

# WIND POWER

The UK has the largest potential wind energy resource in Europe. This potential has yet to be fully realised. Wind energy applications in the UK range from small battery charging applications producing useful electricity remote from the electricity distribution network, to large wind farms producing electricity competitive with conventional power stations. The cost of wind power can be competitive with conventional energy sources but there are concerns about visual impact, noise pollution, and effects on local wildlife that must be addressed before they are developed further in the UK.

## Winds of change...

Wind power has been used for thousands of years to mill grain or pump water. Since the Industrial Revolution the huge increase in use of fossil fuels and nuclear power has meant the number of windmills and wind pumps has dropped considerably. Today, however, there is a new generation of machine called a wind turbine, which can harvest the power in the wind to generate electricity. Wind turbines can be used at the small scale for stand-alone systems (not connected to the mains electricity) or at a much larger scale in wind farms.

## Did you know...?

We currently get less than 1% of electricity from wind but it could provide up to 20% of the UK's electricity needs.

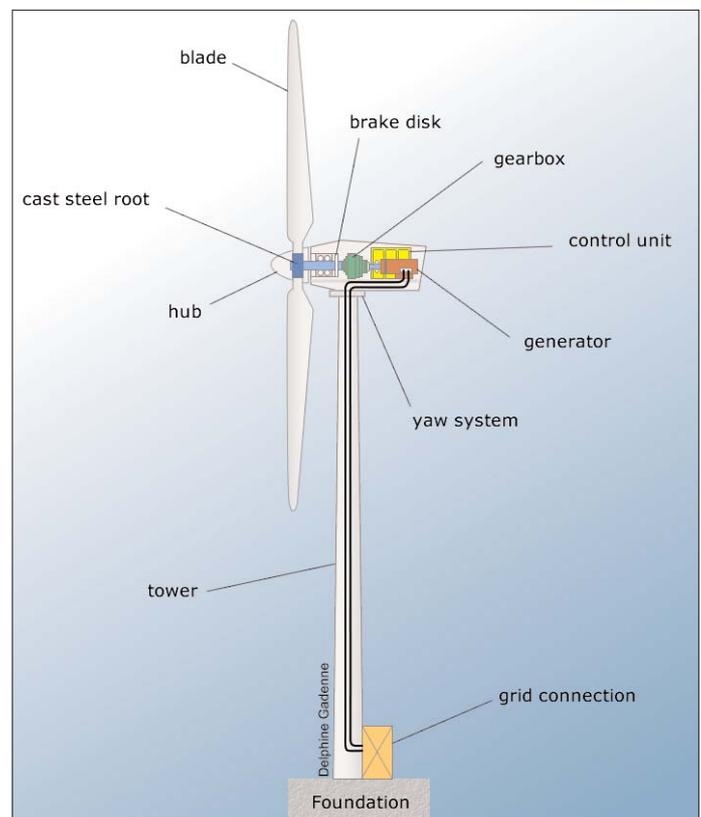
## The Resource

Wind is a free and renewable source of energy. The power of the wind varies a lot throughout the year and is typically stronger in the winter than in the summer. The United Kingdom is an island and so it is one of the windiest countries in Europe. Generally speaking, wind speeds are higher in the west of England, because the prevailing wind direction is west to east. Wind speeds can be influenced by a number of factors such as the landform (For example mountains, hills, valleys or plains), the ground cover (Trees, buildings etc...) and, of course, the weather. Wind is also typically stronger during the afternoon and weaker at night. The windier a site is the more electricity can be generated meaning it is more economically viable to invest in wind turbines. Nature can offer us clues concerning good locations for wind turbines; leaning trees can give us an indication of prevailing wind strength and direction. Wind

speed is measured using an anemometer, which typically has three cups on a vertical axis that catch the wind. The number of revolutions of the cups is registered electronically and converted to wind speed. For commercial projects wind speed is typically measured for up to 12 months on site. The data gathered is then related to long term weather records at the nearest meteorological station.

## How does it work?

Wind turns the blades of the wind turbine generator. The blades are attached to the hub which is attached to the gear shaft. When the wind blows, the blades and hub turn the shaft, which rotates inside the generator and produces electricity. The amount of power generated depends on the



Above: Diagram of a large wind turbine

size of the blades and the swept area, the wind speed and wind availability. The blades of large wind turbines are made from glass fibre or wood epoxy, they measure anywhere from 30-60 metres in diameter. The supporting steel towers measure 25-60 metres high. The foundations can be up to 3.5 metres deep and 12 metres across, and are covered with topsoil to enable agricultural activities to continue right up to the base. The electricity generated is carried away by cables running underground to a substation from where it is fed straight into the electricity distribution network.

### Large scale applications

Where wind turbines are used for large scale power generation large turbines are often grouped together in a wind farm. The first commercial wind farm in the UK was at Delabole, North Cornwall, and came into operation in 1991. There are now 60 wind farms in the UK supplying power to the equivalent of 250,000 homes.

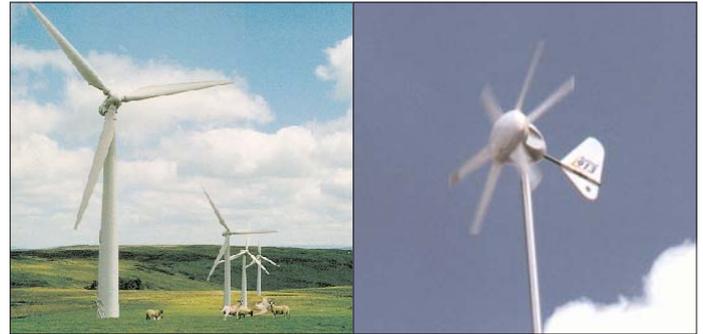
The actual installation of wind farms can be carried out in a very short time, however, the preparation time leading up to installation can take much longer. This would include wind speed surveys, assessment of the topography and environmental effects, as well as discussion with the local population and planners. Offshore wind farms offer an alternative, one which the UK Government is investing in. The wind resource is larger and more predictable offshore but the installation costs can be higher.

### Small scale applications

Small wind generators are often used for stand-alone applications i.e. areas that require power but are not connected to the mains electricity. A good example would be on a caravan where a wind turbine would be used to recharge batteries. Another example would be on a farm in a remote rural area not on the electricity mains.

Small scale applications often use wind and solar power together to produce electricity. This can

be more reliable, as the sun would generate electricity when it was not windy and vice versa.



Above: Wind farm and stand-alone system

### Environmental Impacts

Wind power produces no pollutants or emissions during operation. However, negative environmental impacts can occur with large scale applications. The main area is visual impact; one of the most contentious aspects when siting wind farms. It is an unavoidable fact that the windiest places are often the most beautiful. Noise pollution has also been a problem, however, new designs have reduced this significantly. There is also concern about the affect on wildlife in an area where a wind farm is sited, for example there is concern that local bird populations could be affected, but little evidence of such cases. After the useful life of a turbine has elapsed, foundations can be reused or removed completely. The scrap value should cover the costs of restoring the site to its original condition.

### Competitive with conventional sources?

It is possible to produce electricity from wind for as little as 2 pence per kWh, comparing favourably with the cost of electricity from conventional sources. Overall, wind energy projects are simple, clean and cheap to maintain. The land can still be part of the agricultural system and jobs are often created both in the short and long term in the building and maintenance of the turbines. There are, however, concerns about their impacts that must be addressed in order for them to be part of a future sustainable energy supply.

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**Sponsors:** The National Energy Foundation, The Department of the Environment Transport and the Regions, Student Force, PowerGen

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