Wind Turbines

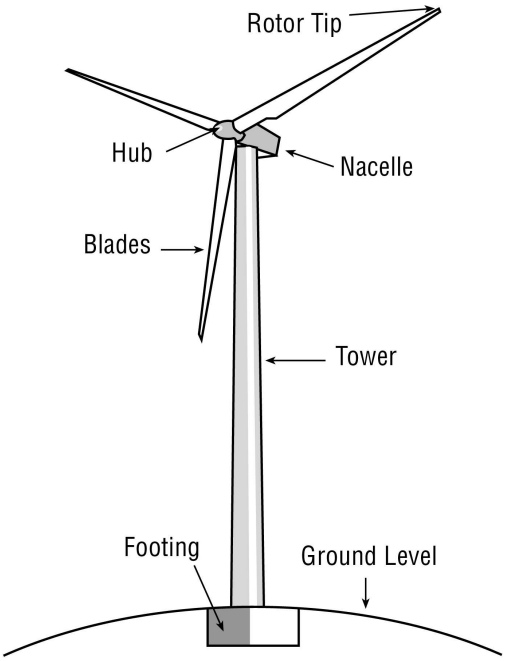
Above: Close up view of a turbines blades, nacelle, hub and rotor.

How does a wind turbine work?

A wind turbine is comprised of a tower, topped by an enclosure called a nacelle which holds the propeller-like structure known as the rotor.

Air flows past the turbine causing the rotor to turn. The rotational energy is transferred via a gearbox to the generator. The generator converts the rotational energy to electricity.

Wind turbines have three blades attached to a nacelle which can turn to face into the wind. The nacelle is designed so that it can rotate around the shaft allowing the turbine to produce electricity regardless of wind direction.



A typical modern wind turbine structure

How do the blades turn?

The rotor turns as the wind pushes past the blades. The turbine rotation is maintained at a constant speed, as the wind blows.

Wind turbines will start to turn generally at wind speeds of 4 metres per second (14 km/hr). Most turbines reach maximum power output at a wind speed of around 15 metres per second (54 km/hr).

The blades of a 2 megawatt turbine turn at up to 17 revolutions per minute (rpm).

At gale force winds of about 25 metres per second (90 km/hr) and above, wind turbines are shut down so they are not damaged. The blades of a wind turbine generally turn in a clockwise direction.

What are wind turbines made of?

Wind towers in Australia have been built up to 80m tall to hub height. Wind turbines operate most effectively in harnessing strong and consistent winds.

The length of blades and tower height depends on the site and the characteristics of the wind. Modern blades are generally between 35 to 40m long.

Towers are mostly made of steel tubes and are held in place by concrete footings. The rotor blades are made from light composite materials such as fibreglass.

Left; Turbine hardstand being constructed. Right; Nacelle and hub ready to be lifted onto the turbine tower.

Turbine foundations:
Each tower base is anchored into position by 300m³ cubic meters of concrete. Concrete foundations measure 13.7m x 13.7m and are approximately 1.5m deep.
Turbine hardstands:
Hardstands are about 20m by 35m.
Hardstands support assembly and lifting equipment for installing the turbines.
Turbines:
Each turbine consists of 4 main components: tower, nacelle, hub, blades and at Waubra range between 110-120 meters high.

For more information please call the Community Relations Coordinator on Freecall 1800 283 550
ACCIONA Energy PO Box 2582 South Melbourne Victoria 3205
March 2009

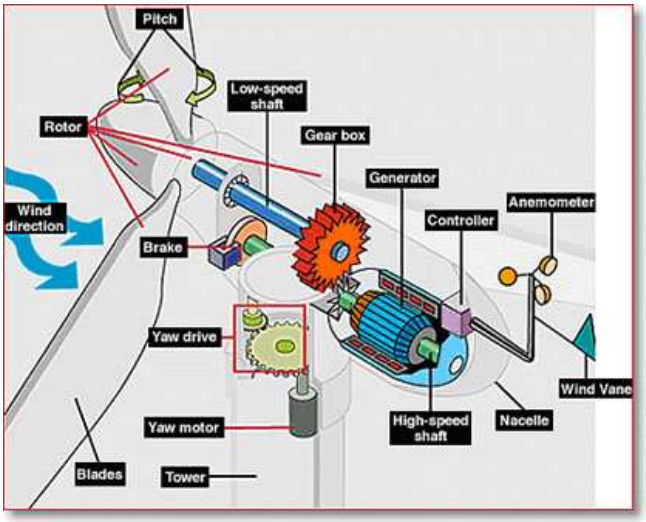
Tower:
The steel towers are produced by local Portland company Keppel Prince Engineering & Haywards Engineering in Tasmania. The Haywards towers are shipped to Portland and transported on trucks from Portland to Waubra and arrive in three sections.
Nacelle & hub:
These components are produced in Pamplona, Spain. They are shipped from Pamplona to the Port of Melbourne and have a combined weight of approximately 65 tonne.
Blades:
The blades are manufactured by Tecsis in Brazil and shipped to Portland. Blades are of fibreglass construction, weigh up to 6 tonnes each and come in 2 rotor sizes: 77 & 82 meter diameter.

How much electricity can a turbine produce?

Early wind turbines in Australia were capable of producing 650 kilowatts to 1300 kilowatts of power.

Modern wind turbines are capable of generating 2-3 megawatts of electrical energy at full power. The amount of electricity provided depends on the type of turbine and the wind conditions.

A single 2 megawatt turbine would provide sufficient electricity to power approximately 1,000 homes, and save over 7,000 tonnes of greenhouse gas emissions per year.



Workings inside a typical nacelle

How does the energy get to the power grid for use in homes and businesses?

Once electricity is generated by a wind turbine, it travels via a 12kV underground, cabled network from the base of every turbine to collector stations. There are five collector stations at the Waubra Wind Farm servicing five separate turbine groups.

Collector stations collect and convert the voltage of the electricity generated by the turbines from 12kV to 66kV. This means the electricity is now at a voltage where it can be exported more efficiently to the next stage of transformation.

Once converted to 66kV the electricity travels from each collector station via 66kV overhead powerlines to meet at a switching station on Troy's Road, Waubra (pictured). The switching station ties together the five 'feeds' of 66kV from the individual collector stations into two 'feeds' which go on to the terminal station.

The terminal station (below) is the largest of the two stations on Troy's Road. The terminal station converts the 66kV power to an extremely high voltage of 220kV, which is the required voltage for connecting to the Australian National Power Grid.

We welcome your contact for information or feedback about any of our activities.
Please call the freecall number 1800 283 550 or fax 9686 6120
Visit the Waubra Wind Farm Website
www.waubrawindfarm.com.au
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