SOLAR ENERGY FOR THE CLASSROOM

Pierce Cedar Creek Institute
for ecological education

Provided by Pierce Cedar Creek Institute
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Activity Overview
Grade Level: 6-8

General Description
Students will experiment with a variety of solar collector materials (sand, salt, water, and paper) to determine which material holds heat most effectively and is therefore best suited to store solar energy.

Learning Outcome
Students will understand how different solar collector materials increase or decrease solar energy potential.

Science Content Standards
Content Area: Constructing New Scientific Knowledge (C) I.1.1
Standard: All students will generate scientific questions about the world based on observation.

Content Area: Constructing New Scientific Knowledge (C) I.1.2
Standard: All students will design and conduct scientific investigations.

Content Area: Constructing New Scientific Knowledge (C) I.1.3
Standard: All students will use tools and equipment appropriate to scientific investigations.

Content Area: Constructing New Scientific Knowledge (C) I.1.4
Standard: All students will use metric devices to provide consistency in an investigation.

Content Area: Matter and Energy (PME) IV.1.2
Standard: All students will explain when length, mass, weight, density, area, volume, or temperature are appropriate to describe the properties of an object or substance.

The Effect of Solar Collector Materials on Solar Energy Potential

Background

The sun is a giant energy source. For many years, people have been using the sun's energy, called solar energy, to make buildings brighter and warmer. Today, we use special equipment and specially designed buildings to capture solar energy for lighting, to heat our living spaces and our water, and even to produce electricity.

Capturing and using solar energy has become more important than ever. Traditional fuels like natural gas and oil are limited, and as these fuels become more scarce, their cost increases. Solar energy also is non-polluting and thus helps us achieve a cleaner environment.

If you collect enough solar heat, you can use it instead of heat from a furnace. One way to collect heat is to trap solar energy with solar collectors. Solar collectors allow sunlight in through plastic or glass, absorb that sunlight, and convert it to heat. Because the heat is unable to pass easily through the plastic or glass, it is trapped inside the collector. An example of how a solar collector works is a car that has all its windows closed tightly. When sunlight passes through the windows of the car, it is either absorbed by the seats and other surfaces inside the car, or it is reflected back out through the window.

Light that is absorbed changes into heat. Darker colored surfaces absorb more sunlight than lighter colors. Similarly, different materials hold heat more efficiently than others and are thus better suited to store solar energy.

Solar collectors come in many shapes and sizes. Passive solar collectors move heat from the collectors to other spaces naturally, without the use of fans or pumps. An attached sunroom or a south-facing room with a large window area and a tile floor (which serves to collect, retain, and then release heat) are examples of passive heating systems. Active solar systems use fans (for systems that heat the air) or pumps (for systems that heat water) to move the heat from the collector to another part of the building.

Science Content Standards

Content Area: Changes in Matter (PCM) IV.2.4
Standard: All students will describe common energy transformations in every day situations.

Content Area: Waves and Vibrations (PWV) IV.4.4
Standard: All students will describe ways in which light interacts with matter.

Materials

- Cardboard box (1 per student work group)
- Black paint
- Four small metal cans (per student work group)
- Four thermometers (per student work group)
- Sand
- Salt
- Water
- Torn-up paper
- Scale
- Saran-wrap

Methods

1. Paint the entire surface of the box (inside and outside) with the black paint.
2. Place the box in the sun.
3. Pick the can to hold the torn paper, place a thermometer in the can and using the scale, record the combined weight in grams.
4. Position the thermometer in the middle of the can and pack torn paper into the can; filling the bottom of the can, around the thermometer, and up to the top of the can.
5. Record the weight of the torn-paper filled can. Subtract the initial weight from the filled weight to determine how much torn paper you added to the can.
6. Use the scale to weigh each can and then add an equivalent weight of the salt, water, or sand equal to the weight of the torn paper.
7. In each can, attach the thermometer such that the thermometer is positioned in the middle of the material inside (this cannot be done with the water).
8. Place the cans in the box and take initial temperatures of each.
9. Cover the box with saran-wrap and leave it for a half an hour.
10. Remove the cans.
11. Watch the temperature in each can fall and record the temperatures for each on the chart on page 3.
12. Using this information, determine which material best stores heat.

	Initial Temp.	Temp. after 30 minutes of sun	2 min.	4 min.	6 min.	8 min.	10 min.
Salt							
Sand							
Water							
Paper							

Discussion/Assessment

- Have students rank which materials are most effective at storing heat.
- Have students brainstorm qualities that would make a solar panel most effective. Have students consider what materials the panel should be made of, where and how the panel should be positioned, the color of the materials used to construct the panel, etc.
- Have students brainstorm ways that collecting solar heat can save money and natural resources.
- Have students make 4 graphs to illustrate and compare how the temperatures of each solar collector material decrease over time (i.e. x axis = time, y axis = temperature).

Source: This activity was adapted from a *Solar Energy Research and Education Foundation-SEREF* activity.