NFU Energy wind energy guide

Over the last few decades, farmers and a growing wind power sector have begun to make use of the UK's geography and take advantage of the fact that we are one of the windiest countries in Europe.

British farmers have been harnessing the wind's energy for centuries. However, generating electricity has only been developed more recently, with the first commercial wind farm built in 1991 in Cornwall.

How does wind energy work?

Wind is essentially the movement of air across the earth, caused by the sun heating the earth, which in turn causes hot air to rise and cold air to sink down and replace it. The movement of the air, and changes in air pressure are what cause winds to blow.

Wind turbines capture this kinetic energy with their blades, and rotate, turning it into mechanical energy, which spins a generator to generate electricity. Like any generator, a wind turbine can be very small or very large; some of the largest turbines will have individual blades that are more than 100m long. The greater the rotor diameter, the more energy can be harnessed.

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WIND ENERGY IN THE UK

There are currently more than 8,500 onshore wind turbines in Britain, and over 2,000 offshore. In total nearly 25% of the UK's electricity in 2020 was generated by wind power, second only to gas, and considerably more than any other renewable source. We have some of the largest offshore wind farms in the world. The offshore turbines are typically much larger given the space available and economies of scale. Thanks to shallow seas we have lots of space available for development, and we are also beginning to see floating turbines in production which will allow the industry to move into deeper and deeper water.

Agriculture is well suited to harnessing onshore wind power in locations where good average wind speeds coincide with nearby electricity demand and space for development. For that reason, many agricultural businesses have hosted wind farms since the late 1990s, and installed their own turbines with the introduction of small-scale renewable energy incentives from 2010 onwards. Since 2015, onshore wind turbine developments have slowed considerably due to changes in planning policy and their removal from the Contracts for Difference (CfD) incentive scheme. However, with onshore wind back in the next round of CfDs at the end of 2021, and some wind farms being developed without any subsidy, things may be beginning to change.

IS IT STILL WORTHWHILE?

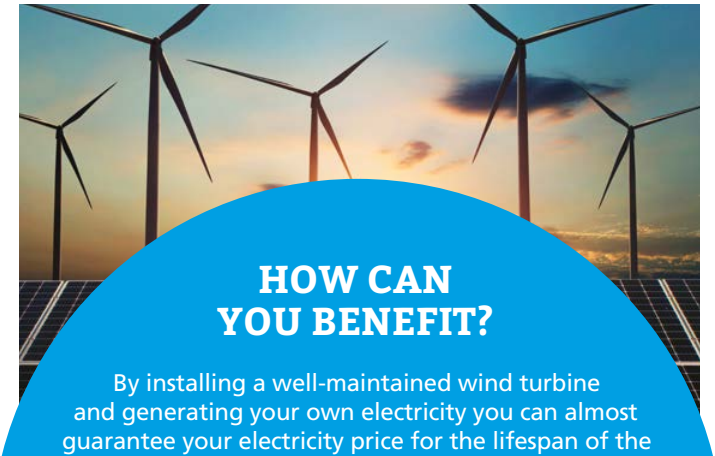
Previously, the Government's Feed-in Tariff (FiT) incentive scheme (2010-19) provided small-scale renewable electricity generators a payment per kWh of electricity generated. Larger scale wind power developments benefited from the Renewables Obligation (2002-2017), a scheme based upon tradeable certificates. Both of these schemes increased the financial benefit of a development beyond the value of the electricity generated, in order to offset the relatively high capital costs. With only limited support now available for large-scale wind power, the financial returns from renewable electricity developments must be considered much more carefully. That said, like most renewables, if you are using the electricity you generate at source, you will likely see some good savings as opposed to buying grid supplied electricity.

CONSIDERATIONS

Nearly all wind turbines installed in the UK will need planning permission; only very small ones are covered by Permitted Development rights. The planning process involves community engagement to allow local communities to voice their opinion for onshore wind power developments. There are numerous planning considerations in local/regional/national planning policy – including sites near Public Rights of Way, designated landscapes, ecological and ornithological sites, etc.

