

# Wind Energy

Electricity is generated by a wind turbine through the rotational movements of the blades. This power can be directed straight to a load, stored in a battery or transferred to the grid. Turbines can be placed on top of appropriately sized poles to take full advantage of wind capacity or can be attached to the sides of buildings provide power for a domestic household.

## Types of wind turbines

Wind turbines can range in output from a few hundred watts to several megawatts. The potential power output available is generally related to:

- Turbine and rotor size
- Wind speeds
- The location of the turbine
- And continuity of the wind resource.

The bigger the turbine and rotor, the higher the power output.

## Location

Wind turbines, whatever their size; require uninterrupted access to a wind source if they are to operate efficiently. Generally the further off the ground the better, but the actual ideal height to the centre of a turbine rotor will depend upon the rotor blade diameter, overall power output, local topography and wind speeds of the site – (for average wind speeds in your area see British Wind Energy Association database)

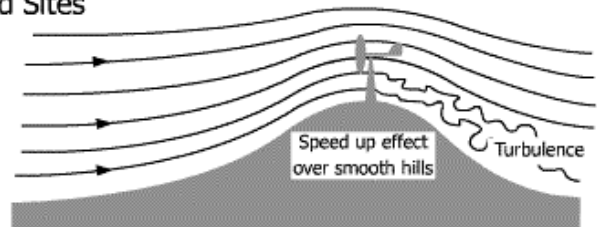
<http://www.bwea.com/noabl/index.html>

In addition to blocking, deflecting and funnelling winds, trees and buildings encourage turbulence in wind flows, which significantly reduces the efficiency of the turbine. These effects will occur tens of metres above, in front and to the side of trees and buildings and hundreds of metres downwind. Similarly, hillsides may completely block winds from certain directions thereby removing a potential

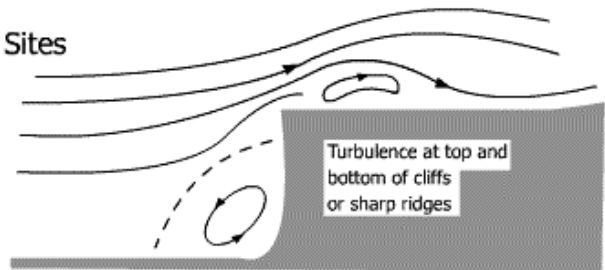
significant wind source. In order to accurately assess the potential output of a wind turbine it is necessary to carry out wind-speed and wind-duration measurements (ideally over a 12-month period).

## Flow over hills and obstacles

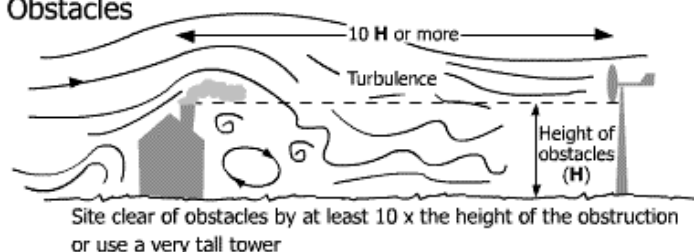
### Good Sites



### Bad Sites



### Obstacles



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## Types of system

There are two types of systems for harnessing wind power: independent systems and grid connected systems. Independent systems are used for remote locations or those that are off grid. Power generated is stored in a battery until used by the load. Examples of this are for use in boats and caravans and also for stand alone units for lighting and parking meters. For grid connected systems, turbines are connected to the grid supply for the household through a meter. Power generated goes into the normal electrical supply and when there is excess, there is the possibility of electricity being sold back into the national grid.

### Independent systems

In order to provide power outside windy periods a battery storage system is usually employed. The capacity of the battery bank needed depends upon several factors including the amount of storage required, the maximum charge and discharge rates and the temperature of the battery. Wind turbines with an output of less than 0.5kW would generally only be used for charging a battery system of up to 600 ampere/hours (ah) capacity. Turbine outputs of 0.5 to 2kW would be appropriate for battery systems up to 2,500 ah. Unless the demand from the batteries was fairly low, some other form of charging e.g. photovoltaic panels (PV) (see Information sheet 3 – Solar Electricity) and/or diesel generator is often required. Wind turbine systems above 2kW, although capable of supplying domestic premises with most of their power, need fairly large battery systems unless they are used in conjunction



(Iskra 5kW, Proven 6kW, Fortis 5.8kW)

with a generator and/or a suitably sized PV system. In order to ascertain the required size of a turbine/PV with generator/battery system, it is important to realistically assess your likely electricity demand. The system has to be capable of putting into the batteries what is taken out.

### Grid-connected System

If a larger turbine is installed, e.g. greater than 2kW, it is possible to run the system in conjunction with your mains electricity supply. Electricity from the turbine is converted, by a special *inverter* (compliant with ER G77) to match the 240V AC mains national grid supply. Electricity generated by the turbine will preferentially supply your home while any electricity not being used is fed back into the national grid via an 'export meter'. You will be billed for the electricity you use from the grid and in return you will be paid for the electricity you supply to the grid. The price you are paid for the electricity you generate (as with the price you pay) varies considerably between companies so it is worthwhile shopping around. With this system it is necessary to obtain a 'Parallel Connection Agreement' from your local Distribution Network Operator and a 'Combined Supply and Purchase Agreement' from an electricity supplier.

