Moorabool Wind Farm

GOLDWIND







What is the wind?

Wind is the movement of air.



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



How is wind measured?

The wind can be measured by both its direction and speed. The direction of the wind can be determined by using a weather vane or a wind sock.







Anemometer

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.

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.

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 it's 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	34 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 and higher	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.



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 onshore, when they are out at sea they are called off-shore.

Moorabool Wind Farm is one of many wind farms across Victoria and Australia.

Goldwind is aiming to power 1 million homes by clean renewable energy by 2020

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 then generates electricity when it turns
- Each turn of the rotor is called a revolution. The rotor turns between 6-12 revolutions per minute (RPM). But in order to generate electricity the generator has to turn 1500 RPM. Magnetic discs convert the 6-12 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 Electricity Grid
- The Grid is the network of cables and pylons that distributes the electricity to houses so we can turn lights on and watch tv.

Find-a-word

Activity Four

Cables

WindTurbine

r	с	b	g	е	n	е	r	а	t	ο	r	j	m	I
е	ο	q	g	h	а	u	j	v	j	x	m	t	I	w
р	Т	t	w	Т	с	x	d	g	j	с	а	w	k	i
t	у	u	ο	d	е	s	h	I	е	а	m	а	d	n
s	i	b	d	r	I	b	е	v	h	b	j	f	а	d
s	Т	с	k	r	I	m	i	r	t	I	е	n	t	t
e	d	I	r	m	е	р	u	g	k	е	s	ο	е	u
k	f	k	с	n	b	I	а	d	е	s	h	i	ο	r
t	f	а	h	s	j	v	S	f	k	q	с	t	v	b
r	j	е	у	v	е	t	z	j	w	ο	v	u	s	i
v	е	j	k	u	k	I	n	s	ο	i	x	I	h	n
I	b	w	d	u	е	j	g	е	а	r	b	ο	x	е
w	n	g	ο	r	f	е	x	k	р	v	n	v	b	I
е	I	е	с	t	r	i	с	i	t	у	m	е	m	u
b	а	h	b	q	k	u	h	f	d	z	g	r	е	с

Gearbox

Revolution

Shaft

Electricity

Tower

Blades

Can you find the words in the box

that relate to wind turbines?

Generator

Rotor

Nacelle

тір неіднт **169m**

rotor diameter

HUB HEIGHT

TOP SECTION L: 25m W: 4.2m H: 4.2m Wgt: 50.6t

SECTION IV ← L: 24.4m W: 4.6m H: 4.6m Wgt: 59.6t

SECTION III --L: 18m W: 4.6m H: 4.6m Wgt: 59.9t

SECTION II L: 14.2m W: 4.6m H: 4.6m Wgt: 64.8t

BOTTOM SECTION L: 16.1m W: 4.6m H: 4.6m Wgt: 104.9t

TOTAL TURBINE WEIGHT

104 TURBINES (NORTH 50, SOUTH 54) MOORABOOL Wind Farm

TURBINE MODEL

OPERATIONAL WIND SPEED 2.5m/s (10kph) to 20m/s (77kph)

GENERATOR length 5.7m weight 89,000kg

> NACELLE length 10.1m weight 42,000kg

The SWEEP AREA of the blades is 14,700m² which is the equivalent to 56 tennis courts

HUB length 5.3m weight 42,000kg

Total Energy Generation is up to 312MW. This equates to up to 200,000 average VIC homes which is approx. 9% of Vic homes

• BLADE length 66.9m weight 20,000kg each

> 55km ACCESS TRACKS



55 **CONNES** in each foundation

CONCRETE 560m³ per turbine (up to 1300t)

July 2020

Parent & 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

- 1. Hot air balloon
- 2. Wind turbine
- 3. Kite
- 4. Windmill
- 5. Man on skateboard being pulled by a power kite
- 6. Sail boat
- 7. Wind surfer
- 8. Clothes drying on the washing line.

Activity Three

- 1. Lamp
- 2. Radio
- 3. Computer
- 4. Television

Activity Four



MOORABOOL

Wind Farm

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