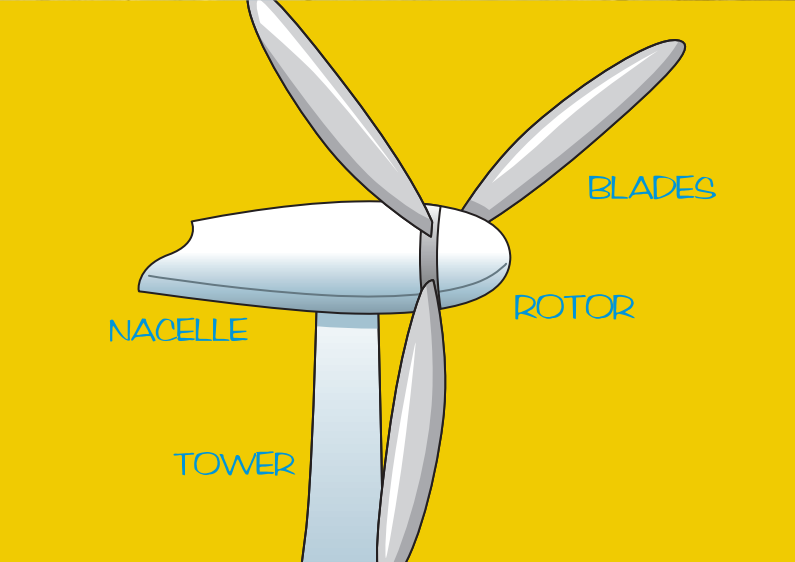


School Children's Pack on Wind Energy



About this pack

This children's pack has been produced to provide children aged 7-11 with information about wind and wind energy. Its purpose is to be fun and educational, encouraging children to think about wind as an energy resource. It contains many fun activities for the children to do, either at home or at school. A parent and teachers' guide is included at the back, this provides the solutions to the activities within the pack and lists a number of useful websites.

About the publisher

This pack has been published by the BWEA.

The BWEA (British Wind Energy Association) is the trade and professional body for the UK wind and marine renewables industries. The primary purpose of the BWEA is to promote the use of wind power in and around the UK, both onshore and offshore. It undertakes research to find solutions to current issues and generally acts as the forum for the UK wind industry.

Wind has been the world's fastest growing renewable energy source for the last seven years, and is expected to continue with falling costs of wind energy and the urgent international need to tackle CO₂ emissions to prevent climate change.

www.bwea.com



What is wind?

Wind is the movement of air.

Activity One

Can you think of five signs that indicate there is wind:

1

2

3

4

5

How is the wind created?

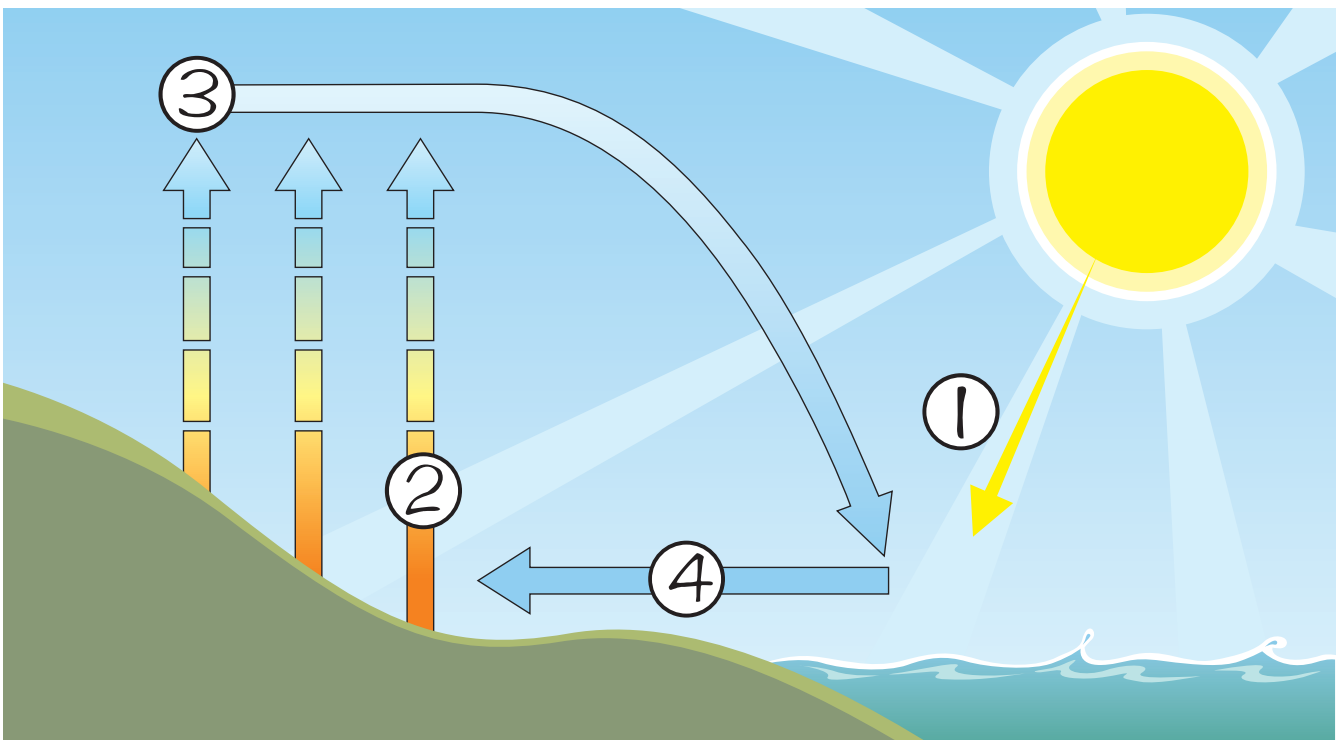
Two things you need to know:

