

Report for:

FuturEnergy

1kW Airforce Wind Turbine Noise Assessment

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FuturEnergy - 1kW Airforce Wind Turbine Noise Assessment

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1. INTRODUCTION

ACCON UK Limited (ACCON) have been commissioned by FuturEnergy to carry out a noise measurement study for the 1kW 'Airforce' type wind turbine installed at Pebworth. This assessment has been carried out broadly in line with the method identified in BS 61400 part 11.

The purpose of the noise measurement study was to provide appropriate noise data for the wind turbine across a range of wind speeds.

An acoustic glossary is provided in **Appendix 1**. A specification of the wind turbine is provided in **Appendix 2**.

2. LEGISLATION, POLICY AND GUIDANCE

2.1. British Standard 61400 part 11

BS 61400 part 11:2013 '*Wind Turbines: Acoustic Noise Measurement Techniques*' sets out a methodology for measuring and characterising noise emissions from wind turbine generator systems.

The procedures within the standard are *'intended to facilitate characterisation of wind turbine noise with respect to a range of wind speeds and directions. Standardisation of measurement procedures will also facilitate comparisons between different wind turbines.*

The procedures present methodologies that will enable the noise emissions of a single wind turbine to be characterised in a consistent and accurate manner. These procedures include the following:

- *Location of acoustic measurement positions;*
- *Requirements for the acquisition of acoustic, meteorological, and associated wind turbine operational data;*
- *Analysis of the data obtained and the content for the data report; and*
- *Definition of specific acoustic emission parameters, and associated descriptors which are used for making environmental assessments.'*

ACCON have utilised an assessment methodology broadly in line with the methodology, for small wind turbines, that is detailed in Annex F.

3. MEASUREMENT SURVEY

In order to determine the sound power level of the 1kW 'Airforce 1' type wind turbine at different wind speeds, noise measurements were carried out between 1200 hrs on 30th June 2015 and 1200 hrs 31st July 2015. The assessment was carried out at a site in Pebworth where a trial wind turbine has been installed. Simultaneous wind and rain data was collected.

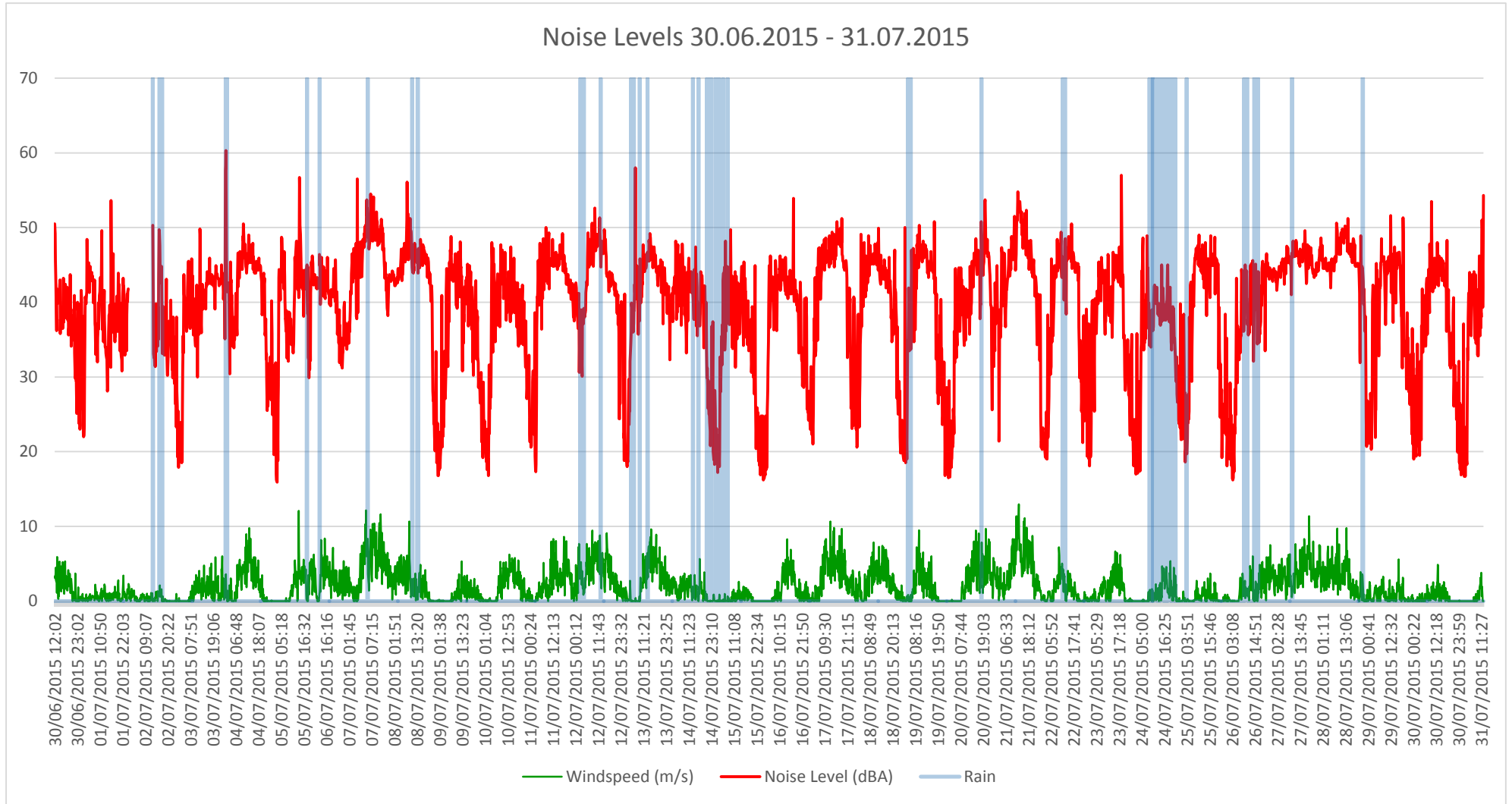
The surrounding area has relatively flat topography and consists of arable and pasturable land. The nearest buildings were at such a distance that no acoustic effect on the noise measurements would be observed. The nearby roads are low density and therefore would not affect the noise measurements significantly.

