renewable devices

SWIFT Rooftop Wind Energy System™

Technical and Planning Pack

Renewable Devices Swift Turbines Ltd, Bush Estate, Edinburgh EH26 0PH

Contents

1. Introduction

As part of our mission to provide accessible renewable energy technologies, Renewable Devices Swift Turbines Ltd (RDST) have produced the world's first silent building mountable wind energy system capable of providing a cost effective renewable energy source for domestic, commercial and industrial use.

The SWIFT Rooftop Wind Energy System™ is a revolution in micro-wind power, having been designed specifically to meet the demands of small wind and on-site usage. The emphasis of the design process has focused on safety, reliablility and ease of operation as well as high performance and the turbine has a number of unique properties which make it the first choice in wind power.

This document is intended to provide guidance to engineers, architects, specifiers and end users when considering the installation of a SWIFT Rooftop Wind Energy System™. It is not intended as an installation manual and does not contain all the information required for the installation, maintenance, and commissioning of the system.

The system must ONLY be installed by Renewable Devices Swift Turbines trained and accredited installers.

2. Technical Specification

SWIFT™ Turbine Technical Specification

Turbine	Upwind Horizontal Axis with Diffuser Ring
Rated Power Output	1.5kW*
Annual Power Supplied	Up to 2000kWh**
Annual CO_2 Displacement	1.2tonnes***
Product Life	20 year maintenance free
Generator	Brushless PMG
Blades & Rotor	2m injection moulded nano-fibre reinforced polymer
Mast	Aluminium or stand-alone wooden or steel pole
Mounting System	Custom designed aluminium brackets
Start-up Speed	2.3m/s****
Speed	<35dB [A] (across all wind speeds)
Acoustic Emissions	CE Certified BS EN 61000
EMI (electro-magnetic emissons)	
Grid Connection	G83, UL & AS4777 Certified
Battery Charging	48v or to your requirements
Hot Water System	Replaces existing immersion heater
Safety, electrical & reliability standards	BS EN 61400-2, BE 7671 & BS 5760-7

* Rated Wind Speed 12m/s
** Dependent on siting of turbine
*** Substituting end-user electricity with a single 1.5kW rooftop turbine at 30% utilisaton by CEDRL RETScreen International
**** Wind tunnel verified

3. Key Features for Planning

The following pages will detail the key concerns of any planning department and the features of the SWIFT™ that you should be aware of for completing or supporting a planning application.

- Visual Impact
- Noise
- Electromagnetic Interference
- Bird Strike
- Safety

Visual Impact

The SWIFT™ has been designed to comply with planning requirements and to complement the aesthetics of the urban environment.

In building mounted installations, the SWIFT™ will be installed in a position to take advantage of higher wind speeds on the top of building structures and will be comparable in height to a large television aerial or chimney stack.

Flash
To minimise the occurrence of 'flash' the SWIFT™ rotor is comprised of injection moulded nano-fibre reinforced polymer, with a matt black surface. Matt is specifically chosen to avoid highlights or bright reflections from rotor surfaces during rotation, in either natural or artificial light. The black colour allows for minimal reflectivity (the ratio of the total amount of white light diffusely reflected by the surface to the amount falling on the surface) as it is extremely absorptive over a wide range of wavelengths.

In addition, the small diameter and likely location of the turbine ensures that reflection and reflectivity are not considered to present any significant issues.

Relative Scale
Planning applications should be assessed on a case-by-case basis, taking account of the existing building/structures, relative scale, nature of the setting and benefits of renewable energy generation. In large scale installations and applications for installation on prominent buildings, computer generated photo montages of buildings with superimposed in-situ turbines can be used to assist the planning process.

Due to the fact that SWIFT™ turbines will be located on or near existing commercial/domestic buildings, they will not add a significant new visual element to the local landscape.

Free standing SWIFTs™ should also be assessed on a case-by-case basis, in accordance with guidance contained in the main planning annex on wind energy and any additional structural/engineering issues.

Noise

The need to control noise emissions from a small-scale wind turbine is critical especially in domestic settings. In commercial/light industrial settings, where there are no residential properties in the immediate vicinity, the control of noise is important, but less critical. Detailed discussion of noise from wind turbines is contained in the main wind energy appendix to "PAN 45 (revised 2002): Renewable Energy Technologies", and wider discussion of planning and noise can be found in PAN 56.

