

Small Wind Systems
Quarterly News Bulletin

Install



From the Editor

Gemma Grimes
Head of Onshore Renewables
RenewableUK

Welcome to the second edition of **Install**, a quarterly news bulletin for manufacturers, installers and anyone who wants to find out the latest information on small wind systems.

We were pleased to receive positive feedback on the first edition of **Install** issued in July. This is rather encouraging and once again proves the rapidly growing interest in the small wind sector.

RenewableUK was delighted to witness the growing Government's support for small scale renewable technologies through the development of new Microgeneration Strategy aiming to reduce the barriers for the microgeneration industry, thereby enabling more households and businesses to generate their own clean electricity.

We are pleased to announce that the dates have been confirmed for the 2011 International Small Wind Conference. This conference will provide you with the opportunity to learn about the latest policy and technical advances and meet with a wide range of industry stakeholders. See page 8 for further details.

We hope you will find **Install** informative and interesting. Should you have any comments or suggestions as to how we could improve **Install** please send these through to me: g.grimes@renewable-uk.com

Gemma Grimes
Head of Onshore Renewables, RenewableUK

CONTENTS

October 2010 | ISSUE 02

The impact of small-scale wind systems on ornithology, ecology and biodiversity	01
Sensible Siting	03
Small Wind Turbine Acoustics	05
Updates	07

The impact of small-scale wind systems on ornithology, ecology and biodiversity

By Stephen Crosher

Wind power is part of the solution to protecting and promoting biodiversity, the real threats to biodiversity are the consequences of other industrial activities.



Image supplied by Lynne Wilson RBGE

Threats to biodiversity are numerous, major threats are loss of habitat and food sources, environmental pollution, climate change, land use allocation, human recreation, domestic predators [such as cats], invasive alien species, low species populations, lack of interconnections between small colonies water management etc.

Energy from wind sources has the potential to have a beneficial

impact on reducing the impacts of both climate change and pollution by the reducing dependency on traditional dirty fuels.

Major causes of habitat loss are caused by the destruction and fragmentation of the natural environment by development, agricultural intensification including woodland management, water abstraction and coastal 'squeeze'. It is relatively simple to install small



Image provided by Eclectic Energy Ltd

“Wind power is part of the solution to protecting and promoting biodiversity, the real threats to biodiversity are the consequences of other industrial activities”.

scale wind systems to avoid habitat loss, there is the potential with sensitive use of the ground below the turbine to provide additional areas for foraging or inter-connection of colonies.

Birds, Bats, Badgers, Newts, Otters, Reptiles, Voles and Hedgehogs have all been the subjects of questions posed to quietrevolution by potential clients during the consultation and planning periods prior to the installation of a small scale wind system. The RSPB are well known to support the deployment of wind turbines, as they firmly believe that the impacts of climate change will eventually devastate bird populations globally and measures must be taken to avoid this scenario. The RSPB have even installed turbines of various sizes on bird sanctuary sites. It is highly likely that the consequences of man’s impact on the environment will have a similar affect on all creatures.

Echo location is a method of ‘seeing’ that man finds incredibly hard to perceive; how it works and how a mammal can ‘visualise’ its surroundings without the use of sight. However a bat can catch insects in flight in a dense wood with high wind speeds without colliding with moving branches or other obstacles. There can be no doubt that a bat receives a very clear and detailed ‘picture’ of its surroundings using echo-location and it is almost certain that a bat will be able to clearly ‘see’ a wind turbine whether moving or stationary.

There are various wind turbine architectures and we can debate whether a turbine that yaws [HAWTs] presents a greater threat than a turbine with a constant shape [VAWTs], a turbine that yaws could suddenly move into the path of bat in flight injuring the animal, however there may be something about VAWTs that present other threats to bats.

Research indicates that bats can certainly ‘see’ small turbines, however we do not know whether bats [like most mammals] are interested in their local environment, and could choose to investigate the new object in their territory, it is possible

[although unlikely] an inquisitive bat may be injured by the turbine.

