ACTIVITY RE3

RENEWABLE ENERGY

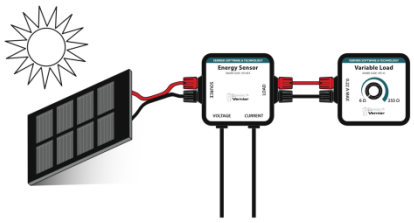
Exploring Solar Panels

SECTION A

There is growing demand for electricity due to the increasing use of technology throughout the globe. The burning of fossil fuels is the most common way that electricity is generated.
Unfortunately, fossil fuels are non-renewable and cause pollution when they are used to generate electricity. For these reasons, in addition to potential money savings, people are looking to other sources to produce energy.
Using solar panels to generate electricity from the sun is becoming increasingly common. Solar panels can be used at many scales to generate power. A single, small panel can be used to charge electronic devices such as your cell phone. Large numbers of panels can function together to generate electricity for an entire neighbourhood.
The amount of electricity that can be generated by a solar panel is affected by many variables. In this experiment, you will explore how the amount of current and voltage produced by a solar panel is affected by the distance to a lamp. You will then test your equipment in direct sunlight and calculate the efficiency of the photovoltaic cell when converting the energy from the sun into electrical energy.

SECTION B

Experiment



Aim

To understand how solar panels can be used to generate electricity.

- Predict variables that affect how much electricity is generated by a solar panel.
- Determine the efficiency of a solar panel.

Materials

- Computer with Logger Pro
- 2 wire leads with clips
- Vernier computer interface
- Protractor
- Light bulb
- Vernier Energy Sensor
- Light bulb socket or lamp
- Vernier Variable Load
- Sunshine
- KidWind 2 V solar panel

Procedure

Part I Exploring solar panels

In this part of the experiment, you will use a lamp and a solar panel to learn more about how solar panels work. You will then take the equipment outside to determine how much current and voltage is produced by the solar panel.

1. Connect the Vernier Energy Sensor Current and Voltage connectors to the interface. Start Logger Pro.
2. Zero the Energy Sensor.
   a. Connect the Energy Sensor Source terminals to each other with a wire lead in order to create a short circuit in preparation for zeroing.
   b. Choose Zero from the Experiment menu. All sensors are selected.
3. Select OK. The readings should be close to zero.
   Note: The resistance value is not meaningful when the current and voltage values are near zero.
4. Set up the equipment.
   a. Disconnect the wire lead that is creating the short circuit and connect the solar panel to the Energy Sensor Source terminals.
   b. Connect the Variable Load to the Energy Sensor Load terminals.
   c. Set up the lamp with the light bulb.
5. Check the current and voltage values and adjust the load.
   a. Turn on the light and place the solar panel close to the bulb.
   b. Note whether the current and voltage values are positive, negative, or zero.
   c. If the values are positive, the setup is correct. If the values are negative or zero, switch the wires connected to the Source terminals so they are connected to the opposite terminals.
   d. Adjust the load by turning the knob on the Variable Load until the resistance is approximately 70Ω or equal to the internal resistance of your solar panel. Make note of the resistance so you can use the same setting in Part II
6. Explore: Does distance between the solar panel and lamp affect current and voltage?
   a. Make a prediction about how distance between the solar panel and the light source affects current and voltage.
   b. Create a plan to investigate how distance affects how much current and voltage are produced. What are you purposefully changing in this investigation? What will you keep constant?
7. Click Collect to start data collection.
8. Examine the data.
   a. Choose Examine from the Analyse menu.
   b. What are the maximum current and voltage values that you find? Record these values in the data table.
9. Take the equipment outside to a place that will receive sunshine for the duration of the experiment.
10. Explore: How are current and voltage affected by sunlight?
    a. Position the solar panel so it is facing toward the sun. **Caution: Do not look directly at the sun!**
    b. Create a plan to investigate how current and voltage levels change in sunlight.
    c. Repeat Steps 6–7 to collect data for sunlight.

Results table

Exploring solar panels			
	Maximum current (mA)	**Maximum voltage (V)**	**Power (mW)**
Lamp			
Sunlight			

Questions

Exploring solar panels

1. What can you conclude about how distance affects how much voltage is produced based on your observation?

2. How do the current values that you recorded inside and outside compare to each other?

3. How do the voltage values that you recorded inside and outside compare to each other?

4. Calculate power for the lamp and sunlight (P=VI). Record the values in the data table.