Other things that will need to be considered in the development stage of a project include:

- Siting of the turbine(s) – Average wind speeds, local topography and turbulence
- Aviation Radar Interference with commercial or military systems
- Acoustic modelling
- Shadow Flicker



HOW CAN YOU BENEFIT?

By installing a well-maintained wind turbine and generating your own electricity you can almost guarantee your electricity price for the lifespan of the turbine, try to avoid rising costs in grid supplied electricity, and lower the carbon footprint of your farm business. This is particularly useful for agricultural enterprises with a large electrical demand.

Alternatively, you can work with an independent developer of wind farms or small clusters of turbines, who will pay the landowners 'rent' for having wind turbines on their land. This would be covered by an initial option agreement, followed by a lease, with a minimum rent determined by the capacity of the turbine/s and generally paid as a fraction of gross income from electricity sales.

GRID CONNECTION

As with any electricity generation, there must be the capacity in the local electrical network sufficient to be able to take the additional load. The Distribution Network Operator may ask you to pay for the necessary upgrades to obtain a generation connection agreement. If grid reinforcement costs make a project financially unviable, it may be possible to obtain flexible connection options that allow you to generate on your site for your own use, but without the capability of exporting power to the grid – Export Limitation. In this instance a control system will monitor the generation, and reduce this to meet your demand, or switch off the generator.

MAINTENANCE

Most wind turbines are fairly complex pieces of electro-mechanical equipment, subjected to quite a harsh working environment. Ongoing maintenance is essential, and it is likely that there will be periodic failures of electrical or mechanical components that will need replacing.

PERFORMANCE

Turbines should be sited where they will perform most efficiently. Turbine models are usually designated for certain wind speeds, some will be able to cope with higher wind speeds, and therefore, increased forces more than others. Siting is often down to a mix of the planning considerations, financial installation considerations and performance.