Quietrevolution were highly intrigued that DEFRA have installed bat boxes adjacent to their installation of 4 turbines at their premises in Weybourne. The assumption can only be, that DEFRA views the risks to bats, should they roost in this location, as very small.

There will be the occasional site where there is a badger set, a rare orchid, a fox hole or other habitat of a ground living creature, however these locations will be rare and when they do occur they should be obvious or at least the location known by the site owner. Disruption can be easily managed locally and on a site by site basis. The land owner is also very likely to have knowledge of any species that could be compromised by the wind turbine and local measures can be taken to mitigate any impact.

The risks to ground creatures are almost entirely associated with the construction works phase – digging foundations and laying cables – rather than the operation of the turbine once installed. Once installed the turbines take up very little space and the impact should be manageable and negligible, providing locations which are clearly harmful are avoided.

By reducing the effects of climate change, reducing pollution and potentially providing additional small areas of refuge, foraging space and interconnection between colonies, the transition to a lower carbon economy, with an increased use of renewables, is likely to increase bio-diversity rather than damage it.



Image provided by Evoco Energy

Sensible Siting

By Geoff Watson

In an extract from his forthcoming book Geoff Watson discusses the case for sensible siting, achieving the maximum from a potential small wind installation.

The story so far

At the beginning of the era of interest in generating electricity from the wind and the birth of what might be called the “modern” wind turbine, two books were written by Golding and Putnam which became “bibles” to those involved in the development of the technology. It is interesting to note that both authors take up almost half of what are weighty tomes with consideration of siting and the wind resource.

Whilst solar dealers cannot make the sun shine brighter and hydro suppliers cannot make a river flow faster, a good wind turbine installation can make it windier. Doubling the wind speed at your site does not result in a doubling of energy

“Doubling the wind speed at your site does not result in a doubling of energy potential but an 800% increase.”

potential but an 800% increase. Whilst this may not prove feasible it is certain that poor siting will reduce the energy potential by a significant amount.

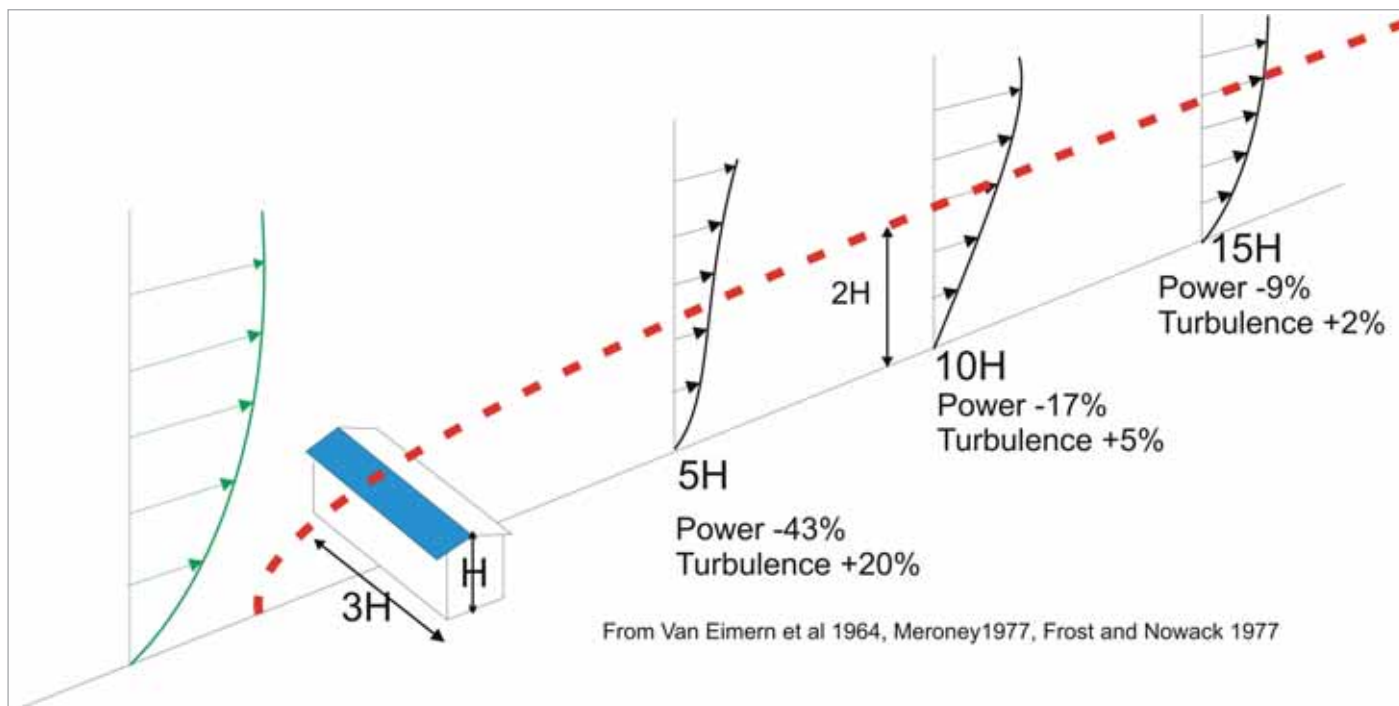
The number one rule of small wind turbine siting is that energy production needs a clean wind. As inevitably small turbines are going to be sited in the lower regions of the atmospheric boundary layer, where air flow is affected most by the surface and obstacles, the objective has to be to minimise these effects.

