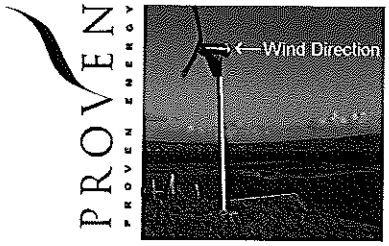

Proven WT6000 Wind Turbine
Mounted on TM1500 15m self supporting tower
Noise Emission Report

General

The dB (A) scale is the most common measure used to quantify noise. It covers sound intensity over the entire audible scale *and* takes account of the sensitivity of the human ear to give an overall measure of "loudness".

Typical dB(A) Levels

Sound Level	dB (A)
Threshold of hearing	0
Whisper	30
Talking	60
City Traffic	90
Rock Concert	120
Jet Engine (10m away)	150

Current Best Practice

In assessing the noise from a proposed wind turbine installation we are often interested in what noise levels will be at various distances from the wind turbine. It is accepted practice to *calculate* noise contributions from the wind turbine. This is because it is only practical to *measure* the wind turbine contribution accurately when it is 10 dBA above background noise. For example, background noise in a "quiet" environment is typically 30-40 dBA making it impossible to *measure* contributions less than 40-50 dB(A).

Proven WT6000 Wind Turbine Noise Calculations

Figure 1 shows how the noise emitted by a Proven WT6000 wind turbine on a 15m mast will disperse over the local environment. Maximum noise output at the base of the machine was recorded at 60dB(A) at a wind speed of 20 m/s. The noise output at the base of the mast in light winds 5m/s was 40 dB(A). The sound meter was held at a height of 1.5m from the ground. Background noise is louder than the turbine when more than 25m from the mast in both cases.

Figure 2 shows how the combined noise of wind turbine plus background; this is what will be detected by the human ear.

Figure 3 graphs the dBA difference between wind turbine and background plus common complaint classifications. *It can be generally taken that there will be no noise complaints where the turbine specific noise is 10dBA less than background.* This happens at a distance of 40-75m depending on wind speed.

Details of the calculations used in these graphs are given in Appendices B & C.

