizza Box Oven Summary* (Appendix 2).
5. Eating the food “fresh from the oven” is a great reward!
6. To end the activity, have a class debriefing. Invite students to discuss their oven’s temperature and performance and their ideas for improving the design.

Ask some questions, such as:

- What did you learn about heat from making the pizza box oven?
- What type of heat transmission was demonstrated?
- Why do you think black construction paper was used? Aluminum foil?
- What other types of heat transmission do we use to cook food?

### **Alternative Option**

Do not provide detailed instructions and instead, have students assemble and examine their materials. Provide students with questions that will be the basis for the construction project, e.g., “How could you use the materials collected to build an oven that used the sun’s rays to cook food?” Direct your students to brainstorm a solar oven design. Have them get permission before proceeding to the construction phase. When students are testing their ovens, encourage them to use a two-column format to record their observations and questions.

## APPENDICES

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Appendix 1 – *How to Make Your Pizza Box Oven*

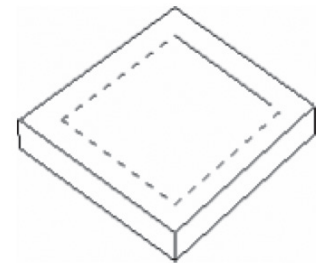
Appendix 2 – *Pizza Box Oven Summary*

**Materials (per group)**

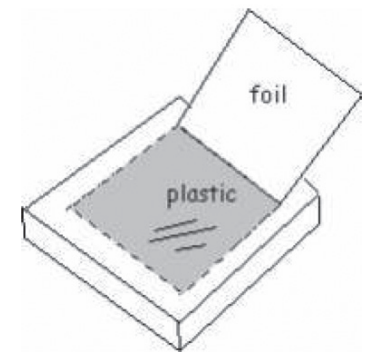
- Clean, used pizza box
- Black construction paper
- Aluminum foil or inside-out potato chip bags
- Clear plastic (heavy plastic laminate works best)
- Non-toxic glue, tape, scissors, ruler, magic marker
- Wooden dowel or stiff straw

**Diagram 1**

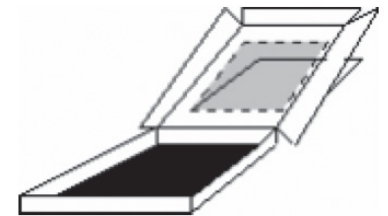
- Draw a 3-centimetre border around the sides and the top of the pizza box.
- Cut along the dotted lines shown to make a large flap. The solid line at the back of the box is uncut.
- Score the back solid line by drawing over it with a sharp pencil.

**Diagram 2**

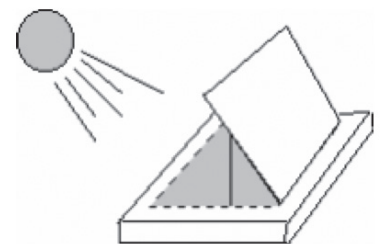
- Fold the flap back along the solid line.
- Cut a piece of aluminum foil to fit on the inside of the flap. Smooth out any wrinkles and glue into place.
- Cover the opening with transparent plastic. Tape it down so that the top of the pizza box can still be opened. The plastic cover should be tightly sealed so air cannot escape through the window when the top of the pizza box is closed.

**Diagram 3**

- Cut another piece of aluminum foil to line the bottom of the pizza box and carefully glue into place.
- Cover the aluminum foil with a piece of black construction paper and tape into place.

**Diagram 4**

- Close the pizza box top (window), and prop open the reflecting flap of the box with a wooden dowel or straw and face towards the sun.
- Adjust the reflecting flap until the aluminum reflects the maximum sunlight through the window into the oven interior.
- Your oven is ready! You can try heating s'mores, English muffin pizzas, or hot dogs, or even baking cookies or biscuits. Test how hot your oven can get using two thermometers, one inside and one outside the pizza box.



**APPENDIX 2**  
**TRAPPING ENERGY: BUILD A SOLAR OVEN**  
**PIZZA BOX OVEN SUMMARY**



Names of group members: \_\_\_\_\_

Special materials used: \_\_\_\_\_

Observations	Questions

What worked well in your design?

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In what ways could you change or redesign your model to increase the temperature?

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