What obstacles create is turbulence (or gustiness) in the wind flow and this is always a bad thing for wind turbines. Whereas an anemometer might be able to accommodate gusts, due to its smaller size and inertia, a turbine rotor won't. Hence the actual output from what is assessed as an acceptable wind speed site can be a disappointment. More importantly the turbulence is going to affect the lifetime of the equipment. Sudden changes in rotor loading in gusts, sudden changes in wind direction and large differences between wind speed over the rotor area are all going to lead to increased wear and potential component failure.

What causes turbulence

It is beyond the scope of this short article to consider topographical effects in detail, in most cases they are of secondary concern for small wind turbines, but never consider siting a wind turbine on or near a cliff edge. It may seem attractive as a nice windy site, but it needs highly detailed consideration or turbulence will lead to destruction.

The most likely causes of turbulence are going to be trees and buildings in the locality. Considerable research was carried out on the effects of these on the wind flow during the 1970's, when small wind turbines were all there was and the might of academia was concentrating on their potential. The diagram shows an outcome of some of that work



“Increasing from 10m hub height to 20m could increase the power available by 30% or more, a hub height of 30m means a 60% increase in output.”

The point to note is how large the region of affected wind is, it stretches both before, after and considerably above the building obstruction. For best performance the turbine rotor needs to be sited outside this region, although the effects become of less concern in the furthest extremities.

It is apparent from the diagram that mounting a turbine, however small, on a chimney is not going to be successful and could cause early failure of both turbine and mounting. That is not to say that building mounted turbines are not achievable but they require specialist equipment and specialist installation and even then.

The affect of trees are similar, but more complicated to assess as it depends on tree types and how solid is the barrier. Assuming a similar affect to buildings is a sensible approach, but remember that trees grow and towers don't, regardless of the affect of global warming!

The quest for height

In most cases the solution is height. A well-known Scottish wind guru always quotes that he likes small wind turbines on as high a tower as can be afforded and at a distance from the building so that the rotor can be watched from the back door without getting a crick in the neck.

But how high is the economic solution? To avoid turbulence the rule of thumb is for the bottom of the rotor to be 10m above the highest obstruction in the vicinity. Even if there are no obstructions there is still the affect of surface friction, meaning as it does an increase in wind speed with height. Increasing from 10m hub height to 20m could increase the power available by 30% or more, a hub height of 30m means a 60% increase in output.

Add to this the availability of clean wind and the ability to generate in stable atmospheric conditions, when it is often calm at ground level, and the output of a turbine on a tall mast can be double that on a low mast surrounded by obstructions. In these days of feed-in-tariffs and assuming a much lower maintenance cost plus an increased lifetime then the economics of taller masts certainly make sense.

