CLASP. Climate Change Local Area Support Programme

Planners' reference guide no. 5: Building mounted wind

Introduction

Building-mounted wind generally refers to turbines in the range 0.4 – 2.5kW, but can also include larger turbines (5kW) positioned on rooftops. These larger turbines are covered in the Planners Reference Guide: Small Wind.

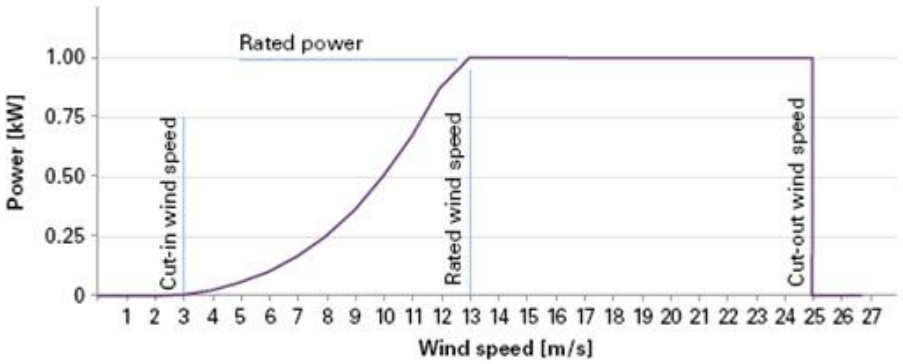
There are two types of turbine – horizontal axis (twin or triple bladed) and vertical axis (often helical).

Turbine rating & output

The power output of a turbine is a function of swept area of the blades, the conversion efficiency of the turbine and the cube of the wind speed:

Power = 0.5 x Swept Area x Air Density x Turbine Efficiency x Velocity^3

Because of this, wind speed is the most significant factor determining the most effective location for a turbine. Turbines are rated for their output at a specified wind speed. A typical output curve is shown below.



The ratio of Actual Output to the theoretical maximum Rated Output is known as the Load Factor. i.e. Actual Output = Load Factor x Turbine Rating x 8760 hours/year

The average Load Factor increases with the size of the turbine and location. Quoted load factors for building-mounted wind turbines are usually around 10% but recent studies by the Energy Saving Trust and the Warwick Wind Trials showed actual load factors of 3% at best in urban and suburban areas and 7.4% in a rural location in Scotland. In some instances the inverter consumed more power than the turbine generated.

The table below gives data from the Warwick Wind Trials showing the actual outputs of four turbines rated at 400W to 1kW compared to their predicted outputs

Site	Predicted energy output using manufacturer supplied power curves			Measured energy output (kWh)
	Using NOABL wind speeds (kWh)	Using scaled NOABL wind speed (kWh)	Using measured wind speeds (kWh)	
Lillington Road	819	127	88	52
Birds Hill	574	114	135	48
Leicester	1101	157	217	64
Daventry Town Hall	650	129	166	69

Although often installed in urban areas, small building-mounted turbines achieve their greatest output in windy rural locations, and can be the most appropriate technology in these areas.