In the absence of specific guidance on noise for small-scale wind turbines, they should meet the criteria identified by the DTI/ETSU report: 'The Assessment and Rating of noise from wind farms.' . As a general rule, noise emitted from any turbine should not exceed 5dB(A) above background noise, with a fixed limit of 43dB(A) recommended for night time. Both day and night time noise limits can be increased to 45dB(A) where the owner of the property benefits directly from the operation of the turbine.

Silent
For all wind speeds the SWIFT Rooftop Wind Energy System™ emits less than 35dB(A), at a distance of two meters from the hub, at all frequencies and in all directions. The SWIFT™ therefore meets all legislative criteria.

There is no evidence to suggest that acoustic emissions from SWIFT Rooftop Wind Energy Systems™ have any detrimental effect on wildlife.

See appendixes for the Preliminary Sound Pressure Levels report compiled by Renewable Devices Swift Turbines Ltd.

Electromagnetic Interference

Aircraft, Military Low Flying, Aerodromes and Technical Sites
SWIFT™ rooftop wind turbines are extremely unlikely to cause any detrimental effects on aviation and associated radar/navigation systems. They have been successfully installed near major airports without any negative effects on aviation.

Television / Radio Reception
The SWIFT Rooftop Wind Energy System™ meets all of the mandatory UK and EU Electro-Magnetic Compatibility (EMC) standards and does not affect television or radio reception.

Effect on Mobile Phone and Telecommunications Links
The SWIFT Rooftop Wind Energy System™ meets all of the requisite UK and EU Electro-Magnetic Compatibility (EMC) standards and does not effect mobile phone reception or fixed radio/microwave communications links.

Emission of Electromagnetic Radiation
The SWIFT Rooftop Wind Energy System™ has been fully EMC tested for electro-magnetic compatibility and exceeds all of the relevant UK and European standards.

Bird Strike

The small diameter of the SWIFT™ rotor (~2m) makes it comparable as an obstacle to a rooftop television aerial, satellite dish or chimney stack. It is extremely unlikely therefore, that the location of a rooftop turbine will cause a significant increase in bird strike, beyond the rates already caused by existing buildings, windows and other such obstacles. During a five year in situ testing program at the Scottish Seabird Centre, not a single bird collision was recorded, neither have any been reported from turbines installed throughout the UK to date.

In addition, the unique diffuser ring of the SWIFT™ allows the system to be more easily identified as an obstacle that any other turbine, both when in operation and not.

All accredited installers are advised to enquire as to the location of localised nesting areas and carry out subsequent installations with the minimum of disturbance, in line with regulations of the Wildlife and Countryside Act 1981 (WCA) and Countryside and Rights of Way Act 2000 (CROW Act - specifically in England and Wales).

The sixteen species of bats in the United Kingdom are virtually all classified as rare, vulnerable or endangered and as such both bats and their roosts are also protected by the afore mentioned WCA 1981 and CROW Act 2000; the regulations of which SWIFT™ installations strictly adhere to.

The RSPB views climate change as the most serious long-term threat to wildlife, both globally and in the UK. They subsequently support the deployment of wind turbines, both large and small, provided they are positioned sensitively with care and consideration shown for the local flora and fauna.

Safety

Structural Safety
The SWIFT™ has been designed and independently tested to ensure compliance with all mandatory product standards of the IEC 61400 and in particular, BS EN 61400-2: 1995 "Wind turbine generator systems - safety requirements".

Safety in High winds
The SWIFT Rooftop Wind Energy System™ is designed to withstand extremely high winds and will typically'furl out' in high wind speeds to protect the turbine from damage.

The SWIFT™ is designed (and has been independently verified) to meet and exceed all of the structural and safety constraints required by BS EN 61400-2 and all other UK safety standards for machines of this type.

Electrical connections and/or an associated hot water system should be installed in accordance with appropriate building standards.

4. Installation

Below steps are required to achieve a safe and effective installation of the SWIFT Rooftop Wind Energy System™.

NB This is not an installation guide; the SWIFT™ must be installed by a Renewable Devices Swift Turbines accredited installer.

- Transportation and receipt of the SWIFT Rooftop Wind Energy System™
- Preparation of walls and installation of mounting brackets or, for freestanding models, preparation of ground and installation of pole.
- Installation of grid tie inverter or battery bank
- Installation of SWIFT™ turbine
- Electrical connection of system
- Testing
- Commissioning
- Completion of test certificates and commissioning documentation

Things to consider when planning an installation:

Timescale
The SWIFT™ turbine can be installed within one day by two people depending on the site, mounting system and any additional requirements.

