Activity Overview

Grade Level: 6-8
Activity: M-8

General Description

Students will measure the output of a PV cell under varying conditions using a DC multimeter. The teacher will describe how photovoltaic cells generate electricity, and explain how to use the multimeter.

Learning Outcome

Students will learn how to use multimeters as a method to measure current and voltage of electrical devices. Students will understand the effects of varying the tilt angle of the PV cells on output.

Subjects

Science, math, electronics

Process Skills

Observation, measurement, grouping facts, conducting research, working in teams

Duration

60 minutes

Key Vocabulary

Multimeter

Curriculum Standards

Texas (TEKS):
112.22.b.6.8, 112.24.b.8.10
Louisiana (LSCS):
PS-M-C1, PS-M-C6, PS-M-C3
Arkansas (ASCF):
3.1.24
National (AAAS Project 2016):
The Physical Setting – 8th,
The Designed World – 8th

Measuring Solar Electricity

Materials

- photovoltaic (PV) cell
- DC meter
- protractor
- recording sheet or graph paper
- reflectors (aluminum foil or mirrors)

Method

1. Divide into teams of two to three students.
2. Provide each student with a copy of the recording sheet.
3. Give each team 1 photovoltaic cell, 1 DC meter, protractor and reflectors.
4. Instruct students to attach alligator clamps on the panel to the wires on the DC meter.
5. Connect the red clamp on the PV cell to the red clamp on the meter. Connect the black clamp on the PV cell to the black clamp on the meter.
6. Place PV cell in sunlight and read meter.
7. Move PV cell to various angles and read meter.
8. Test cell at 0 degrees, 45 degrees 90 degrees and so on.
9. Place foil around cell and repeat tests

Background

PV cells convert sunlight directly into electricity without creating any air or water pollution. PV cells are made of at least two layers of semiconductor material. One layer has a positive charge, the other negative. When light enters the cell, some of the photons from the light are absorbed by the semiconductor atoms, freeing electrons from the cell's negative layer to flow through an external circuit and back into the positive layer. This flow of electrons produces electric current.

To increase their utility, dozens of individual PV cells are interconnected together in a sealed, weatherproof package called a module. When two modules are wired together in series, their voltage is doubled while the current stays constant. When two modules are wired in parallel, their current is doubled while the voltage stays constant. To achieve the desired voltage and current, modules are wired in series and parallel into a PV array. The flexibility of the modular PV system allows designers to create solar power systems that can meet a wide variety of electrical needs, no matter how large or small.

Variables:

- angle of cell
- time of day/year
- use of reflectors
- use of filters

Without Reflector	**Current (Amps)**
0 ^{o}	
45 ^{o}	
90 ^{o}	
With Reflector	**Current (Amps)**
0 ^{o}	
45 ^{o}	
90 ^{o}	