

Lesson 2	Introduction to Wind Power		
Level	Key Stage 3	Time required	1 hour
National Curriculum Links			
Science (view scheme of work for full details of links)			
Aims			
<ul style="list-style-type: none"> • The students will learn how the energy of the wind can be used to generate electricity and power simple electrical devices • They will learn about the component parts of a wind turbine • They will experiment with the Wind Turbine Kit and use it to power simple circuits 			
Resources required			
Pen and paper, Wind Turbine Kit, electric fan, safety goggles			
Web search keywords			
Wind turbine, wind power, wind farm, how do wind turbines work			

Introduction to Wind Power

Wind turbines use the wind's power to generate electricity. The wind turbine has blades that rotate in the wind; this rotation is transferred through gears to an electrical generator. The electricity travels down the cables inside the tower, and ultimately to the place where the electricity is needed.

(Show Wind Turbine slide)

1 Rotor blades

Wind passing the rotor blades causes them to rotate. The greater the wind speed, the greater the rotation speed. The rotor blade is connected to the rotor hub with a spoke.

2 Rotor hub

The rotor hub allows the rotor blades to be attached to the turbine shaft.

3 Rotor

The rotor is an assembly consisting of the rotor blades and the rotor hub.

4 Turbine head

This includes all the mechanisms at the top of the tower, but not including the rotor. Larger wind turbines are enclosed with a protective cover called a nacelle.

5 Generator

The generator is part of the turbine head. As the generator turns, electricity is produced.

6 Gears

In larger wind turbines the generator is connected to the rotor shaft by gears.

7 Tail plane

This enables the rotor of the wind turbine to face into the wind. If the rotor isn't facing into the wind, the wind will push on the tail plane so as to move the rotor into the wind. Larger wind turbines have a motor instead of a tail plane. The motor is controlled by a wind vane which monitors the wind direction.

8 Yaw bearing

The yaw bearing allows the turbine head to rotate to face into the wind. It includes a mechanism, called a commutator, which allows the electricity to pass down the tower without twisting the power cables.

9 Power cables

The electricity produced by the generator travels down cables inside the tower to where it is needed.

10 Tower

The purpose of the tower is to raise the rotor high enough into the wind to avoid disturbance by trees and buildings etc. The tower also raises the rotor blades to a safe height to avoid injury.

11 Base

This is the foundation on which the tower is mounted. It has to be wide enough and strong enough to support the tower.

Wind Turbine Kit

Ensure the students are familiar with the Wind Turbine Kit and how it works before starting the experiments.

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

Ask the students to set up the Wind Turbine Kit according to the instructions and connect the motor module to it. Set up a fan (ideally 15" diameter) as described in the activity sheets.

The polarity of the current generated by the wind turbine is dependant on which way the hub rotates. The LED and buzzer modules are polarity-dependant. If at first they fail to operate, reverse the plugs and try again. The motor module will operate regardless of polarity, but the direction in which it spins will depend on the rotational direction of the generator motor. The LED and buzzer modules will only when operate when properly connected.

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 1

Connect the wind turbine to the motor module. Make sure you have made a complete circuit.

Turn the fan on. If the fan has variable settings, set it to its highest (fastest) setting.

The blue propeller on the motor module will rotate. The faster the turbine rotor spins, the faster the propeller will turn.

Disconnect the motor module, and connect the red LED (light-emitting diode) module. The LED will illuminate. The faster the turbine rotor spins, the brighter the LED will become.

Disconnect the LED module, and connect the buzzer module. The buzzer module will sound. The faster the turbine rotor spins, the greater the pitch/volume of the buzzer.

Task 2

Disconnect the wind turbine from any modules. Now connect the voltmeter/ammeter to the Wind Turbine. The black slide on the meter should be positioned to the left so that 'V' is displayed. Connect one blue plug into the central black socket, and the other plug into the '10V' red socket.

Turn on the fan to its highest setting. What voltage is being generated?

As previously mentioned, the polarity of the current generated by the wind turbine is dependant on which way the hub rotates. If the needle gives a negative reading, reverse the position of the blue plugs.