- 1 Land heats up and cools more quickly than the sea
- 2 Warm air rises as it is lighter than cold air, and cool air sinks as it is heavier than warm air.

Now you know points 1 and 2, it is easy to understand how the wind is created.

- 1 During the day the sun warms up the earth
- 2 As the land heats up from the sun, it warms the air surrounding it and that warm air rises high into the sky
- 3 As the warm air gets higher into the sky it begins to cool down
- 4 High in the sky the now cold air moves out to the sea and sinks down pressing cool air towards the land. The cool air above the sea moves in over the land and replaces the warm air that has risen into the sky.

The cool air that moves across the land is the wind.

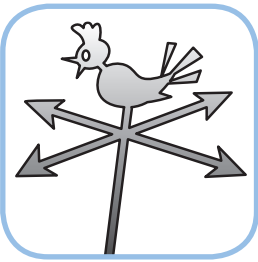


How is wind measured?

The wind can be measured by both its direction and speed.

Direction

The direction of the wind can be determined by using a weather vane or a wind sock.



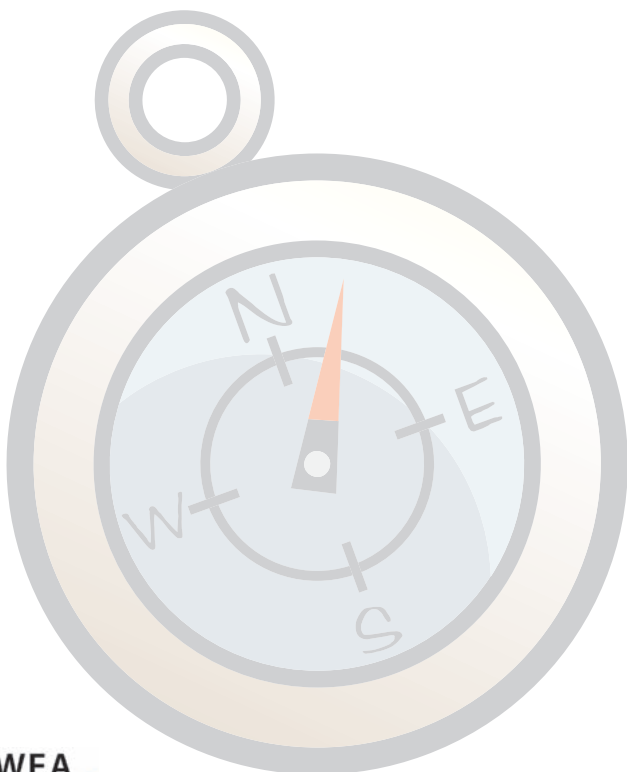
Weather vane

A weather vane is also called a wind vane. It is one of the oldest tools for measuring wind direction. The weather vane works by pointing

in the direction that the wind is blowing. If the head of the arrow is pointing to the west, then the wind is coming from the west.

They can only measure wind a few meters from the ground and are commonly seen on top of buildings such as churches and houses.

How to make your own weather vane.
See Arts & crafts sheet one.



Wind Sock

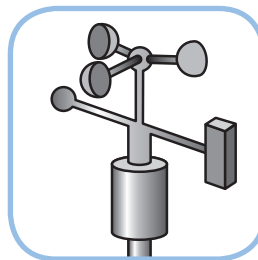
A wind sock, also called a wind cone, shows both the direction and speed of the wind. The direction of the wind is shown when the wind

blows into the larger open end and the sock points the way the wind is blowing. If the sock is pointing to the west, then the wind is coming from the east.

The wind sock can also give an indication of the wind speed. If the sock is flapping about gently then the wind is only light, whereas if it sticks out in a straight line then the wind is much stronger.

Wind socks are commonly found at airports and seaports, but can also be found next to very windy roads.

How to make your own wind sock.
See Arts & crafts sheet two.



Anemometer

An anemometer is the main instrument used to measure wind speed. It has three to four cups which rotate as the wind blows. The speed of the

wind is determined by how many times the cups spin round in a given time. In a strong wind they will spin round very fast.

The Beaufort Scale

The Beaufort Scale is an empirical measure for the intensity of the weather based on wind power – its full name is the Beaufort Wind Force Scale. It was created in 1805 by the British naval commander Sir Francis Beaufort for measuring winds at sea and described how the wind affected the ships and waves. The scale has been adapted for use on land. The Beaufort scale, divides the winds strength into 12 forces:

An empirical measure means that the information is based on observation.