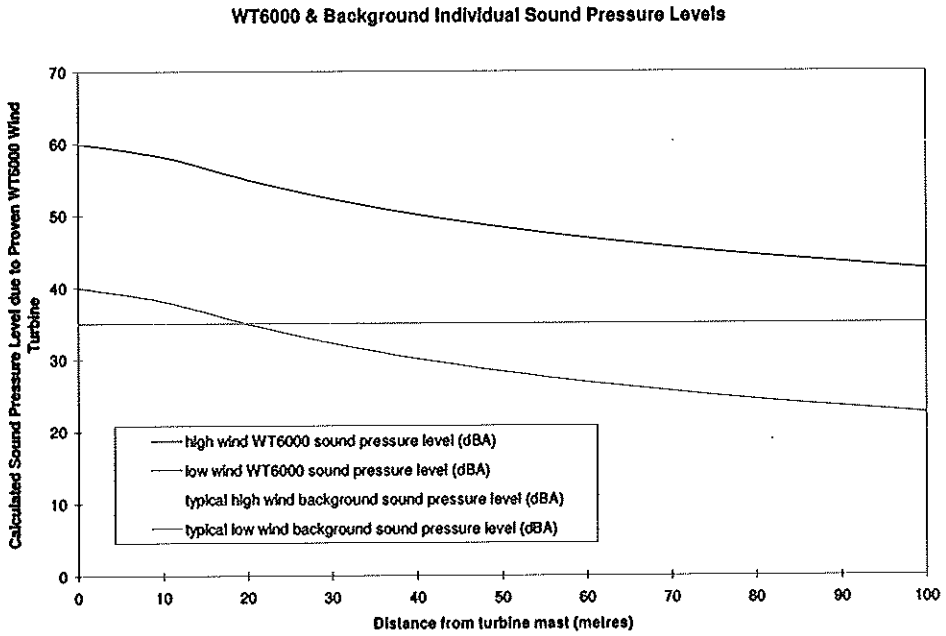

Figure 1

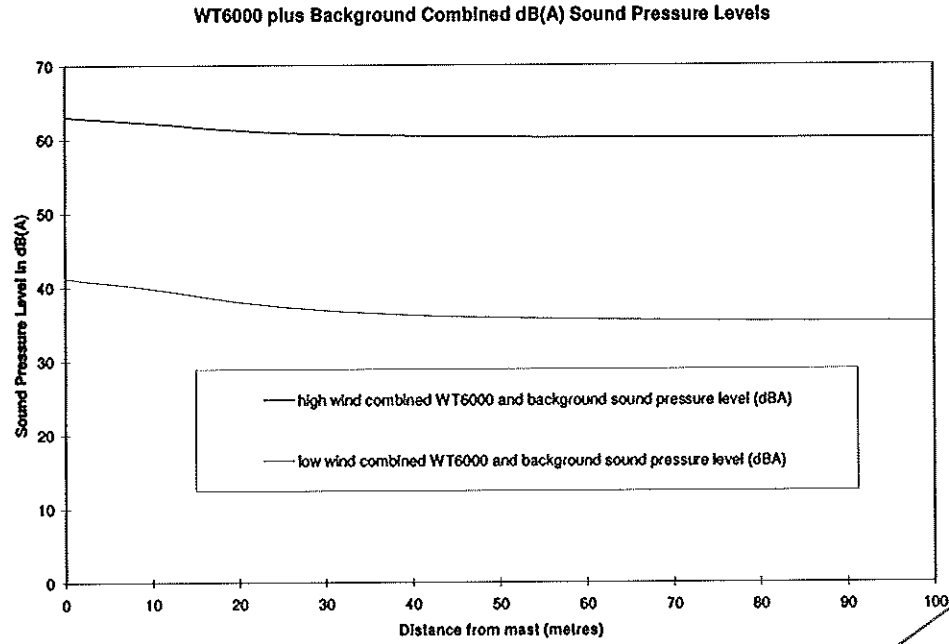

Figure 2

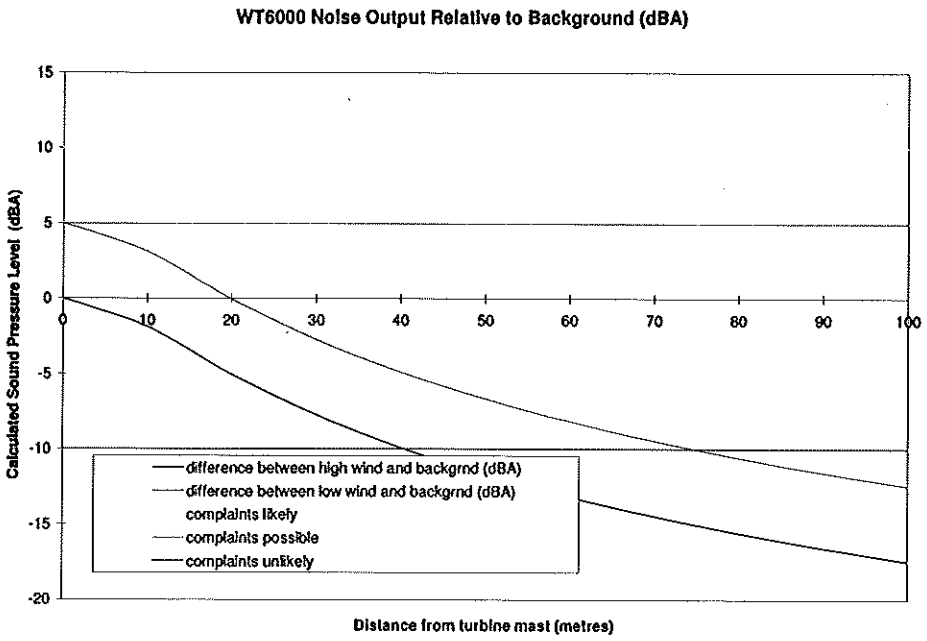

Figure 3

NOTE ON MEASUREMENTS USED IN THIS REPORT

All measurements were taken on a portable SL-25 dBA sound meter at our demonstration wind turbine site in Kilmarnock. Proven Wind Turbines emit a swishing noise only - we do not believe full tonal analysis is needed for our small wind turbines (see also Appendix A).