Access
Method of access should be taken into account. Special access requirements may neccessitate the hiring of additional equipment and therefore result in additional cost to the end user.

SWA
Length and size of SWA to be installed.
Routing of SWA cable and the cost implications.

Additional requirements
Cabling and mechanical protection from DC isolator to distribution board (see page 3. SC0016)

Consumables
Consumable goods required for an install; AC isolator, C10 circuit breaker, gland pack, fixings, Fischer resin kit* (see page 28 of the install manual)

Freestanding Installations
When quoting for a free standing pole, it is recommended that a specialist be consulted regarding the access and cost when planting the pole

Building Mounted Installations
Before building mounting the installer must ascertain the structural suitability of the building

5. Mounting Systems

The SWIFT™ is a versatile solution and can be installed on a number of mounting systems depending on the installation site and customer requirements. The mounting systems supplied are as follows;

- Standard Wall Mounting System
- Flat Roof Stand Mounting System
- Flanged Mounting System
- Stand Alone Mounting System (free-standing wooden or steel pole)

Wall Mounted SWIFT

Building Mounted SWIFT

Stand alone wooden pole

Stand alone steel pole

Standard Wall Mounting System

Application

The building mounted application of the Swift is most commonly used in urban installations where a building of sound structure and suitable to take advantage of the prevailing wind resource can be utilised. It is especially useful for urban properties without adequate land and presents a simple and most importantly an unintrustive solution for those wishing to generate power on-site.

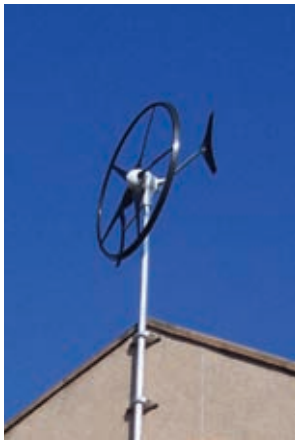
Kit (supplied in addition to SWIFT Turbine)

- 5m aluminium pole
- 4 sets of fixing brackets

Installation

The building mounting system can been fitted to solid, brick and block, double skin brick, and steel framed wall types where the thickness of the wall is in excess of 250mm.***The structural suitability of the building must be ascertained prior to the installation.***

Installation of the mounting system will typically take take a two-man installation team one day however installers should also consider additonal factors including access requirements before confirming a timescale or quote for works. Installation of the SWIFT Turbine, electrical connection and commissioning will typically take a further day.



The mast will be fixed to the side of the building with vibration isolating brackets, attached with a Fischer resin anchor system.

Flat Roof Stand Mounting System

Application

The specially designed flat roof stand allows the SWIFT turbine to become rooftop mounted on horizontal building surfaces. This mounting system is most often used in commerical and industrial installations where multiple SWIFTs are being sited together (see image below).

Kit (in addition to the SWIFT Turbine)

- Aluminium flat roof stand (3 meter pole height with 1meter squared base plate) See image below.
- 16x M10 bolts/steel resin anchors
- 16x RDST rubber AV mounting bushes

Installation

See Appendix for dimensions.

The installation of this stand is site-specific and may require additional engineering work to be carried out in order to assess/ensure the structural suitability of the building.

Installation of the mounting system will typically take take a two-man installation team one day however installers should also consider additonal factors including access requirements before confirming a timescale or quote for works.

Installation of the SWIFT Turbine,electrical connection and commissioning will typically take a further day.

Flanged Mounting System

Application

The flange mounting system offers the benefits of a rooftop mounting system without the horizontal roof structure required to install the flat roof stand.

Kit (in addition to the SWIFT Turbine)

- 1.8 meter pole (20kg)
- Flanged adapter (300mm diameter)
- 6 bolts
- 6 sets of rubber AV bushes
- 1 AV rubber gasket

Installation

See Appendix for dimensions.

The flange adapter can be fitted to any type of building adaptor to integrate with existing structure. The cabling will be routed through the pole and any building adapter must be designed to support this. A round matching flange must be provided with matching hole spacings. The platform the FFRS is fixed to must be regid and designed to take the given loads (above). It is advisable to consult a structural engineer prior to fitting this type of system.

Installation of the mounting system will typically take take a two-man installation team one day however installers should also consider additonal factors including access requirements before confirming a timescale or quote for works. Installation of the SWIFT Turbine, electrical connection and commissioning will typically take a further day.

