

# Renewable energy

## Factsheet

### Small scale wind energy

#### Introduction

Harnessing wind as a renewable energy source involves converting the power within a moving air mass (wind) into rotating shaft power which in turn generates electricity.

#### Wind energy resources

In the UK we have a large potential wind resource. Although we have 40 per cent of Europe's total wind energy resource, it remains largely untapped, currently meeting only 0.5 per cent of our electricity requirements.

Power from the wind is proportional to the wind speed. Therefore relatively minor variations in wind speed can result in large changes in potential output.

Individual turbines vary in size and power output, ranging from a few hundred watts to 2-3 megawatts. Uses range from very small turbines supplying energy for battery charging systems (e.g. on boats or in homes), to turbines grouped on wind farms supplying electricity to the national grid.

#### Siting and planning considerations

Wind speed increases with height so it is best to have the turbine high on a mast or tower. Generally speaking the ideal siting is a smooth-top hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, houses or other buildings. However, other areas may have a sufficient wind resource to make an installation worthwhile.

Knowledge of the local wind resource is critical to designing a wind energy system and predicting output. For domestic installations a good source of information on local wind speeds is the NOABL database which can be accessed from the British Wind Energy website at [www.bwea.com](http://www.bwea.com). Alternatively you can collect primary information by setting up your own monitoring mast to record wind speed. An ideal way of doing this is with an anemometer which can be purchased for around £120.

Planning issues such as visual impact, noise and conservation issues also have to be considered. System installation normally requires permission from the local authority. Smaller



battery charging systems meet few problems as they are treated as similar to TV aerial installations - as long as they are not in a conservation area or next to a listed building. For larger systems seek the advice of planners at an early stage.

#### Stand-alone or national grid-connected systems?

Small scale wind power is particularly suitable for remote locations that aren't connected to the national grid (off-grid) where conventional methods of energy supply are expensive or impractical.

Most small wind turbines generate direct current (DC) electricity. Off-grid systems require battery storage and an inverter to convert DC electricity to AC (alternating current - mains electricity). A controller is also required to ensure the batteries are not over or under-charged and can divert power to another useful source (e.g. space and/or water heaters) when the battery is fully charged. It is common to combine this system with a diesel generator for use during periods of low wind speeds. A combined wind and diesel system gives greater efficiency and flexibility than a diesel-only system. It allows the generator to be used at optimum load for short periods of time to charge batteries when there is little wind, rather than by constant use at varying loads. Alternatively, another renewable energy technology such as solar PV or small scale hydro could be used.

Wind systems can also be installed where there is a connection to the national grid. A special inverter and controller converts DC electricity to AC at a quality and standard that is acceptable to the national grid. No battery storage is required. Any unused or excess electricity can be exported to the national grid and sold to the local electricity companies.

## System sizes

Turbines vary in size. Household systems are typically sized up to 6kW but there are larger turbines of up to 50kW available for larger community scale projects. Turbines are rated to a certain capacity, however this output is only achieved for the time that wind speed is at its optimum level. As a rough guide, a good wind site will produce an average output of 30 per cent of the rated capacity of the turbine.

The size of the wind turbine determines the total amount of energy generated each year. For example, if a 5kW wind turbine generates the equivalent to rated power for 30 per cent of the year, it will generate  $5 \times 0.3 \times 8,760$  (24 hours x 365 days) = 13,140kWh per year.

For off-grid systems, the size of the battery bank determines the time appliances can be run if there is no wind. The size of the inverter installed determines the number of appliances that can be run at the same time from the stored electricity.

## Small scale applications

Small scale applications range from individual battery charging systems to those that provide power for homes, schools or community halls. A small system of 600 watts could be used for charging batteries for caravans and boats. A larger system of 5-6kW could be used to provide power to a community hall or other public building. The optimum size for the average household would be 1.5-3kW, although larger or smaller turbines could still be applied.

Smaller systems of less than 100 watts are used for charging batteries of 12V or 24V. Uses include low voltage household lighting, remote weather stations or electric fencing.



Fig 1: 2.5kW wind turbine used to provide electric storage heating for a household in the Inner Hebrides. Copyright Energy Saving Trust.

## Cost and maintenance

Systems up to 1kW will cost around £3,000 whereas larger systems in the region of 1.5kW to 6kW would cost between £4,000 - £18,000 installed. These costs would be inclusive of the turbine, mast, inverters, battery storage (if required) and installation, however it's important to remember that costs always vary depending on location and the size and type of system.

Turbines can have a life of up to 20 years but will require service checks every few years to ensure they continue to work efficiently. For battery storage systems, typical battery life is around 6-10 years, depending on the type, so batteries may have to be replaced at some point in the system's life. Also on some turbines the blades may need to be replaced during the lifetime of the appliance.

## Where can I get more information?

Your nearest Energy Saving Trust Advice Centre can provide free, impartial, expert advice on renewable energy measures. Based in your region, we can help you choose the most suitable renewable energy technology for your home, as well as put you in contact with local suppliers and installers in your area. To find out more, call 0800 512 012 or visit [www.est.org.uk/myhome](http://www.est.org.uk/myhome).

## Useful links

- For advice and information about renewable energy technologies and other energy saving measures for your home: [www.est.org.uk/myhome](http://www.est.org.uk/myhome)
- British Wind Energy Association (BWEA); trade association of the UK wind industry: [www.bwea.com](http://www.bwea.com)

Title picture courtesy of Proven Engineering