

Alternative Energy

Grade Level: 6th Grade (Earth Science)

Objective:

Students will be able to define a solar cell as a device that converts light into electricity. SWBAT describe photovoltaics as a renewable and clean energy source.

Assessment

“Today I learned about renewable energy, which can help us prevent global warming. Solar is the most abundant form of energy. Solar cells are dark to absorb more light.”

*What is renewable energy?
Why could renewable energy help global warming?
What is a solar cell?*

Lesson Cycle	Estimated Time at End of Section
<p>As You Enter Question Who remembers what the most abundant source of energy is? (the sun!)</p>	5min
<p>Introduction to Lesson Does anyone remember the name of the type of energy that doesn't run out? (RENEWABLE) We don't have to worry about running out of that energy source because it keeps coming back every day. Who can explain to the class why FOSSIL FUELS are not renewable? Who can name some renewable energy sources? Good – SOLAR energy, WIND energy, and HYDRO or water energy.</p> <p>Now, who remembers what GLOBAL WARMING is? Good, and what causes global warming? Fossil fuels cause global warming. So if we didn't burn fossil fuels, we could stop global warming. Do renewable energy sources include fossil fuels? No. So what type of energy sources should we use to stop global warming? (point to solar, wind, hydro on board)</p> <p>Remember that there are 2 kinds of energy we get from the sun – light and heat. We've learned that if we use the heat from the sun, we can heat things up. Can we cook dinner with this heat?</p> <p>Now most of the ways we generate electricity involve turbines and generators, but there is something called a SOLAR CELL. A solar cell generates electricity without any moving parts. When a beam of sunlight hits it, the electrons in it get excited and start running around, creating electricity. Have any of you ever seen a solar cell? Today we're going to do a lab with solar cells. We'll divide up into teams and learn about how to make our solar cell produce a lot of electricity.</p>	15min

<p>Student Practice/Engagement <divide into groups, hand out solar cells, flashlights, multimeters, colored filters, worksheets> First we're going to watch our solar cell work. I want you to be very gentle with the solar cells, and connect the wires coming out of it to the wires of your multimeter. Now let everyone take a turn shining the flashlight on the cell and watching the multimeter. The multimeter tells us how much electricity the solar cell is producing. <teachers make sure multimeters are reading mA></p> <p>Work through the worksheet. Each time students make a measurement, ask them to compare or interpret it (Does the blue filter let more or less light through than the red? Did your concentrator work? Can you increase the electricity a solar cell makes by concentrating light on it?)</p> <p>**If your multimeter has AC (sometimes marked by a ~), make sure to use it. If not, use the highest number that comes up on the DC setting (it will change quickly).</p>	<p>50min</p>
<p>Conclusion/Wrap Up We've learned about how solar cells react to different conditions. Which colored filter gave you the most energy from your solar cell? How did that compare with no colored filter? The colored filters blocked different parts of light from the solar cell, which gave it less solar energy. Did you guys get more energy from solar cells that were tilted or flat? And does the solar cell give more energy if the flashlight is closer to it or further away? We lose some of our solar energy if we don't shine it close to the solar cell. The brighter the sun, the more energy we get.</p> <p>Okay, let's review the rest of the lesson from today. Is solar energy a renewable energy source? Is coal a renewable energy source? What are some other renewable energy sources? Now I'd like you to write a sentence about what you've learned today.</p>	<p>60min</p>

Worksheets/Readings Teacher Needs to Print/Copy and Number Needed of Each

(1 per student for whole class, group of 3, group of 4, half of class, etc.)

- **Datasheets – one per student**

Other Materials Volunteer Needs to Bring to Lesson

- Solar cells (1 per group)
- Strong flashlight
- Protractors (2-3)
- Colored filters (2-3 in each color)
- Al foil (maybe 6 inches square per group)
- Magnifying lens
- Black paper or tagboard for shading (a few pieces as big as a cell)
- Multimeters

Classroom Resources Needed

- Blackboard/whiteboard & chalk/markers
- Pencils

Solar Cell Experiments

Group Members

Recorder Writes down all measurements immediately

Solar Cell Technician(s) Hold probes and read multimeter to measure voltage

Experimenter Holds solar cell and adjusts it or gets other materials according to instructions

Leader Makes sure group follows directions and works safely

Directions

1. Measure the voltage and current your cell produces in the classroom and record it on the table.

You may complete the rest of the experiments in any order you want. Record your results for all of them in the table on the back:

- Take the cell outside and record its voltage and current
- Shine a bright flashlight on the cell and record its voltage and current
- Cover the cell with different color filters and record its voltage and current
- Shade $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ of the cell and record its voltage and current
- Concentrate the light on the cell using a magnifying glass
- Try to build a structure out of aluminum foil that will concentrate extra light on your cell
- Tilt your cell at several angles, from flat on the desktop up to 90 degrees (straight up) and measure the voltage. Measure the angle using a protractor and record it.

Table

Conditions	Cell Voltage (mV)	Cell Current (uA)
Classroom light		
Outside		
Flashlight		

_____ filter		

Flashlight

_____ angle		
_____ angle		
_____ angle		

$\frac{1}{4}$ shaded		
$\frac{1}{2}$ shaded		
$\frac{3}{4}$ shaded		

Magnifying glass	
Aluminum foil	

Questions:

1. Where does the energy that goes into the cell come from?
2. What form of energy is entering the cell?
3. What form of energy is leaving the cell?
4. What are some advantages of solar cells?
5. What pollutant causes global warming?
6. Where does that pollutant come from?
7. Do solar cells cause global warming?
8. What are some of the problems with solar cells? Why don't people use them more?