

Wind Power to Generate Hydrogen

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**Educational Goals:**

• Students will use the Scientific Process to perform the experiment.

• Students will collect and analyze data.

• Students will learn to use a model wind turbine that generates a safe level of DC electricity.

• Students will learn the principles of electrolysis using wind power and fuel cells.

• Students will learn to calculate energy.

• Students will use the Internet to research lesson related topics.

**Learning outcomes:**

Students are shown that the electrical energy produced by a model wind turbine can electrolyze (split) water into hydrogen and oxygen using a device called an electrolyzer. Then students are shown how these two gasses are recombined by a fuel cell to generate electricity to power a small motor.

Students come to understand that:

1. Wind power can be used to generate hydrogen and oxygen in a clean, non-polluting manner.

2. Hydrogen is an “energy carrier” and can be stored for later use in generating electricity.

3. The measured energy in Joules or Watt-seconds is different from power. Energy has a time component and power is an instantaneous reading.

**Time**: about 1 hour

**Materials Needed:**

1 – Wind Turbine with 6 blades

1 – Table fan (20” diameter recommended)

1 – Electrolyzer unit with gas storage containers

1 – Fuel cell

1 – Motor and propeller

1 – Clock, watch or stopwatch

2 – Red hookup leads

2 – Black hookup leads

1 – Circuit Board Module Base

**Directions:**

**Part 1:**

1. Setup the equipment as in Equipment Setup #1.

2. Set the multimeter dial to DC Volts with a range of at least 10 VDC.

3. Fill both the hydrogen and oxygen cylinders to the 20 ml marks with distilled water.

4. Place the table fan directly in front of the wind turbine and set it to its highest speed setting.

5. Make sure that the wind turbine is generating AT LEAST 1.5 volts. If not, move the wind turbine closer to the fan until it does. Also, make sure that the blade pitch is between 10 and 15 degrees. The wind turbine is sensitive to this setting at high wind speeds.

6. Note the time on the clock or watch. Allow the table fan and wind turbine to run for 10 minutes – no longer.

7. Record the voltage and current as this is happening. You will need to place the multimeter in both parallel (voltage) and series (current) wiring configurations for this step. Refer to the **Experiment Guide** for help.

8. Turn the table fan OFF after 10 minutes and convert this number into seconds (10 x 60 = 600 seconds).

**Part 2:**

9. Remove the wind turbine from the setup and replace it with Experiment Setup #2.

10. Connect the red wire from the fuel cell to the Circuit Board Module Base and note the time on the clock or watch. If the motor doesn’t immediately start spinning, give the blade a push with your finger being careful not to allow the rotating blade to cause injury.

11. Record the voltage and current as this is happening. You will need to place the multimeter in both parallel (voltage) and series (current) wiring configurations for this step.

12. Allow the motor to run until the hydrogen is used up.

13. Note the time when the motor-propeller stops turning.

14. Subtract the start time in step 9 from the stop time in step 12 and convert this number into seconds.

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| --- | --- | --- | --- | --- |
|  | Seconds | Volts | Amps | Watts |
| Part 1 |  |  |  |  |
| Part 2 |  |  |  |  |

**Analyzing the results:**

Using the data in the table recorded for Part 1compute the energy used to generate hydrogen. Energy is computed as power times time.

Repeat the same procedure for Part 2.

Energy = Power x Time

**What IF?**

What if there was no more gasoline in the world to run our cars (and this will happen someday soon), could we use hydrogen to power our cars instead of gasoline?