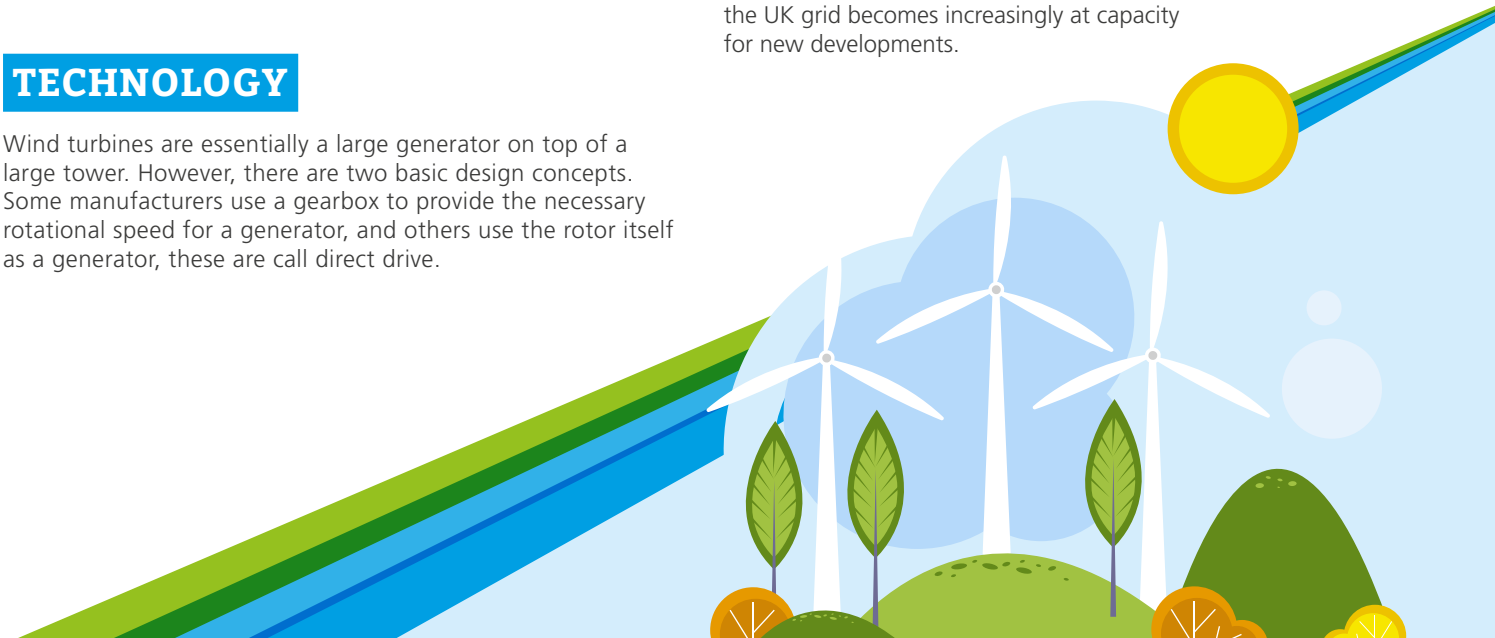
TECHNOLOGY

Wind turbines are essentially a large generator on top of a large tower. However, there are two basic design concepts. Some manufacturers use a gearbox to provide the necessary rotational speed for a generator, and others use the rotor itself as a generator, these are call direct drive.

THE FUTURE OF WIND ENERGY

Like all renewables there are advantages and disadvantages. Wind turbines are highly visible and not always a popular addition to the landscape, and they only generate electricity when the wind is blowing. However, they occupy relatively little land area, and the intermittency or variability of their output can often be managed on the local electric network or else buffered with energy storage. The future looks strong for wind energy, especially offshore, but onshore wind power has a significant role to play, too, notably in meeting local electricity needs.

Developers and installers are looking increasingly at how electricity generation sites in the UK can be used more efficiently, making optimal use of existing grid capacity. In some cases, sites with large scale solar and wind power can be twinned together, with complementary output on a daily and seasonal basis. This co-development may be something we begin to see more of as the UK grid becomes increasingly at capacity for new developments.



FAQs

How much does it cost to buy a wind turbine?

As you can imagine this varies greatly depending on the size – farm wind turbines in the range 5kW – 500kW would typically cost from around £30,000 to £1.5million.

How much electricity can one wind turbine generate?

Again, the size of the turbine can vary hugely, as can the amount of wind it is exposed to. A medium-sized 80kW turbine on a farm may generate around 250 MWh (megawatt-hours) per year, while smaller and larger turbines may have annual output from 30 MWh to 1750 MWh. The largest offshore wind turbines can generate 300 MWh of electricity in a single day!

How do I know if my site is suitable for wind turbines?

Site selection is often a compromise between the best siting for the turbine in terms of generation, and a balancing act with various grid connection and planning considerations.

How much land do I need?

Compared to technology like ground mounted solar, not that much for the foundations – roughly the size of a small or large swimming pool; however, you will also need an access road to a turbine for installation and servicing. The benefit is that animals can graze underneath and crops can be grown just a short distance away from the base.

Are wind turbines noisy?

The blades moving through the air do produce some aerodynamic noise, but mechanical noise is generally minimal; this will have to be modelled during the planning stages of a project to check that they are under certain limits. Electrical kit may use cooling systems and so there may be some very localised noise in the running of these as well.

How long will a wind turbine last?

Most turbines should have a design lifespan of 20 years, but with regular maintenance, including major overhauls, a 30-year working life may be possible.

Can I sell any extra energy produced back to the grid?

Like any generation, yes, so long as you have an agreement with your Distribution Network Operator (DNO) to export electricity and a Power Purchase Agreement or Smart Export Guarantee in place. You will need to set up export metering to be able to be paid for this energy.

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