Unfortunately we live on a crowded island and have become bedevilled by regulations of one form or another. Obtaining clean energy by means of sensible siting is beset with difficulty. The first consideration is site size. Any planning

constraint is likely to require that the turbine is sited at a distance equal to “topple+10%” from a site boundary. There will be secondary considerations of noise and shadow flicker impacts on any neighbours, but these effects are actually reduced by using tall masts.

GPDO

In the near future there is rumoured to be a GPDO for small wind turbines, meaning that within certain restrictions a small wind installation will not require planning permission. The idea of a GPDO was born from the enthusiasm in some circles for the building mounting of domestic turbines. However the enthusiasm was short-lived once those more knowledgeable became involved (and some of the enthusiastic new companies went out of business) but the restrictions are so tight with regard to height that they will potentially drive unsuitable installations.

Given the planned lifetime of both the wind turbine and the associated feed-in-tariff the additional cost of sensible siting and its associated planning cost make economic sense. The smile from a successful installation long outlives the smirk from a cheap first cost – a turbine mounted on a taller tower will always generate more electricity reliably.



Small Wind Turbine Acoustics By Alistair Mackinnon

One of the more important issues currently facing the small wind turbine community is that of the acoustic character of the turbine. This is more often than not simply termed 'noise'. There is a great deal of misunderstanding of this important issue and this article is intended to bring some clarity to the debate and help all stakeholders make correct and well informed decisions on the basis of an appreciation of the terminology and underpinning facts.

First however we need to introduce and understand some of the terminology associated with the acoustic issue. Two of the most important terms in common use are the sound pressure or L_p (which is what the human ear 'hears') and the sound power or L_w (which is the unique source property of the turbine and is a constant at a fixed operating point ie wind speed). Both L_p and L_w are usually expressed as levels, the sound pressure level or SPL and the sound power level or SWL. Both the SPL and SWL are expressed as decibels (dB). This can and does lead to some confusion – a decibel figure without any qualification (SPL or SWL) is essentially meaningless.

The engineering units of sound pressure are Pascal's (Pa) or N/m² and the engineering units of sound power are Watts (W). Due to the very large ranges of pressures or powers, these are usually expressed in decibel terms which use a logarithmic approach to compressing these ranges down to more manageable ones.

The reference sound pressure is 20 μ Pa and the reference sound power is 1pW.

The basic equations are shown below:

$$\text{SPL} - 20 \log_{10} \left(\frac{p}{p_0} \right)$$

Where p is the measured sound pressure in Pa and p_0 is the reference sound pressure (20 μ Pa)

$$\text{SPL} - 10 \log_{10} \left(\frac{w}{w_0} \right)$$

Where w is the measured sound power in Watts and w_0 is the reference sound power (1pW)

However the human ear does not respond in a linear fashion and a 'weighting' to simulate this response is usually applied and is known as 'A-weighting' – the subsequent terms become dB(A).

These terms however do not give any indication as to the 'nature' of the acoustic character, how this may vary in terms of its frequency response – whether it is 'tonal' (usually a narrow discrete character) or more 'broadband' in nature which usually comprises a number of elements across a wider range or how it varies with time – is it continuous or more intermittent.

There are acoustic methods which deal with these factors but are beyond the scope of this article.

“In other words the acoustic power is a tiny fraction of the total electrical power. Consequently if the turbine manufacturer wishes to reduce the ‘noise’ from the turbine then he or she has to work with 0.01 in 50.000 which can be challenging.”



Decibels and their use are probably best illustrated by way of an example:

If we use the above equations then a sound power of 96 dB is equivalent to approximately 10– 2 Watts or 0.01W 96 dB sound power would not be atypical of turbine rated around 50kW (electrical). In reality this means that the ‘noise’ contribution would be 0.01 Watts in the 50kW or 50,000 Watts that the turbine is capable of generating.

