

<b>Lesson 4</b> Blades Pitch on a Wind Turbine	
<b>Level</b> Key Stage 2	<b>Time required</b> 1 hour
<b>National Curriculum Links</b> Science, Maths, English (view scheme of work for full details of links)	
<b>Aims</b> <ul style="list-style-type: none"> <li>• Students will discover how the pitch of the blades on the wind turbine can affect the efficiency of energy production</li> </ul>	
<b>Resources required</b> Pen, record sheet (one per group), Wind Turbine Kit, electric fan, safety goggles	
<b>Web search keywords</b> Wind turbine blade angle, wind turbine pitch	

## Task

The students are asked to experiment with different blade angles.

Ask the students to set up the Wind Turbine Kit according to the instructions and connect the voltmeter. Set up an electric 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)

Once the fan is in position, do not move it or the Wind Turbine Kit. Ensure the fan is always used on the highest (fastest) setting. It is important to keep all these settings constant in order to achieve meaningful results.

For this experiment only use a 3-blade configuration, spaced evenly around the hub.

Make sure the students have connected the turbine into the voltmeter. Explain that this simply tells us how much electricity is being generated by the turbine.

Ask the students to record their findings methodically. Test each angle blade combination at least twice to check and record.

The students will need to record the angle of the blades and the reading on the voltmeter.

## What is the angle of pitch?

With the turbine hub facing directly into the fan, the angle of pitch is 0° when the blade is flat, face to the wind. When the blade is twisted through 90° so it is pointing back towards the gears, this position has a pitch of 90°. All positions between these extremes are described by their individual pitch angles.

## 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.

## For your information

An angle of approximately  $30^\circ$  will give the highest voltage output. The wind turbine rotors will not turn when the blades are angled at  $0^\circ$  or  $90^\circ$ , but it is important for the students to experience this and understand why.

## Suggestion

Ask the children to make their own record sheet. However, if you do need a record sheet you can use the one provided. You can also record this information on an Excel spreadsheet and show the children how to generate a graph of how output varies with the pitch of the blades. You could put all the results from several turbines onto one sheet.

## Extension

Ask the children to represent their data by drawing a graph. Depending upon the age and ability this could be a simple histogram or a line graph.

## Conclusion

- Discuss the students' results
- Which combination gives the most efficient energy production?
- Why do they think this setting gives the best performance?

# KS4 Lesson Plan

## Record Sheet

Pitch of blades	Voltmeter reading
0°	
5°	
45°	
85°	
90°	