Knots are a measure of speed.

Beaufort scale (Force)	Wind speed (knots, ground level)	Wind speed (miles per hour)	Description	Conditions
0	Less than 1	<1	Calm	No motion. Smoke rises straight up
1	1 to 3	1 to 3	Light air	Wind motion visible in smoke
2	4 to 6	4 to 7	Light breeze	Wind felt on face. Leaves rustle.
3	7 to 10	8 to 12	Gentle breeze	Leaves and small twigs move constantly. Flags will flap lightly
4	11 to 16	13 to 18	Moderate breeze	Small branches move, dust and loose paper raised
5	17 to 21	19 to 24	Fresh breeze	Bushes and small trees sway
6	22 to 27	25 to 31	Strong breeze	Large branches move, the wind whistles in electricity and telephone wires. It is hard to use umbrellas
7	28 to 33	32 to 38	Near gale	Whole trees sway and walking into the wind becomes difficult
8	33 to 40	39 to 46	Gale	Very difficult to walk and tree twigs begin to break from trees
9	41 to 47	47 to 54	Severe gale	Larger branches break off trees, and some small trees blow over. Light damage is caused to buildings such as tiles and chimneys being blown from roofs
10	48 to 55	55 to 63	Storm	Trees are blown over and sever damage is caused to buildings
11	56 to 63	64 to 72	Violent storm	Widespread damage is caused to buildings
12	64 and higher	73 +	Hurricane	Severe devastation is caused

What uses wind to work?

Activity Two

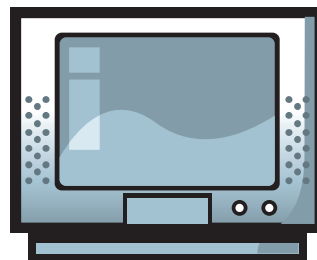
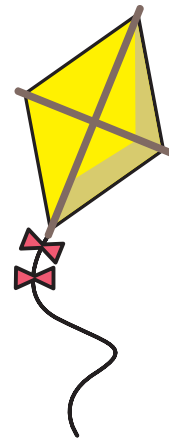
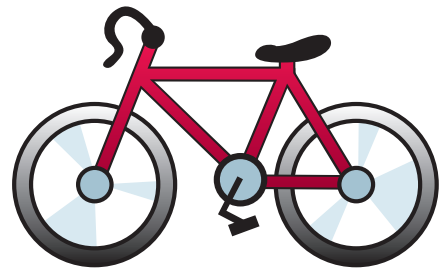
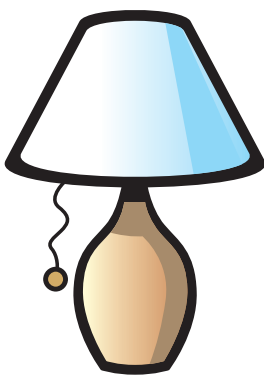
Circle the eight items in the picture that use wind, and then you can colour the picture in.



Did you know wind can be used as a source of energy for electricity?

Energy, generated at power stations, is used everyday to give us electricity and heat.

Can you identify the objects below that need electricity to work.



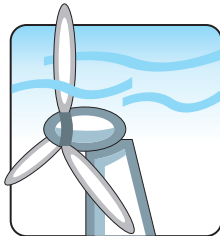
Thinking and discussion point! What have you done/used today that uses electricity?

Sources of energy

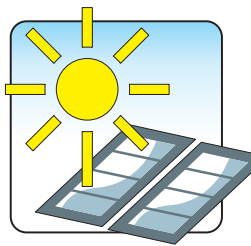
There are two groups of energy sources, renewable and non-renewable.

Renewable

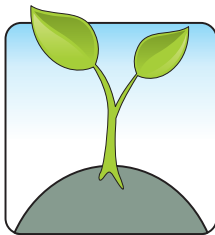
Renewable energy resources are sustainable, meaning they can be replaced and will not run out. They are clean and friendly to the environment.



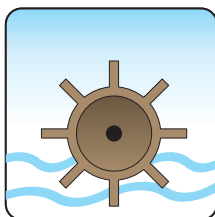
WIND



SOLAR



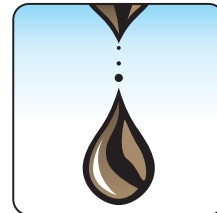
BIOMASS



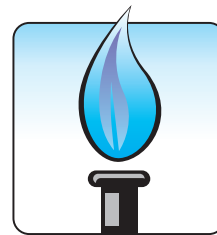
HYDRO

Non-Renewable

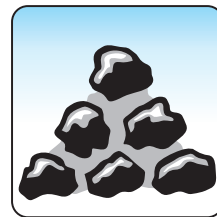
Non-renewable energy resources cannot be replaced once they are all used up. Non-renewable resources can be either fossil fuels or nuclear. This form of energy causes pollution.



