

## FACT SHEET - WINDMILLS

### MEANINGS:

Windmills use the energy of the wind.

A windmill is a machine that converts the energy of wind into rotational energy by means of vanes called “sails”.

Originally windmills were used for milling (grinding) grain into flour for food production. Then its uses expanded to pumping water either to drain water from the land or to extract water from under the ground.



However, the concept of using power from the wind was adapted to do many different jobs, e.g. wind turbines produce electricity. Wind is one of the fastest growing industries of renewable energy.

### HOW DOES A WIND TURBINE DIFFER FROM A WINDMILL?

A wind turbine is a tower that converts kinetic energy from the wind into mechanical energy known as wind power. If the mechanical energy is used to produce electricity, then the tower is called a wind turbine. If the mechanical energy is used to drive machinery for grinding grain or pumping water, then the tower is called a windmill.

### EARLY HISTORY:

Although “sails” had been used to move ships at sea, it was the Persians who converted the use of wind for grinding grain between 500 and 900 A.D. They attached several “sails” to a shaft that was connected to a grind-stone or pump that was housed in a building. Windmills first appeared in Europe at about the time of the Crusades (1096-1270) but the design was different to the Persian model. The first known windmill to be documented in China was in 1219 A.D. It, too, was used for grinding grain.

*For photos and more information refer to [telosnet.com/wind/early.html](http://telosnet.com/wind/early.html)*



## AUSTRALIAN HISTORY:

Windmills appeared in Australia in the later part of the 1800's. The first to appear were the large European type windmills used for milling purposes but unfortunately, they were too expensive to build and not suited to providing water in the outback.

As the land was cleared for pastures and gold discovered, it was water or rather the lack of it that influenced the design and production of windmills. A cheaper, less powerful windmill was required to water to stock, farms, goldfields and emerging country towns.

For people, stock and crops to survive in the harsh arid conditions of Australia, a continuous supply of water is required. It was the windmill that provided a permanent water supply to the early settlers of Australia. The windmill became so common throughout Australia that it became an icon of the Australian bush.

A number of factors have resulted in a decrease for the demand for windmills. Alternative pumping systems, the introduction of water schemes, and the fact that windmills were well constructed and proved to be very reliable. Some windmills built over 50 years ago are still operating and still pumping water up from under the ground. However, only a handful of Australian windmill manufacturers exist today. The original windmill that dotted the Australian landscape can no longer be produced owing to increased health and environmental standards. The foundries that produced the old cast windmills were closed down and a new welded gearbox took its place.



## TYPES OF WINDMILLS:



**Windmills come in many shapes and sizes depending on their use.**

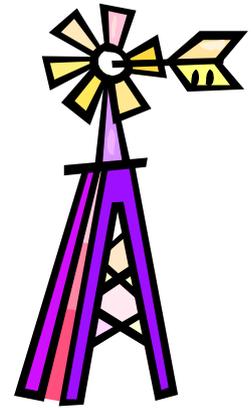
There are two classes of windmill - those with **horizontal axis** and those with **vertical axis**. The vertical axis design was popular during the early development of the windmill but it was inefficient and this led to the development of numerous horizontal axis designs.

The earliest of the horizontal axes windmill was the Post Mill. It was named after the large, upright central post which enabled its head to rotate so that its "sails" could always face in the direction of the wind. The development of the Post Mill made windmills more efficient because windmills rely on wind for power and without wind they are powerless.

However, to keep the post stable a support structure had to be built around the central post for stability. Generally, this structure was built off the ground to prevent rotting.

## HOW DOES THE ORIGINAL WINDMILL WORK?

Windmills have blades that are referred to as “sails”. A shaft connects the “sails” to a wheel, grindstone or rod at the base of the windmill. The “sails” catch the wind which in turn rotates the shaft that connects to the wheel, grindstone, or rod at the base. This movement results in the grinding of grain, pumping of water or moving a blade to saw wood.



## WHY ARE WINDMILLS USEFUL?

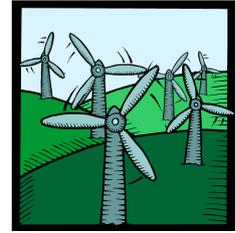
**Windmills used for grinding** tend to be larger than other types of windmills because they need space to house the grinding stone.

Today windmills are generally used for pumping water or generating electricity.

**Windmills that pump water** are called wind pumps and are used in dry and arid places to pump water from under the ground. The wind pump has blades, a pump rod and a piston. When the “sails” catch the wind they rotate. This causes the pump rod to rise and fall. The pump rod makes the piston rise drawing water from below ground. A special valve in the piston closes and does not allow the water out. As the piston rises it pumps water through hoses or pipes to irrigate plants or to a storage tank for use later on. As the piston lowers the valve opens so that more water can be collected. This action continues to happen as long as the “sails” are rotating.

A windmill that produces power is often called a **wind turbine** and these are the type that you see on wind farms. Wind turbines work very similarly to wind pumps. The blades catch the wind and begin to rotate. This action rotates a drive shaft which connects to a gearbox that is attached to a generator at the windmill base. The gearbox converts the slow turning of the “sails” into quicker revolutions which create more kinetic energy. The generator turns this kinetic energy into electricity which is collected and distributed through wires into surrounding homes or industries.

All windmills are based on elementary physics. We know that Energy is neither created nor destroyed but it is only transformed or changes form. We also know that Newton’s third law of motion is that for every action there is an equal or opposite reaction. Both these principles are at work when a wind turbine converts kinetic energy into electricity.



## WIND TURBINES:

### Advantages:

- Wind is renewable energy.
- Reduces pollution.
- Clean and environmentally friendly.
- Water is not required for cooling or generating electricity like nuclear or fossil fuels.
- Good for people in remote areas with no other form of electricity available.
- Once installed there is only a small maintenance cost.
- The area surrounding the turbines can still be used for farming.

### Disadvantages:

- Amount of wind available throughout the day constantly changes. No wind, no electricity.
- Manufacturing wind turbines requires steel, concrete and aluminium. These things require lots of electricity to produce.
- Wind turbines are very large and many people think that they are an eye-sore.
- The turning of the wind “sails” makes a lot of noise and people have complained about the effect wind turbines have on their health so they cannot be built near populated areas.
- Fairly expensive to build.



## INTERESTING FACTS:

- Windmills have been around for centuries. The earliest recorded windmills were used in Persia to grind corn.
- It is said that “windmills built the Netherlands”. Windmills in the Netherlands pump water from the land into canals that take the water back to the sea. Without these windmills parts of the Netherlands would be flooded and farmers would never have grown fruit, vegetables and tulips.
- Windmills can be constructed on site using hand tools.
- Windmills were largely replaced as a power generating structure when steam power was harnessed during the nineteenth century. However, in recent years windmill technology is making a comeback and the wind turbine is being touted as an important alternative to the use of fossil fuels in the future.