

SMALL WIND POWER

Introduction to Urban Small Scale Wind in the UK

The UK has set a target to source 10% of its electricity from renewables by 2010 and 15% by 2015 with an aspiration to reach 20% by 2020. The Government believes that micro-generation (i.e. under 50kW for electricity), which includes small-scale wind, can make an important contribution to this target¹. Katerina Syngellakis, IT Power, Steve Carroll, Loughborough University and Peter Robinson, Reading University report.

In addition to contributing to the national target for renewable energy, there are a number of other benefits that small-scale urban wind can offer, such as:

- CO₂ emissions reductions;
- electricity generation at point of use thus eliminating transmission losses;
- strengthening of the grid reducing the need for upgrades; and
- visibility in the highly populated urban environment leading to raised awareness of sustainability and renewable technologies.

Some local authorities, such as Merton

and Croydon, have already established Development Plans that require a percentage of energy for all major developments² to be sourced from onsite renewables. Guidance laid out in the national Planning Policy Statement PPS22 and the support for renewables by the Greater London Authority is encouraging other local authorities to follow suit³. Small wind generators can be used to meet these local targets opening up a new market for these technologies in towns and cities across the UK. Educational and environmental reasons are currently the main drivers for

installations⁴. Around the country there are already approximately 100 small-scale wind installations in urban areas and with the potential market slowly starting to open up, there is interest being shown in designing, manufacturing and installing small wind turbines for the urban environment.

Manufacturers

Currently in the UK there are nine companies manufacturing 17 small wind turbines (all horizontal axis wind turbines or HAWTs). There are also eleven organisations designing and developing 11 prototype small wind turbines. Of these 4 are HAWTs, while 7 are vertical axis wind turbines (VAWTs). Although any of these 28 small wind turbines could be placed in urban surroundings, 18 of the turbines are specifically aimed at the urban environment as manufacturers are recognising the potential of this new market and designing new products that are adapted to perform well in the wind regimes of densely built up areas.

The larger HAWTs (with a rotor diameter greater than 2m) made by Proven Energy, Iskra Wind Turbines and Gazelle Wind Turbines are established products suitable for the built environment - and which should generate substantial amounts of electricity. These products are almost always ground-based, although Proven has recently ventured into building-mounting their turbines with installations in the UK and Japan. Other established products that could be used in the urban environment are micro HAWTs (with a rotor diameter less than 1.25m), which, although generating much smaller amounts of electricity, can be used for educational purposes and awareness raising. Recently, three turbines have been launched onto the market which are specifically intended for the urban environment and can be building-mounted on domestic properties

Turbine type	Company	Years manufacturing, in 2005
Micro HAWTs (<1.25m diameter) not aimed at the urban market	Marlec	over 25
	LVM	over 25
	Ampair	over 25
Small HAWTs (>1.25m and <2m) not aimed at the urban market	Marlec	over 25
Micro HAWTs (<1.25m) that are aimed at the urban market	Eclectic Energy	This year
Small HAWTs (>1.25 and <2m) that are aimed at the urban market	Windsave	This year
	Renewable Devices	This year
Larger HAWTs (>2m diameter) aimed at both urban and rural markets	Iskra	1
	Proven	14
	Gazelle	7

Table 1: Summary of manufacturers

(and other buildings). These are micro and small HAWTs (in the range of 400 W to 1.5 kW) made by Eclectic Energy, Windsave, and Renewable Devices Swift Turbines.

There are no VAWTs currently on the market in the UK, but many VAWT prototypes are currently being tested and should be available in 2006/2007. These are generally designed to be building mounted and suitable for the urban environment. Table 1 summarises the different companies, the kinds of turbines they manufacture and for how long they have been manufacturing them. Tables 2 and 3 summarise the turbines currently being manufactured or designed specifically for the urban environment. Table 3 is not exhaustive as new ideas are being developed constantly and sometimes limited information is available on new developments due to commercial sensitivity. The tables also show whether each turbine is suitable for building mounting or not.

Up until now all turbines installed in the UK have been HAWTs but if the prototype VAWTs make the progression to fully available market products in the near future there could be a shift towards these kinds of turbines as they may be more suitable for the urban environment & building mounting, and are often regarded as more aesthetically pleasing. However, more practical experience is needed with VAWTs (and HAWTs) in the urban environment to verify their electricity production levels. Some electricity suppliers are showing interest in offering small wind as part of their service package. Scottish & Southern Energy (SSE) have signed a contract with Renewable Devices (Swift Turbines), while British Gas and Powergen are interested in the Windsave and Eclectic Energy D400 turbines respectively. Electricity suppliers may be seeing this as an opportunity to 'lock' customers in to long-term contracts by offering a package with a small wind turbine and special green electricity tariff. As a result, they may offer the turbines at cost price or less. More information on UK and European urban wind turbine manufacturers and technologies is available from the website of the WINEUR project (Wind Energy Integration in the Urban Environment) www.urbanwind.org.