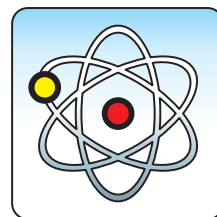
OIL



GAS



COAL



NUCLEAR

Wind energy

People have used wind energy for a very long time. The first windmills were built over 5000 years ago, some were used for grinding stones that crushed grain into flour and others were used to pump water out of wells.

Wind is a renewable source of energy as we will never run out of wind, and it is free as no one can own the sun or the air.

Today, wind energy is also used to generate electricity using wind turbines (modern windmills).

As some places have more wind than others, wind turbines have to be built in good places to catch the wind. This may be on flat land, near the sea or even out at sea. Where there are lots of wind turbines in one place it is called a wind farm. Wind farms on land are called on-shore, when they are out at sea they are called off-shore.

Wind turbines are good for the environment because they produce no harmful solids, liquids or gases. No fuel needs to be transported to them nor does any hazardous or toxic waste need to be taken away from them. At the end of their useful life (typically 25 years) they can be taken down and the parts can be recycled.

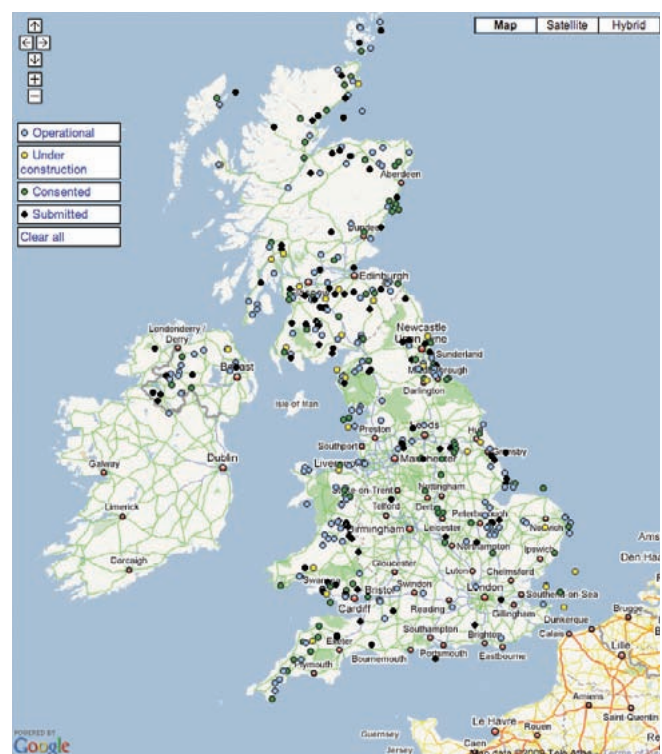
Wind energy has been the world's fastest growing renewable energy source for over seven years. Wind energy is needed to help the world reduce CO₂ emissions and help prevent climate change. As other sources of non-renewable energy are used up, new forms of energy need to be developed to ensure we don't run out of electricity.

Imagine what it would be like if there was not enough electricity to watch tv, play your favourite computer game or even turn the lights on!

World leaders have made an agreement to reduce CO₂ emissions. The UK government has said that by 2010 10% of the UK's electricity must come from renewable energy sources (including wind).

Did you know that the UK is the windiest country in Europe? It is!

