



Domestic Wind Turbines

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<http://info.cat.org.uk/wind>

Introduction

The UK is the windiest country in Europe, and wind farms are a great way to generate renewable, low-carbon electricity. Small wind turbines can also be effective in some locations, but they must be carefully placed to be a worthwhile way to reduce carbon emissions and save money.

It's important to first take energy efficiency measures such as insulating and draught-proofing - these tend to give a bigger saving on carbon emissions for a smaller cost. See our *Energy Conservation* sheet for advice.

If you don't have mains gas, then a low-carbon heating system such as a wood-fuelled boiler or a heat pump may be a more cost-effective way to reduce your carbon emissions. See our information sheets on these options for more advice.

Finally, domestic solar photovoltaic (PV) systems are often easier to install than a wind turbine, as they don't usually need planning permission, don't need regular maintenance, and south-facing roofs are much easier to find than suitably windy sites. See our *Solar Photovoltaics* sheet.

How much wind?

Wind energy is very site specific. You need first to gauge average wind speeds at your site. In our experience, people do tend to overestimate how windy their home is, and a turbine that does not spin will promote neither renewable energy nor your bank balance. It's well worth checking properly.

Although online databases give wind speeds for a given post code or Ordnance Survey map reference, studies suggest that these are often a very poor indicator for the actual energy that will be produced by a small wind turbine. These resources do not account for the local conditions that small turbines in particular will be affected by.

Before spending thousands of pounds for a wind turbine, we strongly recommend spending a few hundred on measuring equipment such as a mast and data logger.

Siting a turbine

The power that can be generated from wind is proportional to the cube of the wind speed - this means that a doubling of wind speed will give eight times as much power. It also means that half as wind as expected means you'll only get an eighth as much power

To get the best from a turbine you need to put it where it will receive the strongest possible winds. An ideal site is a smooth hilltop with a clear open stretch (at least in the prevailing wind direction). This is why turbines are rarely sited in towns.

Wind speeds increase significantly with height, so it makes sense to mount a turbine very high up. Most turbine suppliers provide poles or towers (often several metres high), and the additional cost should be repaid by the extra energy generated. A tower helps to avoid the turbulence created by obstructions such as buildings and trees - this turbulence reduces power output and increases wear and tear on the machine.

The installation of a wind turbine requires planning permission, as it will be above the level of the house and will create a small amount of noise. Because of this it's sensible to talk to your neighbours about your plans - people will generally be more supportive if they are consulted before a planning application goes in.

Can I put a wind turbine on my roof?

We do not recommend mounting turbines on rooftops or buildings. Turbines near roof ridges will receive only weak, turbulent winds. Several field trials have found that building-mounted turbines perform poorly, producing only a small fraction of the energy they would produce if sited properly, on a tower above and away from buildings (see for example www.warwickwindtrials.org.uk).

In addition, turbines can resonate in the wind and produce vibrations in the building. Forces acting on the turbine in high winds can damage the structure of the building.

Choosing a turbine

The smallest turbines, costing a few hundred pounds, are designed to charge up a 12volt battery in a boat or caravan. To make a decent contribution to household energy use, a much larger turbine is needed.

The *rated power* of a turbine is the power produced at its *rated wind speed* (often 10 metres per second, but will vary). The overall performance of a turbine is usually displayed using a *power curve* - a graph of power output against wind speed.

Domestic wind turbines are typically rated between 1kW (kilowatt) and 10kW. Many factors affect how much energy you'll get, but a rule of thumb is that a 1kW turbine on a good site should generate 1000kWh per year (an average UK household uses around 3,600kWh of electricity per year).

What will it cost?

The complete installed cost is typically between £2,500 and £6,000 **per rated kW**. A 6kW turbine could cost a total of £20,000 to £30,000. When calculating full costs it's important to include all the equipment, such as the tower, cables, and inverter (for grid connection) or batteries (for off-grid sites).

Will it pay?

The government's *feed in tariff* (FIT) scheme can make a grid-connected wind turbine a more attractive option in a windy location. Under this scheme you're paid for every unit of electricity generated, whether you use it yourself or export it to the grid.

From 1st April 2017, the FIT rate for a wind turbine rated up to 50kW is 8.39p per kWh, guaranteed and index linked for 20 years.

In addition, an export tariff of 5.03p per kWh is paid, usually set at 50% of generation (as domestic exports are rarely metered). Also, any electricity from the turbine that is used in your home will reduce your electricity bill by around 16p per unit.

The FIT rate available for new installations will drop each quarter. For larger systems and other details, see the Ofgem website: <http://www.ofgem.gov.uk/fits>

For a 6kW wind turbine in a good location, the annual income may be around £1000.

To be eligible, turbine and installer must be accredited under the Microgeneration Certification Scheme (MCS, details below).

Off-grid homes

In an off-grid home (not connected to mains electricity), small-scale wind power can be a good alternative to putting in a new grid connection (may be expensive) or running a diesel generator (noisy and polluting, and with ongoing fuel costs). An off-grid home might be suited to a combination of wind and photovoltaic (PV) solar power, as there is more wind in winter and more sun in summer. See our website for more advice on off grid systems (e.g. sizing batteries).

Further information

For answers to further questions about installing small wind turbines, see: <http://info.cat.org.uk/wind>

Various books on wind power can be purchased through **CAT mail order**.
Tel: 01654 705959; <http://store.cat.org.uk>

Wind & Solar Electricity (£13.95) provides practical advice on all aspects of building and maintaining a low-cost, low-carbon home-generation system.

For those with engineering experience and a well-equipped workshop, **Windpower Workshop** (£16.95) shows how to build a turbine from second hand & scrap materials.

We run renewable energy **short courses**.
01654 704966; <http://courses.cat.org.uk>

Our **Graduate School of the Environment (GSE)** offers a range of full or part time postgraduate programmes that mix academic study and hands-on practical learning, including an MSc in Sustainability in Energy Provision & Demand Management.
01654 705953; <http://gse.cat.org.uk>

Other Contacts

Microgeneration Certification Scheme
Tel: 020 7090 1082
Web: www.microgenerationcertification.org
Lists turbines accredited for feed-in tariffs.

The **Ofgem** website has much more information on the feed-in-tariff scheme:
<http://www.ofgem.gov.uk/fits>

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