Freestanding Pole Mounting System (Wooden or Steel)

Application

The stand alone wooden or steel pole for free-standing applications has been designed to meet the demands of consumers who require added flexibility in locating the turbine, prefer the look of the freestanding system or lack a suitable building structure for wall or roof mounting applications.

Though most commonly installed in rural locations, the freestanding SWIFT is a versatile option which permits the turbine to be installed practically anywhere! Concrete foundations are not required.

Kit

- 9 meter wooden pole
- 1.0 meter steel adaptor (19kg)

Installation

See Appendix for dimensions.

Nationwide pole planting can be arranged through RDST. Suitable access for machinery is required and the area should be clear and level. The pole will be installed at a 2 meter depth and when installed the SWIFT will project 8 meters tall. Wiring SWA is typically buried to a minimum depth of 500mm below electrical hazard tape to comply with IEE wiring regulations.

Installation of the mounting system will typically take take a two-man installation team one day however installers should also consider additonal factors including access requirements before confirming a timescale or quote for works. Installation of the SWIFT Turbine, electrical connection and commissioning will typically take a further day.

6. Masses and Wind Loadings

In all installation configurations, the chosen RDST mounting system will transmit thrust load from the wind to the supporting structure along with a vertical load due to the weight of the turbine.

Loadings and the suitability of the supporting structure to carry them need to be accounted for during the planning stage and if necessary any building modifications approved by a structural engineer prior to installation.

Any changes to the chosen mounting system will void all warranties.

The Swift turbine is designed to safely withstand the wind conditions defined by the appropriate small wind turbine class according to BS61400-2. These classes are defined in terms of wind speed and turbulence parameters. The intention of the classes is to cover most applications. The values of wind speed and turbulence parameters are intended to represent the characteristic values of many different sites and do not give a precise representation of any specific site.

The wind regime for load and safety considerations is divided into the normal wind conditions which will occur frequently during normal operation of a small wind turbine, and the extreme wind conditions which are defined as having a 1 year or 50 year recurrence period.

The external conditions to be considered in design are dependent on the intended site.

The Swift Turbine is class 2. Wind loadings based on design wind speeds of:

Small Wind Turbine (SWT) class 2
Vref 42.5 m/s
Vave 8.5 m/s
I15 0.18

Where:
- The values apply at hub height
- I15 is the dimensionless characteristic value of the turbulence intensity at 15 m/s.

As a guide, when designing the mounting structure, the stresses at the anchor points should be considered to be induced by an axial thrust (acting horizontally at the rotor hub height) as shown in the drawings, plus the loads due to the mass of the turbine and mounting masts.

For reference, the approximate mass of the SWIFT™ turbine components are as follows:

Mass of SWIFT™ turbine: 50 kg
Mass of mounting mast: 40 kg

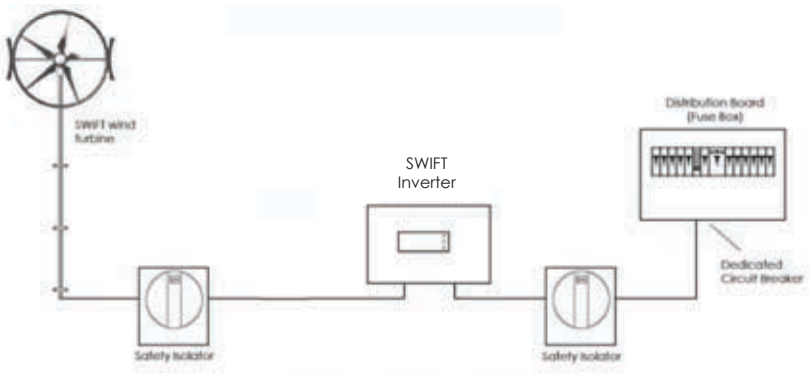
Please refer to the Appendix drawings for more details.

7. Electrical Overview

The SWIFT Rooftop Wind Energy System™ will be supplied with either a grid-tie inverter, a battery bank or a bespoke immersion heater dependent on the model chosen.

The SWIFT Rooftop Wind Energy System™ is normally supplied with a grid-tie inverter. A bespoke DC isolator is also supplied which includes a manual brake to allow safe access near to an installed SWIFT™ turbine should it be required.