COMMENT ON THE CALCULATIONS AND ASSUMPTIONS USED IN THIS REPORT

The above method does not take account of wind "streaming" noise to the downwind side of the turbine. In practice, turbine dBA levels will be shifted downwind by a variable amount depending on the individual site.

In both cases the dB(A) readings taken as coming from the wind turbine **certainly also included a contribution from background noise in a nearby tree.** Secondly, in the graphs shown, the typical background dBA readings have been chosen very conservatively (low).

Proven Energy Ltd
Wardhead Park, Stewarton, Ayrshire, KA3 5LH, Scotland, UK
Tel: +44 (0)1560 485 570
Fax: +44 (0)1560 485 580
email: info@provenenergy.com
web: www.provenenergy.com

Appendix A - Noise Reduction Features In Proven Wind Turbines

Feature	Benefit
Proven rotors are specially designed to operate at low rpm (typical max Tip Speed Ratio 6)	Blades and bearings rotate slowly keeping air noise to a minimum.
Direct Drive Permanent Magnet Generator	There is no gearbox as the rotor is coupled direct to the generator. This eliminates the gearbox hum which is the main source of noise in turbines with gearboxes. There are no touching parts.
Specially shaped blade tips	The rounded tips on Proven Wind Turbine blades are designed to reduce the vortices present at the end of any aerofoil. This keeps wind noise to a minimum.

Appendix B - Calculating Sound Pressure Levels

DEFINITIONS

1. Sound Pressure Level in dB(A) = 10 x $\log_{10}$ (sound power in W/m^2)

2. Sound Power in Watts/m^2 = $10^{0.1 \times (dB-120)}$

Given a sound power P_1 at distance d_1 from a noise source the sound power P_2 at distance d_2 may be calculated by the formula

3. $P_2 = P_1 x \left(\frac{d_1}{d_2}\right)^2$

ADDING DBA SOUND PRESSURE LEVELS FROM DIFFERENT SOURCES AT POINT X

First convert the dBA ratings at their initial distances to sound powers using equation 2.

Use the equation 3 to work out the sound powers at point X where you are interested in the total sound pressure level

Add all the sound powers together to find P_{total}

Convert back using equation 1 to find $dB(A)_{total}$

Appendix C - Calculations used in this report

height to hub	15		dBA high	60								
height meter	1.5		dBA low	40								
initial height	13.5											
Inital dist	0											
db=10log(power in w/m2)+120												
sound power=10^(0.1(db-120)												
horizontal distance (m)	actual distance	sound high (w/m2)	sound low (W/m2)	high wind WT2500 sound pressure level (dBA)	low wind WT2500 sound pressure level (dBA)	typical high wind background sound pressure level (dBA)	typical low wind background sound pressure level (dBA)	combined WT6000 plus background sound high	combined WT6000 plus background sound low	high wind combined WT6000 and background sound pressure level (dBA)	low wind combined WT6000 and background sound pressure level (dBA)
0	13.5	0.000001	1E-08	60	40	60	35	0.000002	1.32E-08	63	41
10	16.8	6.46E-07	6.46E-09	58	38	60	35	1.65E-06	9.62E-09	62	40
20	24.1	3.13E-07	3.13E-09	55	35	60	35	1.31E-06	6.29E-09	61	38
30	32.9	1.68E-07	1.68E-09	52	32	60	35	1.17E-06	4.85E-09	61	37
40	42.2	1.02E-07	1.02E-09	50	30	60	35	1.1E-06	4.18E-09	60	36
50	51.8	6.79E-08	6.79E-10	48	28	60	35	1.07E-06	3.84E-09	60	36
60	61.5	4.82E-08	4.82E-10	47	27	60	35	1.05E-06	3.64E-09	60	36
70	71.3	3.59E-08	3.59E-10	46	26	60	35	1.04E-06	3.52E-09	60	35
80	81.1	2.77E-08	2.77E-10	44	24	60	35	1.03E-06	3.44E-09	60	35
90	91.0	2.2E-08	2.2E-10	43	23	60	35	1.02E-06	3.38E-09	60	35
100	100.9	1.79E-08	1.79E-10	43	23	60	35	1.02E-06	3.34E-09	60	35
						sound w/m	sound w/m2				
						0.000001	3.16E-09				

PROVEN
ENERGY

NOISE REPORT STATEMENT - July 07

This measurement has been taken using a handheld noise meter at our wind turbine test facility located at Proven Energy Ltd, Stewarton, Scotland.
The results are merely an indication of the level of noise produced by our wind turbines and it may be inconsistent when measuring a similar wind turbine at a different location.

