Dorset Agenda 21

P O Box 5789 • Dorchester • Dorset DT2 8ZR

Tel: **01305 21 37 21** email: **john@dorsetagenda21.org.uk**

RESIDENTIAL WIND TURBINES: A BRIEFING SHEET

BACKGROUND

Planning Policy Statement 22 says Planning Bodies should be proactive in supporting microgeneration - households generating some of their own electricity. The Climate Change & Sustainable Energy Bill will set local targets for microgeneration and reduce planning constraints. Thus the planning climate is right for households to take advantage of the many domestic scale, grid-connected, wind turbines existing or shortly to appear on the market.

ENERGY CONSUMPTION

You can determine your annual electricity consumption from a year's electricity bills or meter readings. The national household average is 4000 – 5000 units per year and growing! These units are kilo-watt-hours (kWh) and can be used to determine how big a wind turbine you might need to meet your demand. With greater energy efficiency measures we could all reduce our electricity requirements, **so stage 1 of any project is to improve your energy efficiency (contact: DEAC)**, *then* install your chosen wind turbine!

ENERGY PRODUCTION

Many factors will affect the amount of electricity generated by a wind turbine, but the key one is:

- **Average annual wind speed**. It is very important to know this at the outset, since the power produced is proportional to the cube of the wind speed. The DTI wind speed database will give you an average figure for the kilometre square in which your house is sited. Once you have this figure you then need to allow for your local topography (trees, nearby houses etc., which will both reduce wind speed and cause turbulence), and in fact you may wish to determine your average annual wind speed by monitoring the site for at least a year with an on-site anemometer. Consultants could do this for you, or you can hire the kit. The extra expense may be worth it, for the larger, more expensive, machines. Most of us overestimate the windiness of our site and are surprised to find how low the average wind speed is, when we check the figures. The British Wind Energy Association will provide useful advice in estimating this.

Always remember that if wind speed doubles, the power produced will be eight times as much, and vice versa!

Other important factors are:

- **Height at which the turbine is mounted.** Wind speed increases significantly with height so to get the most from your turbine it needs to be mounted as high as possible.

- **Size of the turbine.** Bigger wind turbines produce more power (power is proportional to the swept area of the rotor) but cost more and are more visible to neighbours.

Some of the models, manufacturer's websites, and their estimated performances are shown in Table 1. The last column is of most interest because it represents the energy each machine may provide in a year, which can be compared to your energy consumption shown by your bills or meter readings. The longer established firms, Proven and Iskra, make less ambitious claims than the others. Calculated estimates by DA 21 members produce figures for the annual energy output which are much less than those quoted by the first three firms, **so treat their claims with great caution**. Also the more recent manufacturers have fewer machines installed and so have little track record of performance on which to base their claims– two Swifts have recently been installed on the National Sailing Academy, Portland and DA 21 plans a site visit on 4th November. Each manufacturer should be able to provide figures for the power produced at different wind speeds for each model so if you like a particular model, ask for this “power curve”. Also ask how they obtain these figures and how they do their calculations.

There appear to be three main ways of obtaining the Rated Power, at a specified wind speed, and so producing a power curve:

1. Mount in a wind tunnel and record power output at different wind speeds.
2. Mount on a lorry, drive at different speeds and record the resulting power.
3. Monitor the machine's performance, at different sites, over a long time at different wind speeds, by datalogging with a computer. This has the advantage of being a real life situation.

The OU book “Renewable Energy – Power for a Sustainable Future” is an excellent introduction to most of the key ideas. Chapter 7 on Wind Energy will be very useful. DA21 office has a copy, available on loan, or why not ask your family for an early Christmas present?

