

Wind Turbines



SMALL WIND TURBINES



Small wind energy systems can be used in connection with an electricity transmission and distribution system (called grid- connected systems), or in stand-alone applications that are not connected to the utility- supplied grid. In areas with adequate wind regimes (more than five meters per second annual average), simple wind generators with an output range of 100 to 500W can be used to charge batteries and thus supply enough power to meet basic electricity needs.

The reason however that we don not see wind turbines in every home is because wind is a diffuse and fickle source of energy and the equipment needed to convert it into a usable power is expensive.

COSTS

In economic terms, a small wind turbine only becomes viable when living in a remote area that is far from the nearest utility lines. To meet the electricity needs of an average Irish home you would need plenty of wind, and a rotor diameter of about 5 metres. The windmill would probably cost over €6,350 and the total system would probably cost over €19,050. Electricity production (around 5,000kWh/year) would only save about €635 per year.

A system without batteries would be cheaper, and could provide heating (and maybe some 'rough' A.C. power).

SMALL WIND TURBINE COMPONENTS

Most wind turbines are designed for battery charging and they come with a regulator to prevent overcharge. The regulator is specifically designed to work with that particular turbine. The turbines usually consist of blade, alternator, regulation and control electronics.

APPLICATION OF SMALL WIND TURBINES

The principle ways in which wind energy can be exploited in rural areas are as follows:

- For pumping water and producing compressed air
- For generating electricity
- For powering mechanical devices

i.e. for drinking water supplies, irrigation or drainage. A suitable combination of different pumping systems with an optimised storage capacity should be installed. The question, as to which combination of possible systems is the right one, depends on a variety of physical, socio-economic and sociocultural conditions, which can differ from area to area.

ASSESSING YOUR NEEDS

In order to determine what size turbine you require you need to look at your energy demand. At this point it is necessary to define the difference between 'Energy' and 'Power'. *Energy* is what you pay for in your electricity bill and is measured in units. The technical term for a unit of electricity is one 'kilowatt-hour' kWh. *Power* is the rate of delivery of energy. It is measured in watts. A load, which uses 1 kW of power, will use 1kWh of energy in one hour. In two hours it will use 2kWh. So it is equally important to know both the power requirements of a load and the hours for which it will run. Then you can calculate the energy it will use.

Assuming that there is battery storage in the windpower system, it is not necessary to match the output of the wind turbine to the power required by the load. Both of these power levels will vary in a complicated way, depending on wind conditions and user activity. Successful system design depends on matching energy supply over a period of time to the energy requirements of the user.

SITE WINDSPEED ASSESSMENT

The most important criterion for a windpower site is the average windspeed. This is quoted in metres per second (m/s). Actual windspeed will vary widely from the average figure, but the frequency with which any higher or lower windspeed will be encountered can be calculated with some accuracy from this average. To measure it accurately, you would need to put up an anemometer (windspeed measuring instrument), however these can be very expensive. It is possible to make an estimate of the sites average windspeed, based on the location, the ground conditions and the height of the tower. Maps are available which show the distribution of windspeed over Ireland.

SUMMARY

- Assess your energy needs by listing the loads you need to run, estimating the power they use, and estimating the periods they will be used for. Will you need 'mains' voltage and if so what size and type of inverter?
- Assess your sites average wind speed, and see what size wind turbine might be appropriate. What height of tower would you need? Where exactly will you need to put it in order to be safe, avoid turbulence, meet planning requirements and keep cable costs to a minimum?
- Apply for planning permission. Always check with the planners before ordering any equipment
- If successful, place a firm order for the equipment you have chosen. Delivery can sometimes take several weeks. Meanwhile you can prepare tower foundations and anchors, build then battery shed and do the necessary wiring.
- Do remember that wind turbines require maintenance!

WIND TURBINE OUTPUTS				
Average	Wind Turbine rotor diameter			
Windspeed	1m	2m	3m	5m
3m/s	0.5	2.5	6	16
4m/s	1.5	6	15	40
5m/s	3	12	25	75
6m/s	4	17	40	110
(energy outputs quoted in kWh/week)				

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