# Wind Turbines

KS3 Curriculum links

**GLO: Renewable energy sources can be used to provide power. To develop them, we use a range of state-of-the-art engineering facilities.**

Science — 3.1: energy: This includes the properties and behaviour of light and sound, renewable energy resources and emerging technologies such as fuel cells

4: sustainability

**GLO: sense of achievement**

Technology — Design: develop and communicate design ideas. Reformulate problems given to them

Make: Select from and use a wider, more complex range of materials, taking into account their properties

Evaluate: Impact on society and environment

School day plan - 45 minutes, 40 students

| Length/Minutes | What | Key points |
|---|---|---|
| 20 | Intro and making | • Split students into (8) groups of 5 around tables<br>• Introduce to renewable/wind/ERU SEE BELOW<br>- What is a renewable energy resource? Why are they important? (Sustainable, replaced and won't run out, clean and environmentally friendly)<br>- What types of renewable energy can you think of? (Wind, solar, biomass, hydro)<br>"The thing we're going to learn about today is wind turbines"<br>- What do you know about wind energy in UK? See **Sheets USE MODEL**<br>- Has anyone seen the wind turbine we have onsite? What do we do here? (won't be able to see it today but it's behind the mound. See **Sheets** on table with pictures)<br>- how does a wind turbine work? Again see **Sheets**<br>• Make own turbine (instructions above) |
| 15 | Testing | • Think of a problem e.g. it's super windy, no wind<br>• Use different materials/templates to make a 'better' turbine – why do you think that material or shape or size or number of blades would be better? |
| 10 | Presentations | • Split 8 groups into 4<br>• Show new turbines<br>• Present to each other for 2 minutes explaining why your turbine is good/bad etc. |

Introduction

Introduce to renewable/wind/ERU

**What is a renewable energy resource? Why are they important?**
*Sustainable, can be replaced and won't run out, clean and environmentally friendly. Other non-renewable energy sources are bad for environment (POLLUTION) and are depleting and cannot be replaced e.g. coal, oil, gas, nuclear*

**What types of renewable energy can you think of?**
*(Wind, solar, biomass, hydro)*

**"The thing we're going to learn about today is wind turbines"**

**What do you know about wind energy in UK? See SHEETS and MODEL**
*Wind energy is now the UK's largest source of renewable energy generation.*
*The UK's first commercial wind farm was built in North Cornwall in 1991.*
*The model in this exhibition is of a WEG MS3 – a two bladed turbine which was rated at 300 kilowatts – which was one of first to be installed in the UK.*
*There are now 5,083 onshore wind turbines in the UK and a further 1,452 offshore wind turbines.*
*It is estimated that 32,410,089 megawatt hours of electricity is generated by wind turbines each year – enough electricity to supply over 7 million homes!*

*FUN FACT: A single 2.5 megawatt wind turbine working at full power can generate enough electricity to meet the annual needs of over 1,400 households, make 230 million cups of tea, or run the average computer for well over 2,000 years!*

**Has anyone seen the wind turbine we have onsite? Do you know what do we do here?**
*Although we won't see the turbine today, it's behind the mound you can find the sheet with the pictures on – this is what we have at RAL. We have two –turbine and test facility.*
*At RAL we have the ERU. [From info sheet:] The Energy Research Unit (ERU) at the Rutherford Appleton Laboratory researches new and renewable energy technologies. The ERU, established 37 years ago, is working on projects with aims to:*

*-reduce the costs of offshore wind energy*

*-improve the reliability of turbines*

*-look at new ways of storing the energy generated by wind turbines*

**How does a wind turbine work? See SHEETS**
*[Taken from sheet and extra notes]The **Tower** of a wind turbine is usually cylindrical, made of steel, and 25 to 75 metres tall. Most large wind turbines have three blades, made of fibreglass-reinforced polyester or wood-epoxy, which turn the rotor they are attached to. The **rotor blades** are usually each between 15 and 40 metres long. The rotor turns a shaft which is connected to a set of cogs called a **gear box.** The gearbox is connected to a generator which makes electricity when it turns. Each rotor turn is known as a revolution. Most large wind turbines operate at around 15 revolutions per minute. The gearbox converts this to roughly 1350 revolutions per minute, the amount required to generate electricity. The electricity is then sent down thick cables which take it to the National Grid to be distributed to power our homes and industry. Sensors are used to **monitor wind direction** to*

*control **the yaw mechanism** which turns the rotor to face the wind. The **wind speed** is also monitored as at high wind speeds, machines are stopped to protect them from damage.*

**We're going to make your own turbine now! – carefully follow instructions step by step!**
*Go through step by step, only handing out equipment when ready.*
*For step 6, a photo is shown on sheets for help.*
*Ensure that they don't:*
*cut the circle*
*fold the blades*
*hole punch the last blade*
*make the bead too tight on the fastener*
*tape the blades too low down on the 'tower' stick*

*Be ready to troubleshoot!*

Extra notes

**MODEL**
- The model in this exhibition is of a WEG MS3 – a two bladed turbine which was rated at 300 kilowatts – which was one of first to be installed in the UK.

**How a turbine works**
- The Tower of a wind turbine is usually cylindrical, made of steel, and 25 to 75 metres tall.
- Blades are made of fibreglass-reinforced polyester or wood-epoxy
- Each rotor turn is known as a revolution. Most large wind turbines operate at around 15 revolutions per minute. The gear box converts this to roughly 1350 revolutions per minute, the amount required to generate electricity.