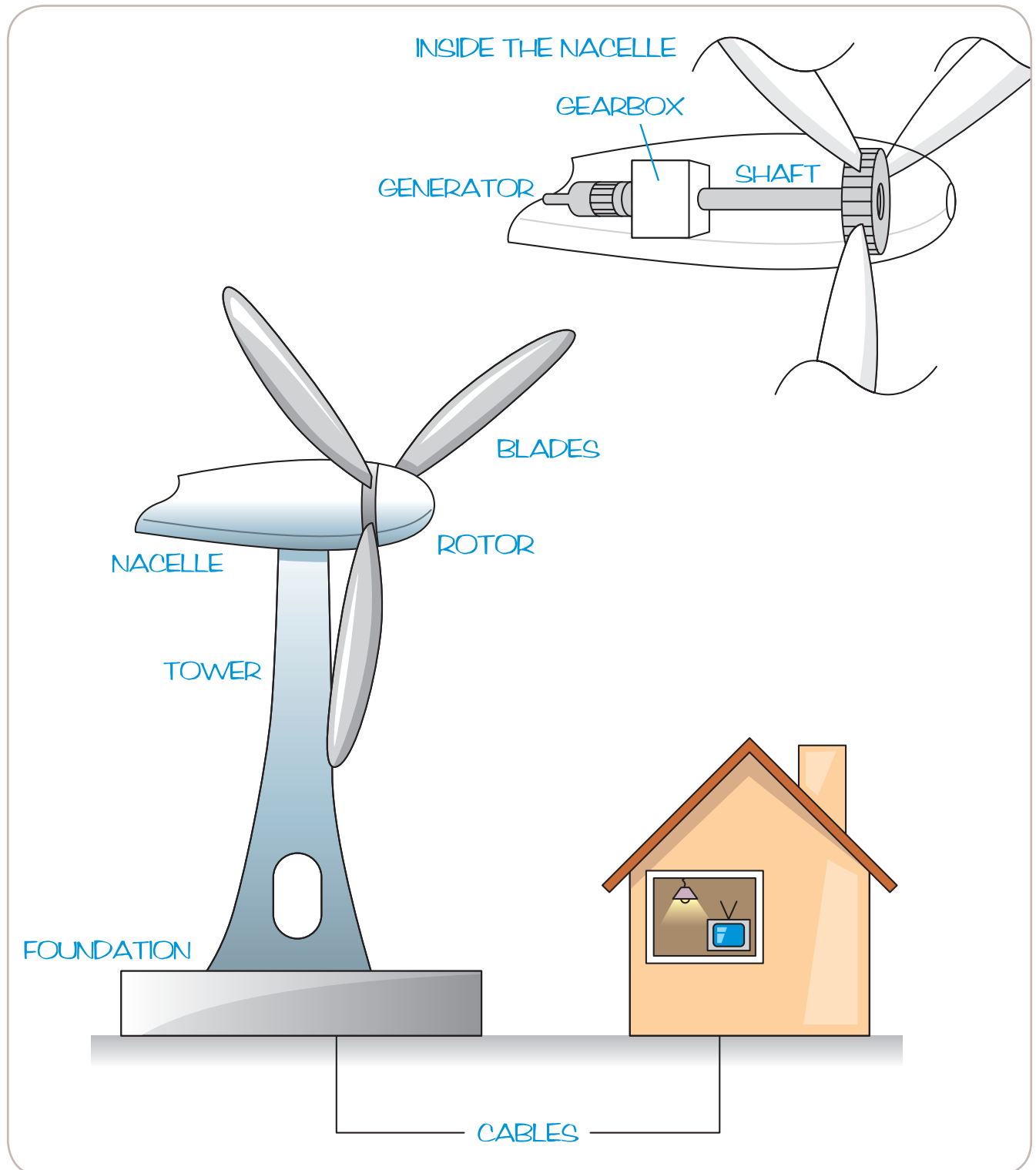
Today there are 211 wind farms in the UK with 2434 wind turbines providing enough electricity to power 2 million homes!



A Wind Turbine

One wind turbine can generate up to 6.5 million units of electricity each year, that is enough to run a computer for 2,250 years!

This picture shows the parts of a wind turbine.



How a turbine works

The blades catch the wind and turn the rotor which they are joined to. The rotor is connected to the nacelle which houses all the workings for the turbine. The rotor turns a shaft which is connected to a set of cogs called a gear box. The gear box is connected to a generator which makes electricity when it turns. Each turn of the rotor is called a revolution. The rotor turns about 22 revolutions per minute (RPM). But in order to generate electricity the generator has to turn 1500 RPM. The gear box converts the 22 revolutions to 1500 revolutions. The electricity is sent down thick cables which run down the tower to the ground. The cables take the electricity to the National Grid.

The National Grid is the network of cables and pylons that distributes the electricity to houses so we can turn lights on and watch tv.

Activity Four

Can you find the words in the box that relate to wind turbines:

R	C	B	G	E	N	E	R	A	T	O	R	J	M	L
E	O	Q	G	H	A	U	J	V	J	X	M	T	L	W
P	L	T	W	L	C	X	D	G	J	C	A	W	K	I
T	Y	U	O	D	E	S	H	L	E	A	M	A	D	N
S	I	B	D	R	L	B	E	V	H	B	J	F	A	D
S	L	C	K	R	L	M	I	R	T	L	E	N	T	T
E	D	L	R	M	E	P	U	G	K	E	S	O	E	U
K	F	K	C	N	B	L	A	D	E	S	H	I	O	R
T	F	A	H	S	J	V	S	F	K	Q	C	T	V	B
R	J	E	Y	V	E	T	Z	J	W	O	V	U	S	I
V	E	J	K	U	K	L	N	S	O	I	X	L	H	N
L	B	W	D	U	E	J	G	E	A	R	B	O	X	E
W	N	G	O	R	F	E	X	K	P	V	N	V	B	L
E	L	E	C	T	R	I	C	I	T	Y	M	E	M	U
B	A	H	B	Q	K	U	H	F	D	Z	G	R	E	C

Words to look for:

Generator

Rotor

Nacelle

Cables

Wind Turbine

Gear Box

Revolution

Shaft

Electricity

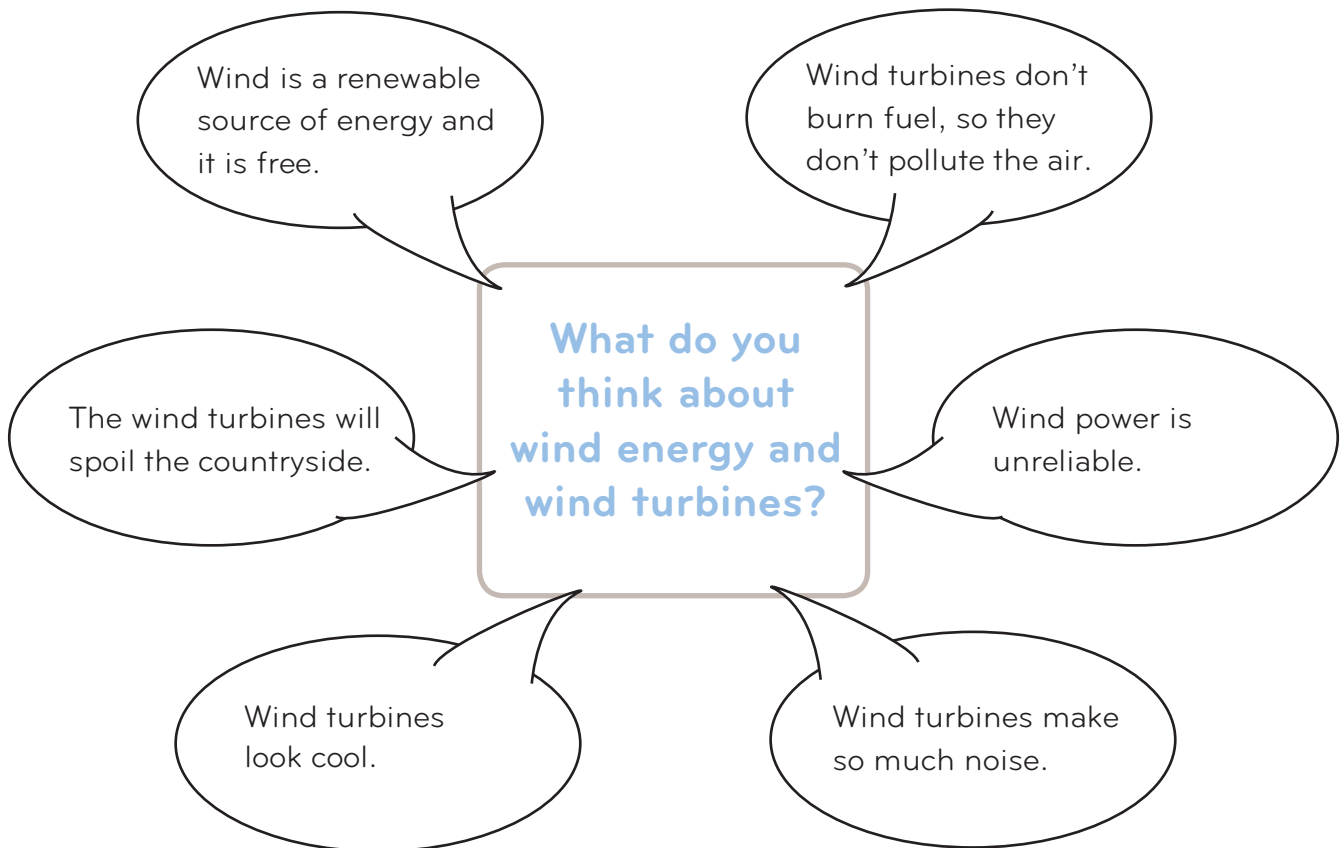
Tower

Blades

Wind power or no wind power?

Activity Five

Despite the benefits of wind power, not everyone thinks it is such a good idea. Take a look at the statements below, which statements do you think are in favour of wind energy, and which are against it. Put a smiley face next to the statement that like wind energy, and a sad face next to those that don't.



Activity Six

What do you think about wind energy? Do you think wind turbines have a place in our countryside?

Write a Haiku to express what you think about wind energy.

A haiku is a form of Japanese poetry. It consists of three lines. The first and last lines have five syllables and the middle line has seven syllables. The poem doesn't have to rhyme; it could just be words that come to mind about wind energy. For example:

Spinning in the wind
Renewable, clean and green
Will never run out

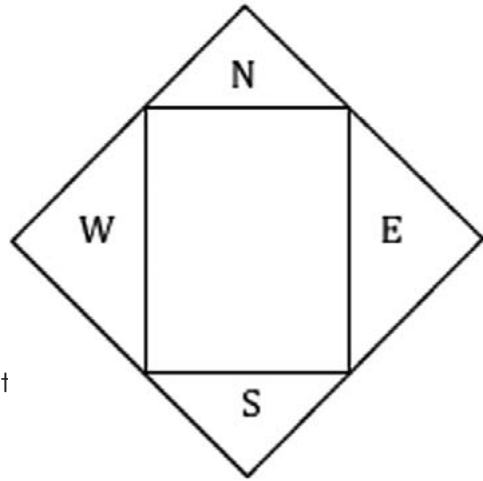
Arts & crafts sheet one

Make your own weather vane

Adult supervision required

You will need:

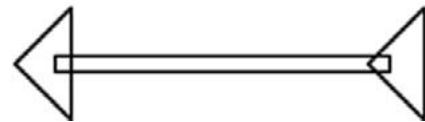
1 berry pin (sewing pin with a bead top) • Scissors
Modelling clay • One plastic pot, container or plant pot
Ruler • Glue stick • Thin card • Drinking straw
2 pencils with a rubber top • Compass



Directions:

- 1 Turn the plastic container upside down
- 2 Make a hole in the center by inserting the pencil, sharp end first.
(You may need to get an adult to help you here.)
- 3 Insert the pencil into the hole making sure it is firmly in place.
- 4 On the card draw two large triangles and four small triangles, and cut them out using the scissors.
- 5 On the four small triangles, write an N, S, E and W, so each triangle has one letter on it, all the same way up. These represent the four points of a compass – North, South, East and West.
- 6 Glue the small triangles onto the plastic container so North and South are opposite each other, and with North facing top, put East to the right and West to the left (just like on a compass).
- 7 Cut short slits into each end of the straw.
- 8 Insert the large triangles into each end of the straws so that they make an arrow shape.
- 9 Push the tack through the centre of the straw and into the eraser on the pencil sticking out of the pot.
- 10 Your weather vane has now been made.
- 11 Take it outside and use the compass to determine which direction is north, and place the pot with the small arrow with the N on it pointing in the direction of North.
- 12 Secure the bottom of the weather vane to a level surface, the arrow will move around in the wind and tell you which way the wind is blowing.

Colour in the card with patterns to personalise your weather vane.



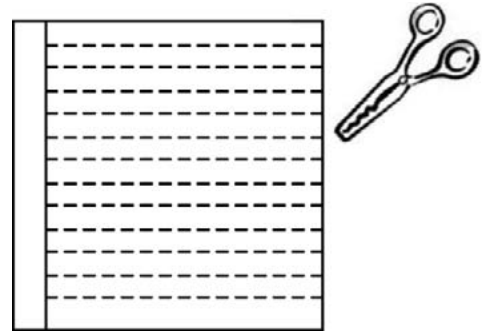
Arts & craft sheet two

Make your own wind sock

Adult supervision required

You will need:

1 sheet of A4 printer paper
 1 sheet of tissue paper 28cm x 28cm
 Glue stick • Sticky tape • Scissors • Hole punch
 1 paper clip • Pencil • Ruler
 1.2m thick, strong thread or kite string
 Pole • Compass



Directions:

- 1 Roll the A4 printer paper width ways to make a cylinder and secure the two short ends together with sticky tape (you may need to overlap them slightly).
- 2 Lay the tissue paper flat on a table and draw a line 3cm from one edge.
- 3 On the opposite side of the paper cut strips 2cm wide up to the drawn line – be careful not to cut the strips off completely.
- 4 Roll the tissue paper to make a cylinder and fit it to one end of the other cylinder by about 2cms and secure it with sticky tape.
- 5 Using the hole punch, punch 3 holes evenly around the edge of the printer paper cylinder (on the edge that doesn't have the tissue paper attached to it).
- 6 With the strong thread, or kite string, cut 3 lengths 25cm long. Thread each one through the 3 holes punched into the printer paper and tie a knot to secure them.
- 7 Tie the three loose ends together and attach them to one end of the paper clip. Attach the remaining length of thread to the other end of the paper clip.
- 8 Tie the wind sock to the top of the pole and push the pole firmly into the ground.
- 9 You have made your wind sock.

Using the wind sock and the compass you can work out which direction the wind is blowing.

You can personalise your wind sock by colouring in the paper before turning it into a cylinder.

Arts & craft sheet three

Make your own windmill

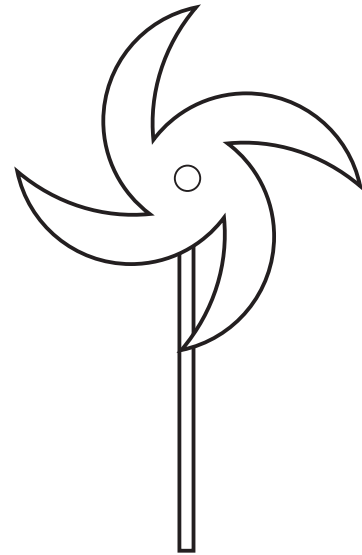
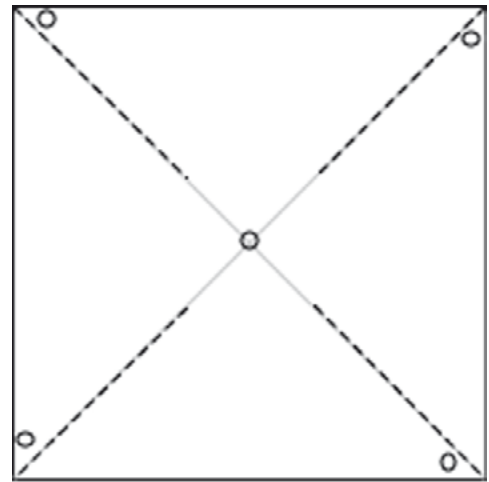
Adult supervision required

You will need:

Thin card or thick paper
 1 berry pin (sewing pin with a bead top)
 2 Pencils, one with a rubber top
 Ruler
 Scissors

Directions:

