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
These are introductory role-playing activities where students will gain a basic understanding of solar energy and how energy from the sun is converted to power electrical appliances/devises. Students will act out (1) the interaction of sunlight with PV panels, and (2) the movement of electrons along an electrical circuit.

Learning Outcomes
Students will become familiar with the basic principles of solar energy, will understand that photovoltaic panels turn solar radiation (sunlight) directly into electricity, and that there are many different ways PV panels can be used to provide energy.

Science Content Standards
Content Area: Matter and Energy (PME) IV.1.5
Standard: All students will construct simple circuits and explain how they work in terms of the flow of current.

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

Solar Energy Role Playing Games

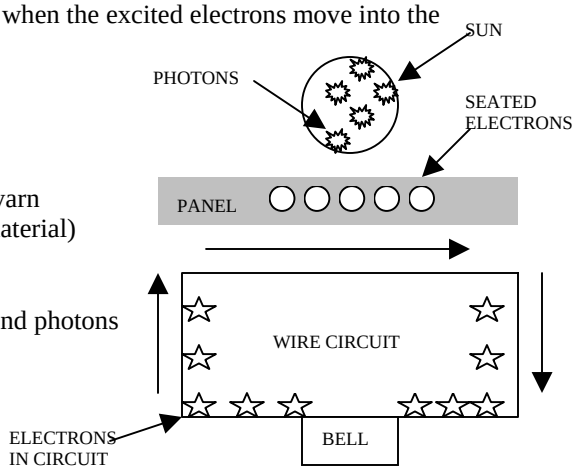
Background

Photons are the minuscule packets of energy that make up light. When they strike the photovoltaic cells, they transfer their energy to electrons in the cells' material. Electrons are the part of the atom that absorbs the energy of a photon and moves around a circuit to create electricity. Atoms are the little bits of matter that make up all materials.

After picking up the energy from the photon, the electrons have enough energy to move around. The electrons can only move in one direction though. The free electrons ("excited" electrons) move into the wire, and create a stream of traveling electrons. The electrons moving along the wire create electricity to power devises such as lights and appliances. It is necessary to have a complete circuit so the electrons can continually refill the spaces left in the cell when the excited electrons move into the wire.

Materials

- Chalk or string/rope/yarn
- Balls (made of soft material)
- Masking tape
- Bell/noise maker
- Labels for electrons and photons
- Paper
- Drawing tools



Methods

Game 1: Students act out the interaction of sunlight with PV panels

1. Set up the game area accordingly. Use masking tape on the floor to designate wire circuit and chairs (◯) as shown in the diagram.
2. Designate 10 students as photons, 5 as seated electrons, and the rest as electrons in the wire. Give the students either photon or electron labels to display while they play the game.
3. Explain the game procedure:
    a. All of the photons stay in the sun circle until instructed by the teacher.
    b. All of the electrons should either be seated or standing on the wire (tape) on the other three sides of the circuit.
    c. When released, a photon travels to the PV panel and transfers his/her energy to an electron in the panel (seated) by tagging the electron.
    d. The seated electron stands up and steps on the wire (tape) in front of the chairs.
    e. This electron is now on the circuit and able to move along the wire in the direction of the arrows.
    f. An electron from the other end of the circuit sits down in the chair and all of the electrons on the wire move clockwise.
    g. As each student passes by the bell/noise maker, s/he rings it once. This indicates that electricity is passing through an appliance and supplying electrical energy to do work.
4. Vary the amount of electrical energy produced by changing the number of photons that are released from the sun.
5. Introduce different scenarios such as a snowy afternoon in January; a sunny noon in July; or a partly-cloudy night in March.
6. Discuss how the panels produce electricity as long as some sunlight reaches the panel. How much electricity is produced depends on the weather, location, and time of the year.

Game 2: Students act out the movement of electrons through electrical circuits and silicon atoms.

1. Using chalk outdoors or string indoors, draw/mark a circle about 4 feet in diameter on the ground/floor.
2. Four student “electrons” stand inside this circle, simulating the 4 electrons in the outer ring of a silicon atom.
3. Create a “circuit” by drawing/marking a large oval on the ground/floor about 5 meters long and 2 meters wide (15’ X 6’) running from one side of the circle to the other.
4. The student who represents the sun holds several soft balls which represent photons, or packets of energy from the sun.
5. The sun tosses the balls, one at a time, to the electrons. When an electron catches a ball, it becomes “energized” and runs through the electrical circuit and back into the outer ring of the silicon atom. When the electron drops back into the ring of the atom, it releases excess energy by tossing the ball to the teacher.
6. Along the chalk/string line that represents the circuit, other students can play the roles of appliances such as a light bulb, fan, or doorbell. As the electrons pass by them, the appliances whirl or buzz to indicate that they are powered on.

Discussion/Assessment

- Have students discuss why capturing and using solar energy is important (traditional fuels such as natural gas and oil are limited, and as these fuels become scarce, their cost increases. Solar energy is also non-polluting).

- Have students brainstorm creative and practical ways PV panels can be used to provide energy in their home, school, rural locations, or in developing countries.

Source: This activity was adapted from a *Solar Energy Association of Oregon* activity. (http://solaror.org).