The noise measurements utilised a Rion NL-52 in a free-field location approximately 5m from the wind turbine tower. The sound level meter is a Type 1 instrument and has a current certificate of calibration. Before and after the measurement period, field calibration was carried out in order to ensure that the equipment had remained within reasonable calibration limits (+/- 0.5 dB).

Figure 3.1 identifies the noise levels and the wind speeds recorded over the measurement period. **Figure 3.1** also identifies where periods of rain were experienced and these periods of data have been removed from any further analysis.

The noise monitoring position is shown on a site layout plan in **Appendix 3**.

Figure 3.1: Noise Levels for the Entire Measurement Period



4. NOISE ASSESSMENT

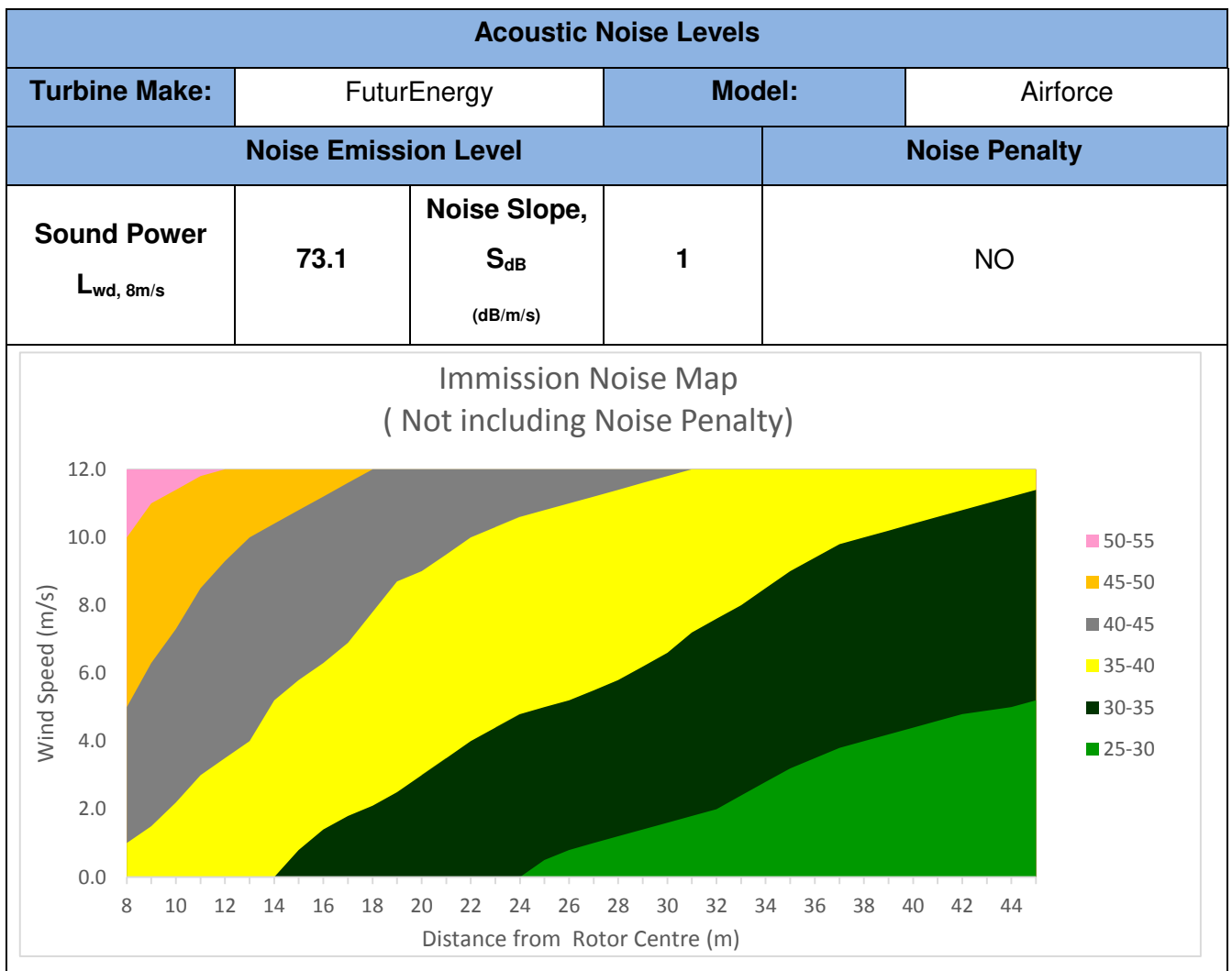
The noise levels and wind speeds, as shown in **Figure 3.1**, have been assessed in line with BS 64100 part 11. The apparent sound power level at the centre of the turbine for specific wind speeds is shown below in **Table 4.1**.

Table 4.1: Sound Power Levels at Specific Wind Speeds

Wind Speed (m/s)	1	2	3	4	5	6	7	8	9	10	11	12
Apparent Sound power Level (L_{wa})	66.0	67.9	68.7	69.7	70.9	72.1	72.7	73.0	73.5	74.6	76.6	77.8

From the sound power levels identified in **Table 4.1**, a noise label has been produced including an immission noise map of the Airforce 1 wind turbine. This can be seen in **Figure 4.1**.

Figure 4.1: MCS Noise Label



Appendix 1 Glossary of Terms

Appendix 1: Glossary of Terms

Term	Description
'A'-Weighting	<i>This is the main way of adjusting measured sound pressure levels to take into account human hearing, and our uneven frequency response.</i>
Decibel (dB)	<i>This is a tenth (deci) of a bel. Decibel can be a measure of the magnitude of sound, changes in sound level and a measure of sound insulation. Decibels are not an absolute unit of measurement but are an expression of ratio between two quantities expressed in logarithmic form.</i>
$L_{Aeq,T}$	<i>The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given period, T. T may be as short as 1 second when used to describe a single event, or as long as 24 hours when used to describe the noise climate at a specified location. $L_{Aeq,T}$ can be measured directly with an integrating sound level meter.</i>
L_{A10}	<i>The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 10 per cent of a given time and is the L_{A10T}. The L_{A10} is used to describe the levels of road traffic noise at a particular location.</i>
L_{A50}	<i>The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 50 per cent of a given time and is the L_{A50T}.</i>
L_{A90}	<i>The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 90 per cent of a given time and is the L_{A90T}. The L_{A90} is used to describe the background noise levels at a particular location.</i>
L_{Amax}	<i>The 'A'-weighted maximum sound pressure level measured over a measurement period.</i>