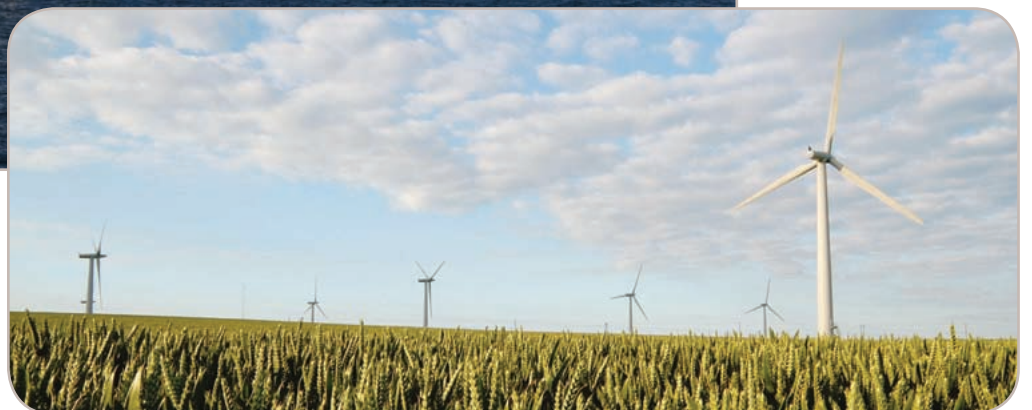
- 1 Cut out a 20cm x 20cm square out of the card or paper.
- 2 Lightly draw a line diagonally across the paper from each corner to the opposite (diagonal) corner.
- 3 Mark the middle of the square (where the two lines cross) and make a small hole. You can use a pencil or the tack to do this.
- 4 Measure 3cm from the hole along each of the diagonal lines and make a small mark with your pencil.
- 5 Cut along each of the diagonal lines from the outside corners to the mark.
- 6 Using a pencil or the tack make a hole on the left top corner of each of the four flaps (see diagram above).
- 7 In turn pick up each flap at the corner with the hole in it, and curl it to the hole in the middle of the square, and thread the pin through the hole, so the head of the tack is on top of the folded flaps.
- 8 Thread the pin through the middle hole.
- 9 Push the pin into the rubber on top of the pencil. Be careful not to push the tack too far through the rubber so it sticks out the other side. If it does, gently pull it back through. You may need to ask an adult to help you this.
- 10 You have now made your windmill – watch it turn by blowing on it or holding it in the breeze.



To personalise your windmill, colour in the card on both sides with your own design.

Arts & craft sheet four

These images show what working wind turbines looks like. Here there are on-shore wind turbines and one image shows some off-shore wind turbines.



Draw your own wind turbine here.



Parent and Teacher Support Notes:

Activity One

Examples include: leaves blowing around, trees swaying, hair being blown about, a sail boat moving across water, flags moving, a kite flying, clouds moving across the sky etc.

Activity Two

List of the items in the picture that use wind.

Hot air balloon, wind turbine, kite, windmill, man on skateboard being pulled by a power kite, sail boat, wind surfer and clothes drying on the washing line.

Activity Three

List of the items that need electricity to work.

Lamp, radio, computer, television.

Activity Four

R	C	B	G	E	N	E	R	A	T	O	R	J	M	L
E	O	Q	G	H	A	U	J	V	J	X	M	T	L	W
P	L	T	W	L	C	X	D	G	J	C	A	W	K	I
T	Y	U	O	D	E	S	H	L	E	A	M	A	D	N
S	I	B	D	R	L	B	E	V	H	B	J	F	A	D
S	L	C	K	R	L	M	I	R	T	L	E	N	T	T
E	D	L	R	M	E	P	U	G	K	E	S	O	E	U
K	F	K	C	N	B	L	A	D	E	S	H	I	O	R
T	F	A	H	S	J	V	S	F	K	Q	C	T	V	B
R	J	E	Y	V	E	T	Z	J	W	O	V	U	S	I
V	E	J	K	U	K	L	N	S	O	I	X	L	H	N
L	B	W	D	U	E	J	G	E	A	R	B	O	X	E
W	N	G	O	R	F	E	X	K	P	V	N	V	B	L
E	L	E	C	T	R	I	C	I	T	Y	M	E	M	U
B	A	H	B	Q	K	U	H	F	D	Z	G	R	E	C

Parent and Teacher Support Notes:

Activity Five

In Favour of Wind –

Wind is a renewable source of energy and it is free

Wind turbines don't burn fuel, so they don't pollute the air

Wind turbines are majestic looking and enhance the countryside

Against wind –

The wind turbines will spoil the countryside

Wind power is unreliable

Wind turbines make so much noise

Other useful sources of information:

1. The Government has produced a Cross-Curricular programme for schools called 'It's Only Natural'. Here you can download the education programme which contains information cards, activity sheets and posters for school children. You can view these here: www.berr.gov.uk/energy/sources/renewables/schools/teaching-resources/cross-curricular/page23360.html
2. Wind with Miller is a website on wind energy for children developed by the Danish Wind Industry Association. Here children can learn about wind energy, wind turbines and meteorology.
www.windpower.org/en/kids/index.htm
3. www.ecofriendlykids.co.uk/RenewableNonRenewableSources.html
4. www.edfenergy.com/powerup/keystage3/index.html

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