

Sound Testing of Skystream

Southwest Windpower
Testing conducted at:

USDA - Agricultural Research Service
Bushland, TX

Overview of Installation

- The following presentation is a measurement and analysis of the acoustical noise from the Skystream 3.7m wind turbine connected to a 230 Volt single phase utility line . Data from the turbine and background noise was measured separately. Skystream was installed on a conventional 33' (10 meter) monopole tower which represents a worst case scenario for sound output.
- The IEC 61400-11 noise standard specifies that data is needed from 4 to 10 m/s with primary wind screen, secondary wind screen is used for higher winds.
 - The amount of data collected is 30 samples in each wind bin.
 - The standard recommends samples should be at least one minute however the actual data collected was 10 second samples which are considered to be more accurate.
 - The average noise at 4 m/s for the Skystream is less than the background noise. This is due to large standard deviation of about 5 dB.
- The equipment used was recommended for sound measurement testing in the IEC specification
- No special modifications were made to the turbine or tower. In standard field installations, towers are routinely modified with insulation to further dampen sound output.

Equipment used and Location to Test Skystream

- Type 1 Sound Level Meter (SLM)
- Acoustical calibrator (IEC 60942 class 1)
- Diameter of microphone less than 1.3 cm
- Sound Board at least 1 m in dia., 1.2 cm thick
- Primary Wind Screen at least 9 cm in dia.
- Secondary Wind Screen at least 45 cm in dia., 1.3 cm to 2.5 cm thick (4 to 8 pores/cm)
- SLM located a distance of tower height + half rotor diameter downwind of Wind Turbine (WT)
- Anemometer 2-4 rotor diameters upwind of WT

Equipment

Larson-Davis Model 824 Sound Pressure Level Meter



Equipment

Primary and Secondary Microphones

Primary Wind Screen
17.8cm (7") in diameter

Secondary Wind Screen
61cm (24") in diameter



Sound Board 122 cm (48") in diameter and 1.9 cm (0.75") thick.

Field Test Site



Skystream test was performed on a conventional 33' (10M) monopole tower. All other turbines on site were turned off during testing period



