1. GYC201
2. Steven Merriman, Intro. to Physical Science (PHS101).
3. Lab: Renewable Energy.
4. Conservation of Energy, How scientific knowledge changes over time.
5. Renewable vs. nonrenewable energy, energy conservation
6. It would be part of the series of labs for the course. Each lab gets graded out of 10 points for completeness upon turning in the lab manual at four points throughout the semester.

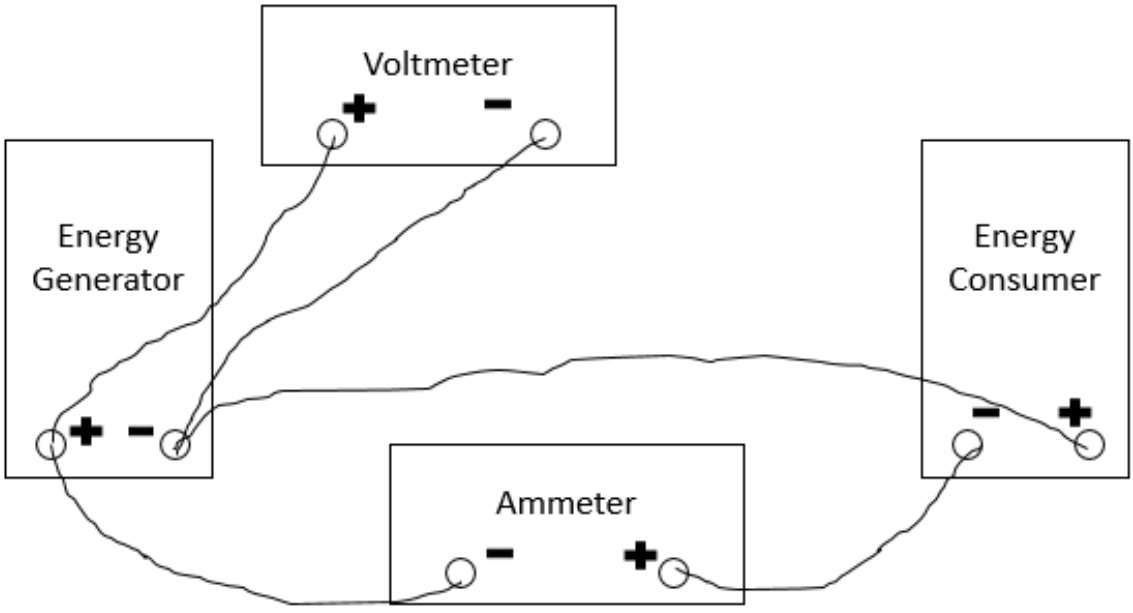
Experiment: Renewable Energy

Goals: Upon completion of this lab, the student will be able to:

- Explain the way various forms of renewable energy operate
- Experimentally verify the conservation of energy
- Test the amount of energy created by the renewable source
- Calculate the amount of power generated by the renewable source

Procedure

In this lab, you will be studying the generation of energy through four methods: mechanical, chemical, wind and solar. You will do so by using the energy generated to power three devices: an LED light, an electric motor and a mini speaker (buzzer). We will set the set the energy generator up in a circuit with the energy consumer along with a voltmeter and an ammeter (to test the voltage and current). The general circuit will look like the diagram below:



Part A: Mechanical Power

In this part of the lab we will connect the hand crank generator into the energy generator position and then test it with each energy consumer.

1. Place the electric motor in the circuit. Turn the hand crank at a medium speed. What do you see happen?

2. Do the same thing at roughly the same speed. This time, read the numbers displayed for the voltmeter and ammeter. Record these in Table 1.
3. Increase the speed that you turn the hand crank (try to double your last speed). What do you see happen? Once again, record the values for current and voltage in Table 1.

4. Switch out the electric generator for the LED light. Using the hand crank at a medium speed, light the LED. Do the same at a fast speed. Is there a difference in the LED? Record the values for voltage and current from both trials in Table 1.

5. Switch out the LED light for the mini speaker. Using the hand crank at a medium speed, make the mini speaker create a buzzing noise. Do the same at a fast speed. Is there a difference in the pitch or volume? Record the values for voltage and current from both trials in Table 1.