The inverter helps to synchronise the SWIFT™ turbine power output to that of the consumers' electricity supply, i.e 240V AC, 50 Hz. The latter hot water heating version replaces the inverter with a bespoke immersion heater, which is easily fitted to your own immersion water heating system.

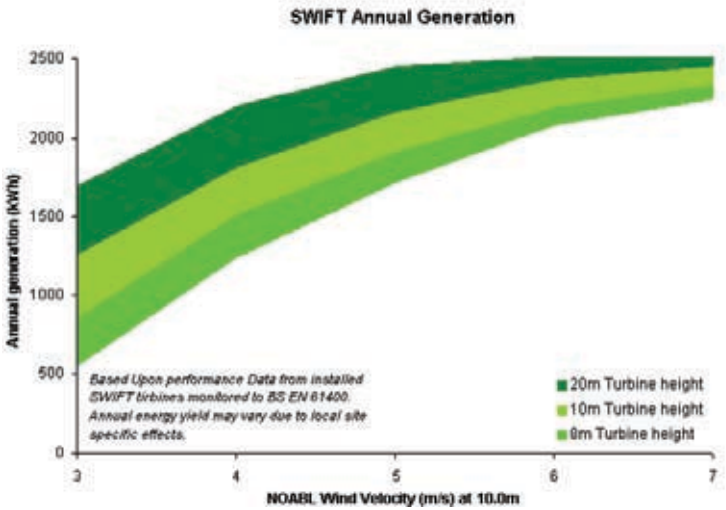


Electrical Schematic of a typical installation

8. Performance

The power curve below shows the expected annual generation for a SWIFT™ a the given NOABL wind velocity.

To find out the NOABL wind rating at any site in the UK go to www.bwea.org/NOABL



BWEA small wind turbine standard 2007

Self-certified by Renewable Devices Ltd

Reference Annual Energy **2050**kWh

Annual average wind speed of 5m/s (11mph). Your performance may vary.

9. Compliance

The SWIFT Rooftop Wind Energy System™ has been independently tested and certified to comply with the following standards and directives:

EN 61400-2: 1996 - This standard relates to the safety of wind turbine generator systems and is applied as the SWIFT Rooftop Wind Energy System™ has a swept rotor area of less than 40m2 and generates at a voltage below 1,000 V, a.c. or 1,500 V, d.c. Mechanical components are designed and specified to meet this standard. Apart from EMC, described below, the specific electrical standard applied to satisfy EN 61400-2 is EN 60950.

EN 61400-24: 1996 - Lightening protection of wind turbines.

EN 60950: 2000 - The SWIFT™ turbine operates at safety extra low voltage (SELV), below the threshold voltage at which the low-voltage directive is normally applicable. However, EN 60950 is applied as a standard for safety aspects other than the risk of electric shock. These include flammability of component parts, temperature rise of user-accessible components, labelling and accompanying documents.

BS 5760-0:1986 - Although BS 7671 deals with electrical installations, component parts of the SWIFT Rooftop Wind Energy System™ are designed to facilitate its installation in accordance with this standard.

BS EN 61000-3-2 and BS EN 61000-3-3 - Electro-magnetic compatibility limits for harmonic distortion & voltage fluctuation.

EN 50081-1 - Electro-magnetic compatibility - domestic, commercial and light industrial premises.

EN 50081-2 - Electro-magnetic compatibility - industrial premises.

EN 61000 - Mains frequency (power quality) effects including flicker and harmonic distortion.

VDE 126 - For the safety of Grid Monitoring (Including Anti-Islanding Protection).

IEE 16th Edition Wiring Regulations BS7671 - For the safety of domestic electrical installations.

Electricity Association, Engineering Recommendation G59 - Electricity Association (since 1 October 2003 superseded by Energy Networks Association). Grid connection of embedded generators at <5MW and <20kV.

Electricity Association, Engineering Recommendation G83/1 - Electricity Association (since 1 October 2003 superseded by Energy Networks Association). Grid connection of embedded generators up to 16A per phase (supersedes G77).

BS 5080-1: 1993 - The structural fixings used to attach the SWIFT™ system to a concrete substrate are tested in compliance with BS 5080-1: 1993.

G83 Compliance - The SWIFT Rooftop Wind Energy System™ has been independently verified to ensure that it meets the G83 standard for the grid-connection of small-scale generators.

CE Marking - The SWIFT™ Rooftop Wind Energy System™ meets all appropriate European Directive legislation and is certified as CE compliant.