In other words the acoustic power is a tiny fraction of the total electrical power. Consequently if the turbine manufacturer wishes to reduce the ‘noise’ from the turbine then he or she has to work with 0.01 in 50.000 which can be challenging.

In energy terms a difference of 3 dB is equivalent to a doubling or halving. This means that a relatively small change in dB, equates to a very significant change in energy.

For planning purposes it is usually important to know what the acoustic effect will be on the receiver and this is usually expressed as sound pressure or sound pressure level. This means that we need a robust, repeatable method of taking a turbines sound power and using that unique

parameter to calculate the sound pressure that a receiver is likely to perceive. There is a general rule of thumb that the sound pressure decreases by 6dB for every doubling of distance.

There are international standards (IEC 61400– 11: 2003) which use well accepted methodologies for calculating a wind turbines sound power. Similarly there are a number of standards which give guidance on how to measure or calculate a receiver sound pressure. Most typically these include BS 4142 and the ETSU–R–97 guidelines.

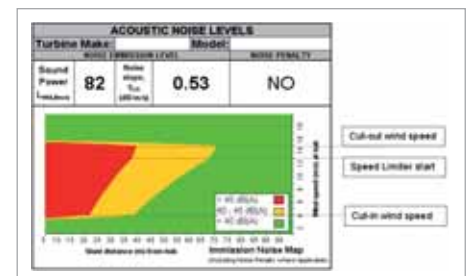
Given we can accurately determine a turbines sound power and then use an appropriate methodology to calculate a receiver sound pressure, then the issue becomes one of what those receiver sound pressures should be.

Internationally at a World Health Organisation (WHO) and UK nationally under the provisions of the GPDO (General Permitted Development Order) there is ongoing debate and discussion on what these levels should be.

It is RenewableUK’s opinion that these receiver sound pressure levels should be set at 45 dB(A) as this is currently the night time WHO level and is believed to be current best practice that both protects the

environment and individuals amenity whilst encouraging the uptake of wind turbines in most settings.

RenewableUK is at the forefront of encouraging better understanding of the acoustic issues and to this end has worked with the wind turbine industry to develop a robust methodology to address many of the factors discussed above. The acoustic data is summarised in the acoustic map. More complete details on its derivation and use can be found in the current edition of the small wind safety and performance standard, a typical map is shown Below:



Updates

The latest news from the sector.

10% UK electricity to have come from Wind – September National Grid announcement

National Grid informed that production of electricity from wind has reached an unprecedented level of 10 per cent of all electricity delivered to consumers generated by the UK's wind farms.

At the peak time of 8.30pm on Monday 6th September, 1860 MW was being generated, mostly from Scotland, accounting for 4.7 per cent of total generation at the time. National Grid believes that if embedded wind farm generation (generation feeding directly into the low voltage local electricity networks by smaller wind farms) is taken into account wind generated about 10 per cent of country's power during the 24 hour period. The total UK consumption during the 24 hours was 809.5GWh.

The UK currently has 4,616.05MW of installed wind energy across 263 wind farms, with a further 2,716MW in construction and 6,126MW with planning consent. The industry has highlighted that added together this represents 13.5GW about to come on stream in the next few years. A further 10GW of wind energy projects in the planning system awaits determination.

Links

National Grid:
www.nationalgrid.com

Feed-in Tariff: Data comes through

In September, DECC has published statistics on the Feed-in Tariffs (FIT) covering installed capacity for the first quarter of the scheme (1st April – 30th June 2010). In future these statistics will be updated on a quarterly basis two months in arrears.

According to DECC statistics, at the end of the quarter 15.2 MW of capacity, across 2,771 installations, had been included under the FIT scheme. Of overall capacity, wind turbines represented 35 per cent, or 5.3 MW, across 63 installations. Although Solar Photovoltaics represented 98 per cent of all installations, this translated to 44 per cent of total capacity, at 6.7 MW. Hydro had four installations covered by FIT by July, which were larger-sized non-domestic schemes, and represented 3.3 MW of capacity, 22 per cent of the total.