6. Take the product of the voltage and current to get the power consumed by the energy consumer. This is the same as the power generated by the hand crank. Was the power generated roughly the same for the medium speed? The fast speed?

	Voltage (Volts)	Current (Amps)	Power (Watts)
Motor (medium speed)			
Motor (fast speed)			
LED (medium speed)			
LED (fast speed)			
Buzzer (medium speed)			
Buzzer (fast speed)			

7. Which device required the most power to operate?

Part B: Chemical Power

In this part of the lab we will connect the 9V battery into the energy generator position and then test it with each energy consumer.

1. Place the electric motor in the circuit. What do you see happen? Record the voltage and current values in Table 2.

2. Connect a higher voltage battery into the circuit (12V). What do you see happen? Once again, record the values for current and voltage in Table 2.

3. Switch out the electric generator for the LED light. Using the 9V, light the LED. Do the same with the 12V. Is there a difference in the LED? Record the values for voltage and current from both trials in Table 2.

4. Switch out the LED light for the mini speaker. Using the 9V, make the mini speaker create a buzzing noise. Do the same with the 12V battery. Is there a difference in the pitch or volume? Record the values for voltage and current from both trials in Table 2.

5. Take the product of the voltage and current to get the power consumed by the energy consumer. This is the same as the power generated by the battery. Was the power generated roughly the same for the 9V battery? The 12V battery?

	Voltage (Volts)	Current (Amps)	Power (Watts)
Motor (9V)			
Motor (12V)			
LED (9V)			
LED (12V)			
Buzzer (9V)			
Buzzer (12V)			

6. Which device required the most power to operate?

Part C: Solar Power

In this part of the lab we will connect the solar panel into the energy generator position and then test it with each energy consumer.

1. Place the electric motor in the circuit. What do you see happen? Record the voltage and current values in Table 3.

2. Cover half of the solar panel. What do you see happen? Once again, record the values for current and voltage in Table 3.

3. Switch out the electric generator for the LED light. Using the entire solar panel, light the LED. Do the same with half of the solar panel covered. Is there a difference in the LED? Record the values for voltage and current from both trials in Table 3.

4. Switch out the LED light for the mini speaker. Using the full solar panel, make the mini speaker create a buzzing noise. Do the same with half of the solar panel covered. Is there a difference in the pitch or volume? Record the values for voltage and current from both trials in Table 3.

5. Take the product of the voltage and current to get the power consumed by the energy consumer. This is the same as the power generated by the battery. Was the power generated roughly the same for the full solar panel? The half solar panel?

	Voltage (Volts)	Current (Amps)	Power (Watts)
Motor (Full)			
Motor (Half)			
LED (Full)			
LED (Half)			
Buzzer (Full)			
Buzzer (Half)			

6. Which device required the most power to operate?

Part D: Wind Power

In this part of the lab we will connect the Windmill into the energy generator position and then test it with each energy consumer.

1. Place the electric motor in the circuit. Blow on the windmill to make it move at a medium speed. What do you see happen?

2. Do the same thing at roughly the same speed. This time, read the numbers displayed for the voltmeter and ammeter. Record these in Table 4.
3. Blow on the windmill stronger to increase the speed of rotation (try to double your last speed). What do you see happen? Once again, record the values for current and voltage in Table 4.

4. Switch out the electric generator for the LED light. Using the windmill at a medium speed, light the LED. Do the same at a fast speed. Is there a difference in the LED? Record the values for voltage and current from both trials in Table 4.

5. Switch out the LED light for the mini speaker. Using the windmill at a medium speed, make the mini speaker create a buzzing noise. Do the same at a fast speed. Is there a difference in the pitch or volume? Record the values for voltage and current from both trials in Table 4.

6. Take the product of the voltage and current to get the power consumed by the energy consumer. This is the same as the power generated by the windmill. Was the power generated roughly the same for the medium speed? The fast speed?

	Voltage (Volts)	Current (Amps)	Power (Watts)
Motor (medium speed)			
Motor (fast speed)			
LED (medium speed)			
LED (fast speed)			
Buzzer (medium speed)			
Buzzer (fast speed)			

7. Which device required the most power to operate?