

Lesson 6	Performance of the Wind Turbine Under Load		
Level	Key Stage 3	Time required	1 hour
National Curriculum Links			
Science, PSHE, Maths (view scheme of work for full details of links)			
Aims			
<ul style="list-style-type: none"> The students will examine the properties of the circuits they have made using the Wind Turbine Kit as a generator and the module boxes as the load 			
Resources required			
Pen, record sheet (one per group), Wind Turbine Kit, electric fan, safety goggles			
Web search keywords			
Wind turbine under load			

Introduction

The students are going to observe and record the changes in output voltage of the turbine when it is connected to various loads, including no load.

Ask the students to predict what differences (if any) they expect to find when they record their data.

Using all the information the students have gathered so far, ask them to set up the Wind Turbine Kit as efficiently as possible. Set up a fan (ideally 15" diameter) as described in the activity sheets.

Instructions are included with the Wind Turbine Kit. These can be downloaded in PDF format from: [http://www.ecostyle.co.uk/products/wind turbine kit/wind turbine kit activity sheets v2.15.pdf](http://www.ecostyle.co.uk/products/wind_turbine_kit/wind_turbine_kit_activity_sheets_v2.15.pdf)

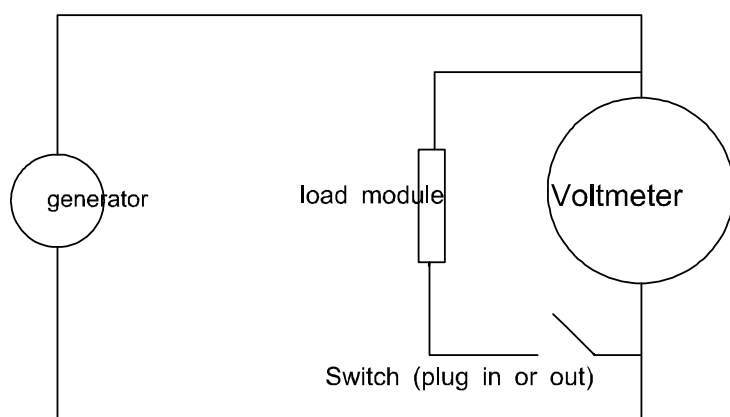
Risk assessment

Ensure the rotor blades are pushed firmly into the rotor hub. If the rotor blade spokes become loose, squashing the spoke slightly with pliers will achieve a tighter fit. Safety goggles should be worn by students operating the equipment and by those in the surrounding area.

Task

Connect the wind turbine to the voltmeter. Using the stackable plug capability, attach a red or black lead from the motor module to the voltmeter. Set the fan to the lowest (slowest) setting and record the wind turbine's voltage output in the chart.

Repeat the experiment with the fan speed set to medium, then with the highest (fastest) setting. Record what happens to the wind turbine, the motor module and the reading on the voltmeter. During the test, the other lead will be connected to the other socket of the voltmeter so that the voltmeter now registers the voltage from the turbine with the motor module in taking current from the turbine, i.e. the turbine is loaded.



This is the generic circuit the students will use. The second experiment will use the buzzer module as the load, and the final experiment will use the LED as the load. Remember that LED and buzzer modules are polarity-dependant, so if these modules fail to operate, reverse the wires (i.e. take the plug from the red socket and connect it to the black socket, and connect the plug previously in the black socket to the red socket). The motor module will operate regardless of polarity, but the LED and buzzer modules will only when operate when properly connected.

Use Excel to store these results in a spreadsheet and create graphs to illustrate the behaviour of the system under load.

The students may repeat these tests with more or less blades and compare the results.

Conclusion

- Which combination gives the most efficient energy production?
- Did the devices perform as you expected?
- Discuss your conclusions with your peers.

KS3 Lesson Plan

Record Sheet

(Experiment 1 - Motor module as load)

Wind speed	Wind turbine behaviour	Voltmeter reading module connected	Voltmeter reading module not connected
High velocity			
Medium velocity			
Low velocity			

(Experiment 2 - Buzzer module as load)

Wind speed	Wind turbine behaviour	Voltmeter reading module connected	Voltmeter reading module not connected
High velocity			
Medium velocity			
Low velocity			

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Record Sheet

(Experiment 3 - LED module as load)

Wind speed	Wind turbine behaviour	Voltmeter reading module connected	Voltmeter reading module not connected
High velocity			
Medium velocity			
Low velocity			