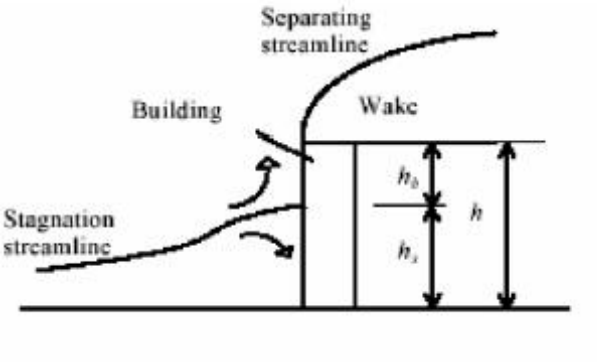
Wind speed

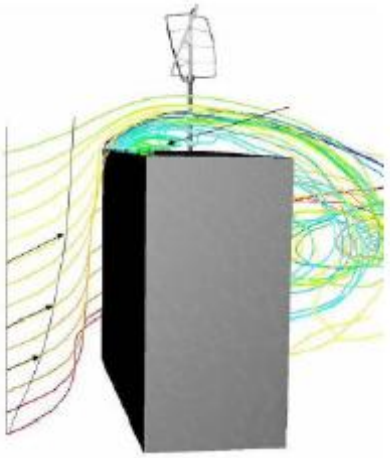
The average wind speed for each 1km grid-square is given on the NOABL database, at mast heights of 10m, 25m and 45m above ground level. However while this data may be useful for stand-alone turbines, it does not take account of turbulence and is not sufficiently accurate for urban areas. The Energy Saving Trust study of small wind turbines found that this database over-estimates wind speed, and the Carbon Trust Wind Yield Estimation Tool was more accurate.

NOABL wind speed database: www.bwea.com/noabl/index.html

Carbon Trust Wind Yield Estimator: www.carbontrust.co.uk/emerging-technologies/current-focus-areas/offshore-wind/_layouts/ctassets/aspx/windpowerestimator/windpowerestimatorterms.aspx

Wind speed quality and consistency are key factors. The urban environment with gusting and multi directional wind going round buildings, makes it very difficult to channel air into the turbine, and wind flow modelling will be necessary.





Dimensions

The dimensions of building-mounted horizontal axis turbines are in the ranges below:

Blade diameter: 1 – 2.1m

Gable-mounted turbine pole height: 2 - 3m above the roof level

Flat-roof mounted turbine pole height: 5 – 10m above the roof level

Installation and maintenance

Gable-mounted turbines generally have a damping mechanism between the pole and the wall, but require a structurally-sound wall to avoid any damage from the multi-directional forces transmitted from the turbine.

Flat-roof mounted turbines are generally guyed to the roof, with a base plate and a number of anchor points.

Noise can be an issue for turbines mounted on residential buildings, both from the turbine and the inverter, and many of these have been switched off at night.

Most turbines are designed for a 10-year lifetime and product warranties are around 1-2 years. Regular maintenance is required.

Grid connection

For small systems (< 16 Amps per phase, or roughly 4kW for single phase or 11.4 kW for 3-phase connection) the installer is only required to inform the Distribution Network Operator (DNO) that the connection will happen.

Costs

Installed costs for building-mounted turbines range from £2,500 - £5,000 (June 2011). This excludes any work needed to ensure the structural integrity of the building.

Feed in tariff (FIT)

FIT rates to March 2012 are shown below (these are expected to change for 2013 based on the outcome of the FIT Review). To qualify for FITs the system must be installed by a Microgeneration Certification Scheme (MCS) accredited installer.

At June 2011, no building-mounted turbines had achieved MCS-accreditation turbines but several are going through the accreditation process.

Technology	System Size	p/kWh	Years
Wind	≤1.5kW	36.2	20
Wind	>1.5 - 15kW	28	20

Planning considerations

Planning permission will be required for a wind turbine of any size. The main planning considerations will be:

- Visual impact on the local landscape
- Impact on any protected habitats or species that might be present in the locality e.g. birds, bats or newts.
- Impact of the turbine upon neighbouring residents (noise nuisance, creating 'shadow flicker' or visual prominence).

A consultation on permitted development rights for building-mounted wind turbines was carried out in 2009/10 but as yet this has not been progressed.

Further information

Planning for Renewable Energy: A Companion Guide to PPS22 - http://www.communities.gov.uk/publications/planningandbuilding/planningrenewable

Energy Saving Trust small wind turbine field trial report - www.energysavingtrust.org.uk/Generate-your-own-energy/Energy-Saving-Trust-field-trial-of-domestic-wind-turbines

Warwick Wind Trials Reports - www.warwickwindtrials.org.uk/2.html

Permitted Development Rights Consultation (archived) - http://webarchive.nationalarchives.gov.uk/+/http://www.communities.gov.uk/publications/planningandbuilding/microgenelectriccars

Feed In Tariffs - www.decc.gov.uk/en/content/cms/meeting_energy/renewable_ener/feedin_tariff/feedin_tariff.aspx

Microgeneration Certification Scheme - www.microgenerationcertification.org

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