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## Funding - Low Carbon Buildings Programme grant:

From May 2007 the new UK Microgeneration Certification Scheme came into force replacing the existing Clear Skies accredited installer scheme. Therefore grants will now only be available to persons using both a BRE certified product and installer. Visit [www.lowcarbonbuildings.org.uk](http://www.lowcarbonbuildings.org.uk) for more information.

- Community schemes can apply: Non-profit community organisations such as registered charities, community groups, local authorities and schools.
- Businesses can apply: Stream 2 grants, designed for medium and large scale micro generation projects is open to public, not for profit and commercial organisations. See: <http://www.lowcarbonbuildingsphase2.org.uk> or call 08704 23 23 13 or email [info@lcbpphase2.org.uk](mailto:info@lcbpphase2.org.uk)

## Larger turbines for landowners

If you have enough land, an adequate wind resource and are at least 600m away from neighbouring homes, it is possible to have



up to 3 larger grid-connected wind turbines installed. These turbines are usually in the region of 1.3Megawatt

s output. The turbines would be installed and connected by National Wind Power at no cost to you. You would receive an income of around £3000 to £4000 per turbine per year. A site with 1 to 3 turbines is really a small-scale wind energy project

rather than a 'wind-farm'. The need for Environmental Impact Assessments (EIA) depends on the height and size (in MW) of the turbine. It is advised that you check with the Council as to whether you need an EIA. As the landowner, your main commitment would be to apply for the planning consent and instigate/support community a consultation process.

## Current products available

The following is a brief description of wind power products that are available. New products are appearing on the market regularly due to advances in technology so this is possibly not an exhaustive list.

### “On the roof” turbines.

These systems are intended to be attached to buildings on or near the roof. Because these turbines are small and do not protrude much above the roof line, planning consent should be easier.

‘Windsave’ turbines have a typical rotor diameter of around 1.75 metres and an output of around 1kW in a wind of 12.5 metres/second (27 MPH). This system’s main feature is that the output of the turbine is matched (via an inverter) to the mains electricity. This is intended to allow the turbine to be **simply plugged into any mains-electricity socket** and so boosting the mains supply. **It is not grid-connected.** If you are not using any electrical equipment the turbine ceases to generate. The manufacturer suggests that up to 15% of a typical household’s electricity consumption can be supplied from one turbine but this depends on a household’s energy consumption rates and the efficiency of the turbine. The standard Windsave WS1000 system is being promoted by B&Q and should qualify for a government ‘Low Carbon Buildings

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Programme' grant. The 'Windsave' system can be viewed on <http://www.windsave.com/>. B&Q sells the 'Windsave' turbine at £1,498. The "D400 Stealthgen" is another small wind generator designed to be mounted onto buildings but also for boats. The makers claim that it is exceptionally quiet and vibration free and can provide 15% - 20% of a household's average need but this varies with the household's consumption rates and the efficiency of the turbine. It produces 400W and has a blade diameter of 1.1m. The installed cost is around £1,600 (as of July 2006.) The "Stealthgen" is available from eclectic-energy ([www.eclectic-energy.com](http://www.eclectic-energy.com).)

### **Disadvantages of 'Building-Mounted' systems**

The main problem with mounting a turbine on a building is that it is very difficult to assess the available wind resource. The roof of the building, along with any other nearby buildings, trees, embankments etc will create turbulence, which will impede the smooth operation of the turbine. This turbulence will vary in strength and direction as the wind speed/direction varies. Moving the turbine by only a few metres in any direction or height may make significant changes to that wind-resource variability.

This means that although a generally expected output can be provided (assuming the turbine is sited properly), accurate assessment of the output at a given location is almost impossible unless a site-specific analysis is carried out.

### **Pole mounted turbines**

The larger turbines that you can see on top of poles produce more power than those mounted on buildings. Not having trees and buildings nearby, pole-mounted turbines are more efficient without this obstruction.

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Notable products on the market are the Iskra and Proven.

The Iskra AT5-1 is rated at 5kW at 12m/s. The rotor diameter is 5.4m and the Iskra turbine has an "upwind orientation." The height of the pole would be around 12 m, but this depends on the location.

Approximate installation costs for the Iskra would be £20,000.

Proven Energy sells a range of turbines from 2.5kW to 15kW. The Proven 2.5's rotor diameter is 3.5m and the hub height is ideally 11m. The rotor diameter of the Proven 15 is 9m and the hub height is 15m. These turbines cost £10,900 and £39,000 respectively (July 2006.)