A house making use of more than wind power. Photo: Berwickshire Housing Association

Policy and planning

Planning policy statements (PPS) set out the Government's national policies for different aspects of land use planning in England. These policies need to be taken into account by regional planning bodies in preparation of regional spatial strategies and by local planning authorities in preparation of local development documents. PPS22 recognises that urban areas can be used for renewable energy developments; however, it does not include guidelines on small scale generation, except to state that small scale schemes should be encouraged. This lack of guidance has led to an overall omission of small scale wind references in regional and local planning documents. This omission will hopefully be addressed with the release of the Micro Generation and Low Carbon

Building's strategy currently being developed by the DTI, which is to replace the Clear Skies funding initiative for domestic and community renewables in April 2006.

Planning permission should always be applied for when installing a small wind turbine⁵ with many local authorities recommending a pre-planning consultation. Constraints experienced by small wind turbine owners when applying for planning permission are mainly centred on the local planning departments and individuals' lack of experience with small wind installations. They often suffer from the same prejudices as their multi-megawatt big brothers. To aid in a successful planning application the visual appearance, noise emissions, power output and contribution to regional and/or local renewable energy targets should be

Model and Manufacturer	Type of turbine	Building mounting possible	Rated Power, kW
D400 (Eclectic Energy)	HAWT	Yes	0.4
Windsave	HAWT	Yes	1
Swift (Renewable Devices)	HAWT	Yes	1.5
Proven WT600	HAWT	Yes	0.6
Proven WT2500	HAWT	Yes	2.5
Iskra	HAWT	No	5
Proven WT6000	HAWT	Yes	6
Proven WT15000	HAWT	Unknown	15
Gazelle	HAWT	Unknown	20

Table 2 - Turbines being manufactured for the urban environment

addressed. Many small wind turbine manufacturers offer planning advice and have published information which can be used in planning applications.

Due to small wind only recently being seen as an option for large scale implementation the only major funding scheme was the national Clear Skies programme (which came to an end in March 2006). The UK government has a green certificate based system to enable its RE targets to be met. A Renewable Obligation Certificate (ROC) is issued to accredited generators for every MWh of electricity produced from renewable sources. ROCs can be freely traded and have a current market value of approximately £46/MWh⁶. Small generators of electricity (<50kW) can claim ROCs on a yearly basis, unlike larger generators who claim monthly. This makes it infinitely more possible for smaller systems to achieve a generated target of 1MWh, but the administration, paperwork and technical knowledge required in gaining the status of an accredited generator is often too arduous for domestic, community groups and small organisations to justify completing. Therefore only approximately a quarter of small wind installations are currently claiming their ROCs⁷.

For ROCs to be claimed where generators use some of their own electricity (which is the case of most UK Small Scale Embedded Generators or SSEGs) the generator must also have a buy and sell back contract with a supplier, this adds further complications of metering and finding an appropriate contract. Companies exist which will collect ROCs on your behalf, and tariffs such as Good Energy will give you ~ 4.5p/kWh produced and then claim the ROCs on your generation. Due to the complications of claiming ROCs the SSEG industry has not greatly benefited from this incentive. If ROCs were easier to claim for small scale generators their economics would greatly improve and this may give the micro generation market the stimulation it needs.

Costs and economics

A questionnaire was distributed as part of the WINEUR project, the results of this questionnaire showed that only 4% of small wind turbine installations were financially driven,

Model & designer/developer	Type of turbine	Building mounting possible	Rated Power, kW
Rugged Renewables	VAWT	Yes	0.4
Eurowind	VAWT	Yes	1.3 to 30
FreeGEN	Unknown	Unknown	Unknown
Posh Power	VAWT	Unknown	~2-2.5
Smaller Swift (Renewable Devices)	HAWT	Yes	Unknown
XCO2	VAWT	Yes	~6
Wind Dam	VAWT	Yes	2 (modular design)

Table 3: Prototypes being designed for the urban environment

with most installed for educational or environmental reasons. The average cost of systems was £4200/kW⁸, but this varied greatly depending on site factors. The underlying driver for an economic wind installation is of course the site mean wind speed. Smaller installations cannot warrant the financial outlay of onsite wind speed measurement prior to erection, therefore the Noabl database⁹ is being used by many to predict the mean speed in urban areas. The Noabl database shows the result of a mass wind flow model across the UK with corrections made for land/sea interfaces. The model has a 1 km resolution and does not take into account roughness changes such as in urban areas and it is likely that predictions of the wind speed in areas of complex terrain are inaccurate. It was seen that by calculating wind speeds in urban areas from the actual power output of two small wind installations at a 9 m hub height that the Noabl database over predicted by approximately 2 m/s¹⁰.

As installers advise that small wind turbines are erected far from habitation to reduce the risk of noise nuisance and increase the distance from obstacles which can extract energy from the wind, the cost of cabling can become significant. In some cases cable laying can account for up to half of the installation cost, especially where concrete needs to be excavated at up to £90 per metre. Manufacturers of small wind turbines above about 2.5kW often recommend an annual service. This may cost £200+ and will therefore cancel out much of the revenue gained in electricity savings from such a turbine. Yearly maintenance mainly involves inspection and some re-greasing, the costly aspect of the service is paying for an installer to travel and lower the turbine to working level. Due to the comparatively less demanding wind regime of an urban area, there may be scope for reducing the maintenance intervals or even better, conducting the service yourself. In the absence of



Two turbine configuration on a house. Photo: Berwickshire Housing Association