Appendix 2

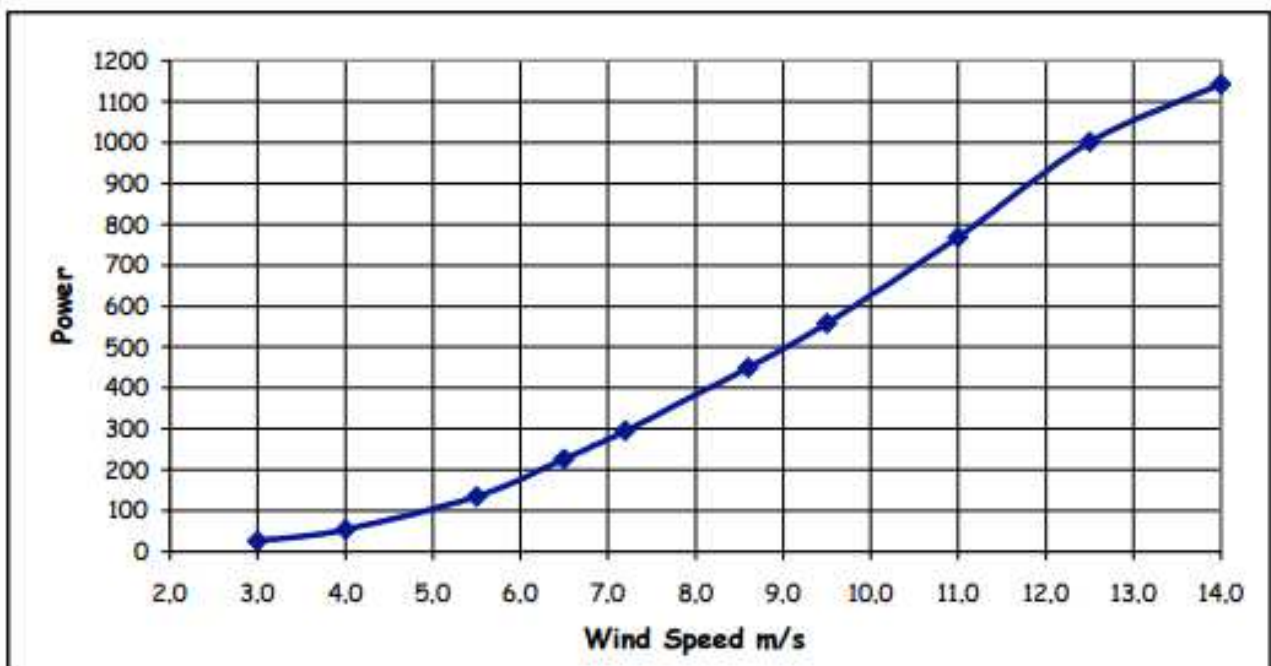
Specification of the Airforce 1 Wind turbine

APPENDIX 2 – Specification of the ‘Airforce 1’ 1kW wind turbine

Manufacturer	FuturEnergy
Model Number	Airforce 1 kW
Serial Number	6026
Axis Plane	Horizontal
Up/Downwind Rotor	Upwind
Hub Height	8m
Distance from rotor centre to tower axis	33cm
Rotor Diameter	1.8m
Tower type	Tube
Turbine control	Passive stall
Constant or Variable Speed	Variable
Rated Power output	1kW
Control Software version	0
Number of Blades	3

Power Specification and Power Curve

Wind (m/s)	Wind (mph)	Turbine RPM	Output Current (A)	Battery Voltage (V)	Power (W)	Power/Day
3.0	6.8	258	1.0	26.0	26	624
4.0	9.0	280	2.1	26.0	55	1310
5.5	12.4	310	5.0	27.0	135	3240
6.5	14.6	316	8.4	27.0	227	5443
7.2	16.2	400	10.2	29.0	296	7099
8.6	19.4	420	15.0	30.0	450	10800
9.5	21.4	442	18.0	31.0	558	13392
11.0	24.8	460	24.0	32.0	768	18432
12.5	28.1	480	30.0	33.4	1002	24048
14.0	31.5	490	34.0	33.6	1142	27418



Appendix 3

Baseline Noise Monitoring Location





Email: enquiry@accon-uk.com

Reading Office:

Tel: 0118 971 0000
Fax: 0118 971 2272
Unit B, Frons Park,
Frouds Lane, Aldermaston,
Reading, RG7 4LH

Brighton Office:

Tel: 01273 573 814
Citibase, 95 Ditchling Road,
Brighton, East Sussex, BN1 4ST

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