### **Disadvantages of "pole mounted" turbines.**

Ideally, tower turbines needs to be clear from buildings and trees to work efficiently. So the location should be away from anything that may cause turbulence. Fields are ideal but spaces in urban areas are less suitable. These turbines are mounted on towers between 12m and 15m high, subsequently planning permission maybe more difficult than a roof mounted turbine.

### **Is planning permission required?**

We recommend that you contact your local council who normally offer pre-application advice. Also, it may be preferable to discuss your proposal with your neighbours. Please note there is a fee payable to make a planning application. The Government has made it clear that it will legislate further to allow free-standing and building-mounted wind turbines on detached properties, and air source heat pumps to be installed without needing planning permission, but has to await clearance from the European Commission. This is expected later in 2008. For micro-wind and air source heat pumps, the

government has indicated to Parliament that it will require that neighbours are not exposed to noise levels exceeding 45 decibels. This limit will be reviewed after two years.

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## More Information

### Installers:

Please refer to the Low Carbon Buildings Programme's approved list of installers for Grant-funded installations. You can call them on 0800 9150990 or go to [www.lowcarbonbuildings.org](http://www.lowcarbonbuildings.org)

Some installers operating in Cornwall:

Company	Telephone	Website
Natural Generation	01872 554144	<a href="http://www.naturalgen.co.uk">www.naturalgen.co.uk</a>
Microgeneration Ltd	0845 4348084	<a href="http://www.microgeneration.com">www.microgeneration.com</a>
Aeolus Power	01454 633323	<a href="http://www.aeoluspower.co.uk">www.aeoluspower.co.uk</a>
Hendra Renewable Energy	01566 779542	<a href="http://www.hendrarenewableenergy.com">www.hendrarenewableenergy.com</a>

For up to date lists of local installers visit: <http://www.csep.co.uk/page140g.html>

*We advise that you obtain at least 2 comparable written quotes from different installers and check the VAT discount for renewable technologies has been applied.* For more information on VAT discounts, please see:

[http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?\\_nfpb=true&\\_pageLabel=pageVAT\\_ShowContent&id=HMCE\\_CL\\_000514&propertyType=document#downloadadopt](http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?_nfpb=true&_pageLabel=pageVAT_ShowContent&id=HMCE_CL_000514&propertyType=document#downloadadopt)

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## Some useful websites:

### Wind Turbine Suppliers

Proven Energy	<a href="http://www.provenenergy.com">www.provenenergy.com</a>
Iskra Wind	<a href="http://www.iskrawind.com">www.iskrawind.com</a>
Air 403 – 400W turbine	<a href="http://www.solartechuk.co.uk">www.solartechuk.co.uk</a>
Fortis Range	<a href="http://www.fortiswindenergy.com">www.fortiswindenergy.com</a>
Windsave	<a href="http://www.windsave.com">www.windsave.com</a>
Stealth	<a href="http://www.stealthgen.com">www.stealthgen.com</a>
Navitron wind turbine kit	<a href="http://www.navitron.org.uk/wind_turbine.htm">www.navitron.org.uk/wind_turbine.htm</a>
Quiet Reveolution QR 5	<a href="http://www.quietrevolution.co.uk">www.quietrevolution.co.uk</a>
Rutland	<a href="http://www.marlec.co.uk/products/products.htm">www.marlec.co.uk/products/products.htm</a>
SEA wind turbines	<a href="http://www.solarenergyalliance.com/wind.htm">www.solarenergyalliance.com/wind.htm</a>
Wind rotor – vertical axis (Llumarlite)	<a href="http://www.ropatec.com">www.ropatec.com</a>

### Further wind turbine advice and suppliers:

Bergey	<a href="http://www.bergey.com">www.bergey.com</a>
Essential Spark	<a href="http://www.essentialspark.com/wind_turbine.aspx">www.essentialspark.com/wind_turbine.aspx</a>
Build your own wind turbine	<a href="http://www.bwea.com/you/byo.html">www.bwea.com/you/byo.html</a>
Best practise guides for installing small wind powered electricity generating systems	<a href="http://www.energysavingtrust.org.uk/uploads/documents/housingbuildings/ce72.pdf">http://www.energysavingtrust.org.uk/uploads/documents/housingbuildings/ce72.pdf</a>
Low cost green energy direct to industry	<a href="http://www.wind-direct.co.uk">www.wind-direct.co.uk</a>
Better Generation	<a href="http://www.bettergeneration.co.uk">www.bettergeneration.co.uk</a>
British Wind Energy Association	<a href="http://www.bwea.com/small/index.html">www.bwea.com/small/index.html</a>
UK windspeed database	<a href="http://www.bwea.com/noabl/index.html">www.bwea.com/noabl/index.html</a>

### For further information

Cornwall Energy Efficiency Advice Centre	0800 512012	<a href="http://www.cep.org.uk">www.cep.org.uk</a>
Energy Saving Trust		<a href="http://www.energysavingtrust.org.uk">www.energysavingtrust.org.uk</a>
The Centre for Alternative Technology	01654 702400	<a href="http://www.cat.org.uk">www.cat.org.uk</a>

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