The models range from Windsave, they estimate will provide about 25% of the average household's electricity, to Iskra, estimated to provide around twice the consumption of the average household, both with an average annual wind speed of 5 metres per second (m/s). With average wind speeds of 4m/s you have to reduce the annual output figures in table 1 by around 50%. This wind speed, or even less, is typical of average urban environments so before you install **be sure you have enough wind!**

Table 1. Some wind turbine models, including size and power generation

MODEL	ROTOR (m) DIAMETER	WEB SITE	RATED POWER (wind speed12m/s)	ENERGY OUTPUT per year (wind speed 5m/s)
Windsave	1.75	www.windsave.com	1000W	1000kWh
FutureEnergy	1.8	www.futurenergy.co.uk	1000W	900kWh
Swift	2.1	www.renewabledevices.com	1500W	2000kWh
Proven600	2.55	www.provenenergy.com	700W (at 10m/s)	900 – 1500kWh
Proven2500	3.5	www.provenenergy.com	2500W (at 10m/s)	2500 – 5000kWh
Iskra AT5-1	5.4	www.iskrawind.com	5300W	9000kWh

COSTS OF WIND TURBINES

Table 2 shows the current cost of several wind turbine models and the potential grant money that could be claimed. Where there are blanks no information could be found and the total cost given includes wind turbine, grid connection and full installation. All costs should be taken as estimates and there may be extra expenditure on e.g ground works and cabling, especially for the larger machines which may be sited some distance from your house. The smaller machines are intended to be mounted on roof or gable end of house, which raises issues about the stability of mounting. Read carefully what each firms' web site has to say about this.

The Low Carbon Buildings Programme (LCBP) grant will reduce the cost of installing a wind turbine by £1000 per kilowatt, up to a maximum of 30% of the total cost or £5000, whichever is reached first.

Table 2. Wind turbine models and average costs

MODEL	TURBINE (£)	INSTALLATION (£)	TOTAL (£)	LCBP GRANT (£)
Windsave	995		1,600	480
Future Energy	695			
Swift	3500	1000	4,500	1350
Proven600	Including delivery and installation		8,000	600
Proven2500	Including delivery and installation		10,900	2500
Iskra AT5-1	Including delivery and installation		20,000	5000

LIFESPAN AND PAYBACK

Most wind turbines have an expected life span of 20 – 25 years with minimal annual maintenance. Models that have been around for several years have proved very reliable and new models may prove equally reliable. *Financial* payback time or the time needed to save as much money in reduced fuel bills as was spent on the turbine, is quoted, by the firms themselves, as 5-7 years for Windsave and 8 years for Swift. These figures include grant assistance and Renewable Obligation Certificates (ROCs), which are government sponsored credits. An annual ROC credit is worth about £ 60 per 1000W and, for example, the Windsave may produce, on average, sufficient electricity per year to claim one ROC. *Energy* payback time or the time needed to generate energy equal to the total energy used in making the turbine, is around 1 year.

THE FUTURE

In the UK we have 40% of Europe's total wind energy but it is largely untapped with only 0.5% of our electricity generated by wind power. Residential wind turbines have the potential to increase this percentage as well as save you money, so do your research, do your sums and then seriously consider installing one – or even two!

One final cautionary note: *we do not recommend any of the models and there are potential issues (see Energy Production claims) with some of the more recent models, so ensure that your research phase is long and thorough and treat this short paper as only an introduction to the whole topic. We have only looked at 6 models, out of the 10 – 12 existing or planned, so please investigate further and let us know your results.*

USEFUL CONTACTS

DTI wind speed database: **www.bwea.com/noabl** for wind speed data
Meteorological Office: www.metoffice.gov.uk or Tel: **01344 420242** for wind speed data
British Wind Energy Association: **http://www.bwea.com/** for general information
The Low Carbon Buildings Programme (LCBP): www.lowcarbonbuildings.org.uk or Tel: **0800 915 0990** for details of the grant scheme and how to apply
Centre for Alternative Technology: www.cat.org.uk or Tel: **0845 330 8373** for info sheets
Dorset Community Renewables: wheaton-greens@tiscali.co.uk for info on large wind turbines
Dorset Energy Advice Centre (DEAC): Emily@deac.co.uk or Tel: **01202 469907**
Open University: PO Box 188, Milton Keynes, MK7 6DH

John Tomblin, Project Officer, DA 21, 6 September 2006