Proven Energy is committed to providing high quality products, and is in the process of commissioning and collating further noise reports on its range of wind turbines.

South Moor Farm- 6kW Proven Wind Turbine.

Planning Supporting Statement.

Introduction.

South Moor Farm is a small isolated 80 acre farm used for rearing sheep and cattle, situated in a clearing in Dalby Forest. Six years ago we diversified into provision of Bed and Breakfast accommodation. We already have a solar panel for water heating and wish to produce our own electricity from a wind turbine to supplement the electricity we buy from Npower on their green tariff.

Extract from. **Renewable Energy Supplementary Planning Document North York Moors National Park Authority Local Development Framework**

Forest.

• Located in the south eastern area of the Park. • Sited on the gradually rising areas of former moorland and the moorland fringe areas. • Largely coniferous with some deciduous on the fringes. • Settlement is almost completely absent from the area with exception of occasional isolated properties. • Small hamlet of Low Dalby in the Dalby Forest is exceptional.	As forests will screen long distance views turbines could be located within clearings against a back-drop of trees or associated with buildings. Turbines may also be suitable around the edges of the forest where they can blend in to a backdrop of trees. Care should be taken to ensure that the turbine can operate effectively in the proximity of trees or buildings

Visual impact

Proven's small - scale wind turbines are designed so that visual impact is kept to a minimum without compromise to power output. Ideally, a wind turbine requires a location where it is exposed to wind from all directions, but consideration should be given to the visual impact. The turbine head & blades are black and the galvanised tower will weather to become a dull grey, making it almost invisible to the human eye at a distance in some cases.

South Moor Farm- 6kW Proven Wind Turbine.

Noise

Proven recognise that noise can be a nuisance, not only to the owner of a wind turbine, but also to their neighbours. This is why Proven turbines have been developed as one of the quietest on the market. South Moor Farm as no close neighbours.
Most of the noise associated with larger - scale wind turbines comes from the gearbox located inside the nacelle (head). Proven's small - scale turbines are produced without a gearbox for this reason! No gearbox – no gearbox noise.
In severe winds, the blades fold away from the wind, thus reducing the exposed area. At the same time, the blades twist and reduce the speed. This prevents damage to the turbine and generator, whilst maintaining maximum output. It does, however, increase the noise, but this is balanced by the sound of the wind itself. During normal operation, the Proven turbine is generally regarded as one of the quietest turbines on the market.

Ornithological Issues

The Royal Society for the Protection of Birds (RSPB) supports the sustainable development of renewable energy such as wind power because it helps mitigate climate change, which they believe "poses the most significant long - term threat to the environment" – this was also echoed in a recent report in Nature. It concluded that over the next 50 years climate change is expected to drive a quarter of land animals and plants into extinction and that under the higher estimates of climate change a quarter of the birds could become extinct.
The RSPB described the report as 'a deeply depressing paper'. The RSPB further agree that developed alongside other forms of renewable energy and energy efficiency, wind energy has a key role to play in averting the worst of these impacts. Across the country as a whole, studies carried out at the UK's existing wind farm installations show hit rates of less than one per turbine per year. For example, nine turbines on the harbour wall at Blyth are in a busy bird area and of bird flights through the wind farm, only 1 in 10,000 resulted in a collision. This translates to 1 - 2 collisions per year per turbine. To put this into perspective, cars in the UK kill more than 10 million birds – every year.
When scaling this type of statistic down to our small - scale type of equipment, the rate drops even more dramatically to an almost non - existent figure! This fact, coupled with the careful siting of our systems, means that we can further protect our feathered friends and help to ensure their long - term future. Quite simply, birds are in far more danger from colliding with overhead power lines, being eaten by domestic cats, or hit by vehicles than they are from wind turbines.