10. Notices

All information contained in this document is believed to be reliable, however Renewable Devices Swift Turbines Ltd assumes no responsibility for inaccuracies or omissions. The user of the product assumes full risk and responsibility.

All specifications are subject to change without notice.

Wind generator systems must be installed and operated only by registered installers and in accordance with all of the appropriate regulations and manufacturers approved installation and operation procedures. This document is not an installation manual and is intended for guidance only.

Model Number: SRWES-M2

Appendixes

Provisional SWIFT™ Sound Pressure Level Report

Renewable Devices Swift Turbines Ltd. currently have under commission an independent acoustic analysis of the SWIFT Rooftop Wind Energy System™. There has been some delay in the delivery of the acoustic report to us, and thus a delay in publication of its findings.

Renewable Devices Swift Turbines Ltd. has conducted its own measurements of the acoustic properties of the turbine in operation, and can issue the following statement:

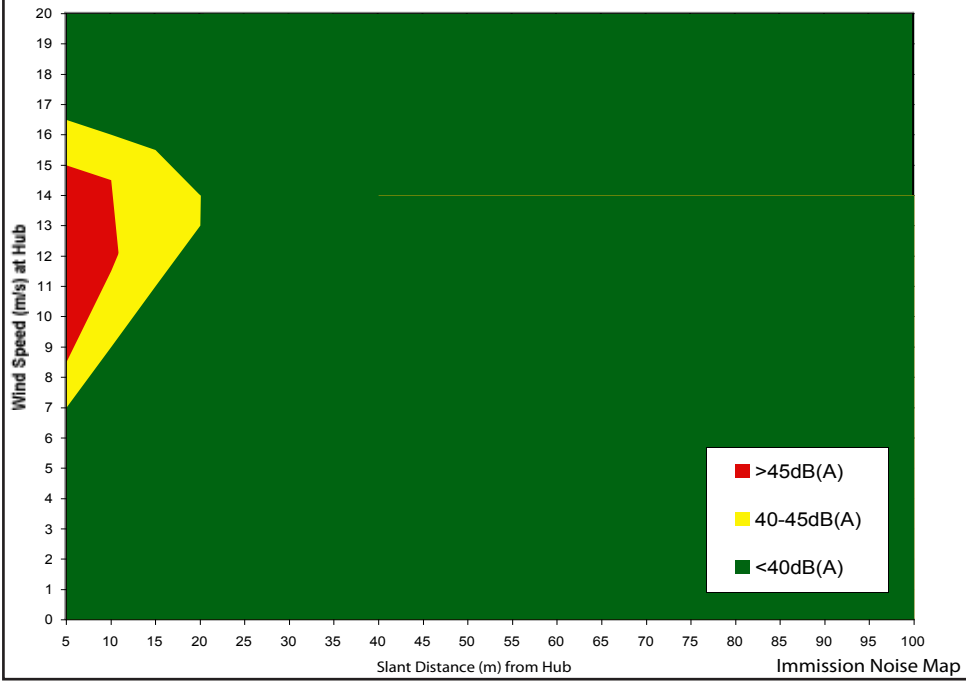
The measurement of the acoustic properties of the SWIFT™ turbine in accordance with the British Wind Energy Association's Guidelines and BS 61400 standard has proved difficult due to the following reason:

The standards require measurement of the equipment during periods of varying wind speeds. The final turbine sound pressures are then calculated based on the difference that the turbine has on the background noise made by the wind itself. For most turbines which operate above the background noise due to the wind this system is adequate. When measuring of the average acoustic output over 1 minute of the Swift at 2.5m below the hub of the turbine it is not possible to distinguish the acoustic output from the operation of the turbine from ambient background noise of the wind over all wind speeds. The Swift is therefore effectively silent when in operation.

We have made assumptions and extrapolated a provisional curve pending a review of this situation by an independent expert in the field. RDST can guarantee that, when measured to the British standard during low winds (and therefore low background noise) the turbine does not exceed 35dbA across all frequencies. During High winds the turbine remains below background noise in urban environments.

ACOUSTIC NOISE LEVELS

TURBINE MAKE: SWIFT™			MODEL 1.5kW			
NOISE EMMISSION LEVEL			IMMISSION LEVEL			CHARACTER
$L_{W.8m/s}$	66	Noise slope (dB/m/s)	1.97	BWEA Lp60m	22	NO
				Lp25m	30	



Immission Noise Map