The domestic sector has currently the most installations covered by the FIT scheme, with 2,730 of the 2,771 total. However, these are typically smaller sized installations, and represent less than half of the overall installed capacity. The 41 non-domestic installations represent 54 per cent of overall installed capacity, at 8.3 MW.

Links

DECC press release:
www.decc.gov.uk/assets/decc/Statistics/publications/trends/556-pn10-105.pdf

Potential new small wind turbine blade manufacturer on the Isle of Wight

Wind turbine manufacture is set to return to the Isle of Wight nearly one year after Danish wind giant Vestas closed its only major turbine plant in the UK, making 425 people redundant. Worker-lead new company SureBlades aims at the micro-turbine market, producing turbines that have environmental advantage of being fully recyclable.

SureBlades that has been set up by Keith Hounsell and former Vestas employees will be making an innovative type of micro-blades. Unlike conventional turbine blades made from an epoxy resin which cannot be broken down, the company will use a material that can be melted down and made into new blades once the old ones are no longer in use.

SureBlades sought orders prior to entering the production and already received and order of 1,000 blades by the Irish C&F Green Energy. The company is due to become fully operational this autumn.

Links

SureBlades Website (coming soon):
www.sureblades.com



International Small Wind 2011 Conference & Exhibition

RenewableUK's third annual event dedicated to small wind systems development will be held on 5–6th April 2011 at The Sage, Gateshead, UK.

The 2010 event was a great success and we expect over 700 delegates from across the globe to attend next year's event.

- Online registration open
- Exhibition bookings open soon
- Sponsorship opportunities

Links

Event website:

www.renewable-uk.com/events/small-wind-conference

Opportunity to book a pod at the RenewableUK Wind Pavilion – Ecobuild 2011

RenewableUK will be hosting a Wind Pavilion at Ecobuild in London's ExCeL exhibition and conference centre 1st – 3rd March 2011. Ecobuild is the world's biggest and most successful event for sustainable design, construction and the built environment, with over 41,000 visitors at the 2010 event.

Wind Pavilion provides a unique opportunity for RenewableUK members to promote their products and services to a larger and wider public audience. Members can still join the pavilion by booking a stand on the pavilion or a pod.

Further details are available from Sarah Harper (s.harper@renewable-uk.com) at RenewableUK.

Links

Ecobuild 2011 website:

www.ecobuild.co.uk

Industry consulted on the new Microgeneration Strategy

On 12th July 2010, Government announced a consultation on a new Microgeneration Strategy, which will look forward to 2020 and cover England only.

Rather than produce a document on which interested parties could comment, Government aimed to involve all those with the greatest knowledge and expertise in the field to contribute to the development of a draft Microgeneration Strategy, which would then be published for the wider public consultation.

The new strategy will focus on the four areas, namely Quality, Technology, Skills and Advice. Throughout August and September, series of working group meetings, around these four theme areas, were held to discuss what industry should be doing, and where Government could assist to tackle non-financial barriers. RenewableUK has been involved in all working groups.

Links

RenewableUK press release:

www.bwea.com/media/news/articles/pr20100712.html

DECC website for the Microgeneration Strategy Consultation:

www.decc.gov.uk/en/content/cms/consultations/microgen_strat/microgen_strat.aspx

UK Trade & Investment Workshops

Throughout 2010 UK Trade & Investment (UKTI) has been conducting a review on how best to support the Renewable Energy industry and its growing export potential.

For this purpose, UKTI is therefore holding three ½ day workshops across the UK to communicate the findings of this review and to encourage collective working to maximise the export potential of the UK's renewable energy community.

The workshops are aimed at bringing together key stakeholders to consider how best to ensure that the UK Renewables Sector's International Trade effort is carefully focused.



RenewableUK

Greencoat House,
Francis Street
London SW1P 1DH,
United Kingdom

Tel: +44 (0)20 7901 3000

Fax: +44 (0)20 7901 3001

Web: www.renewable-uk.com

Email: info@renewable-uk.com