Field Test Site Microphone Placement

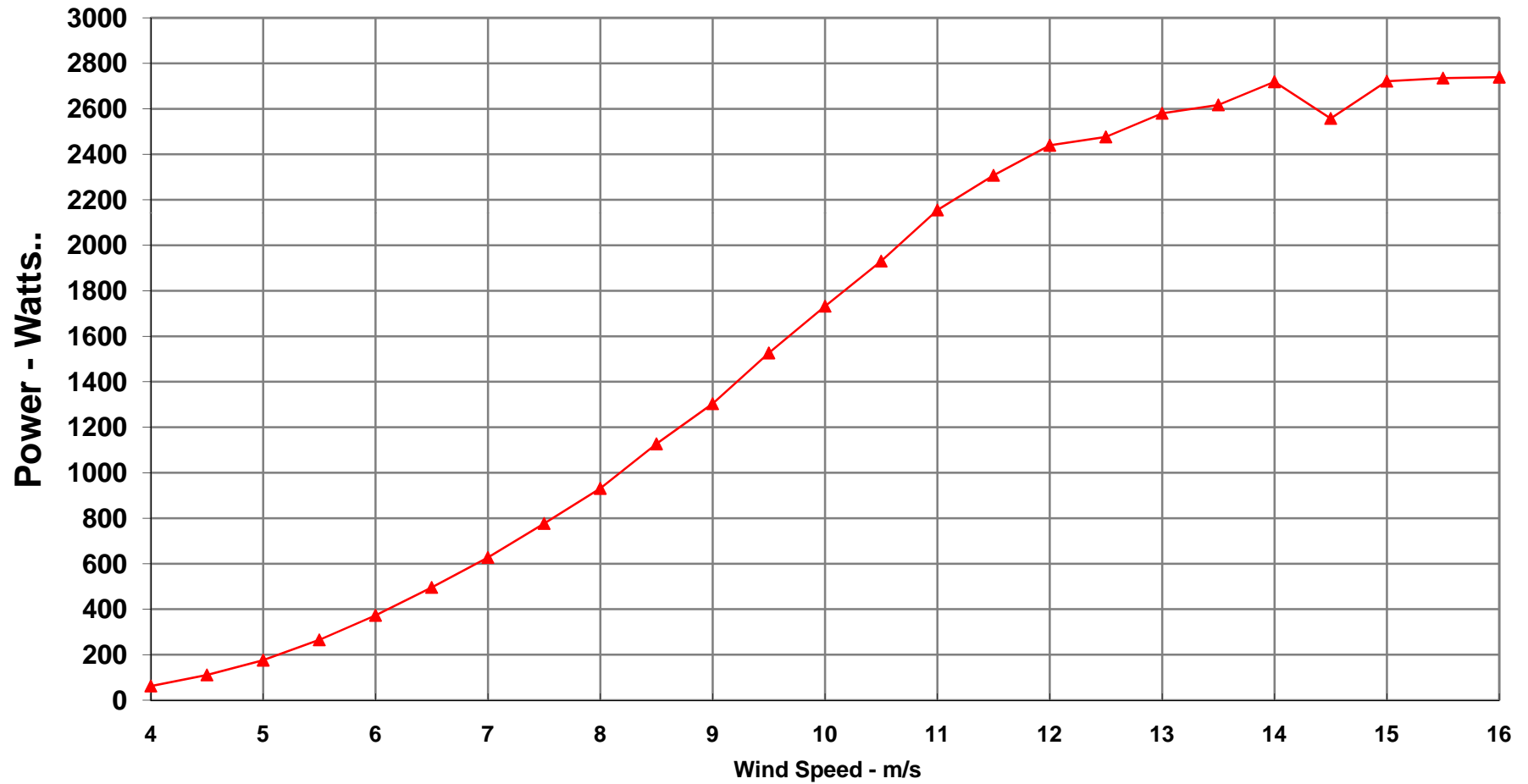


Performance Results

Turbine Performance During Sound Testing Period*

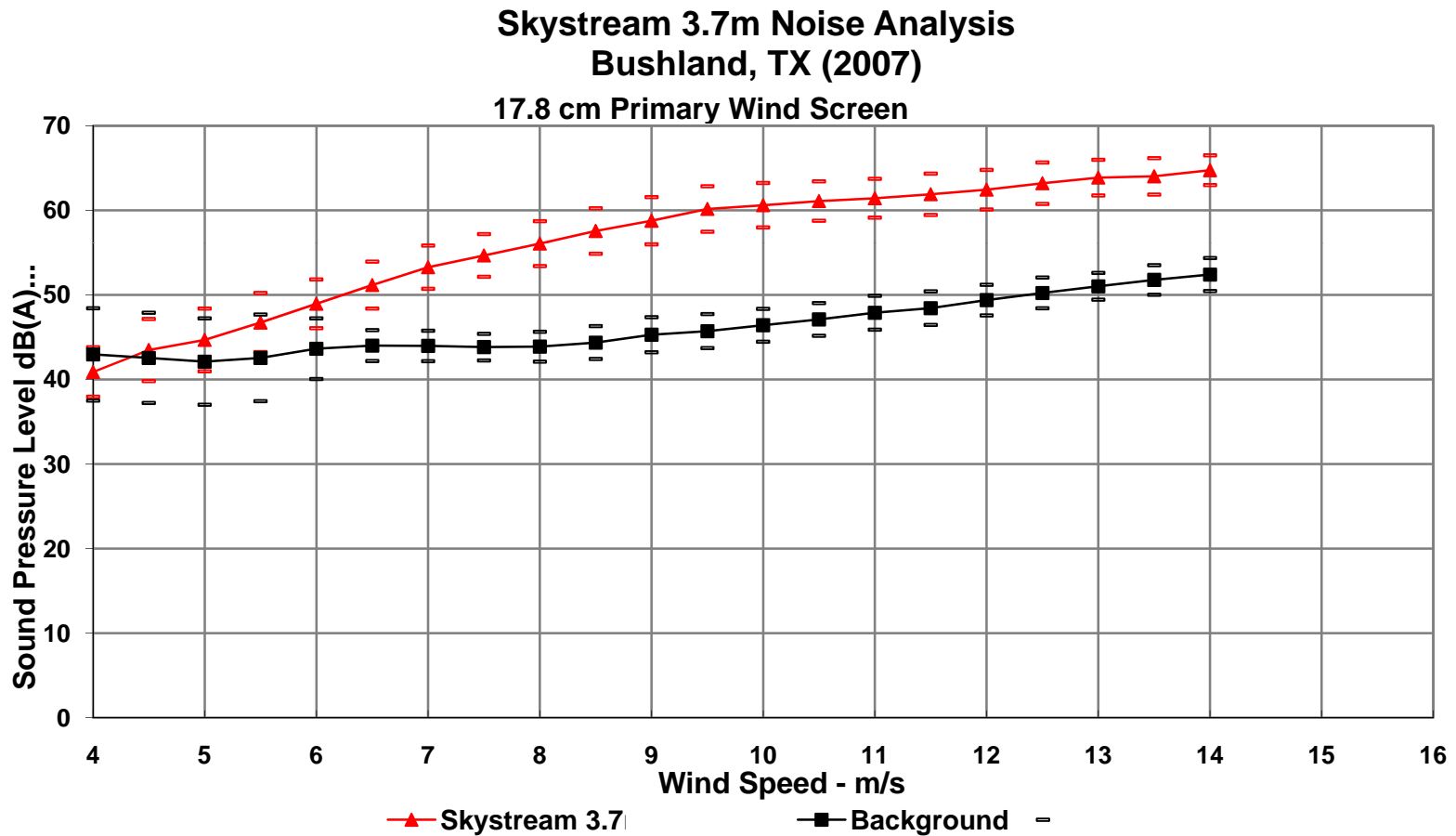
Skystream 3.7m Noise Analysis
Bushland, TX (2007)

17.8 cm Primary Wind Screen



*Note: Data is not corrected for elevation

Skystream Sound Output Compared to Background

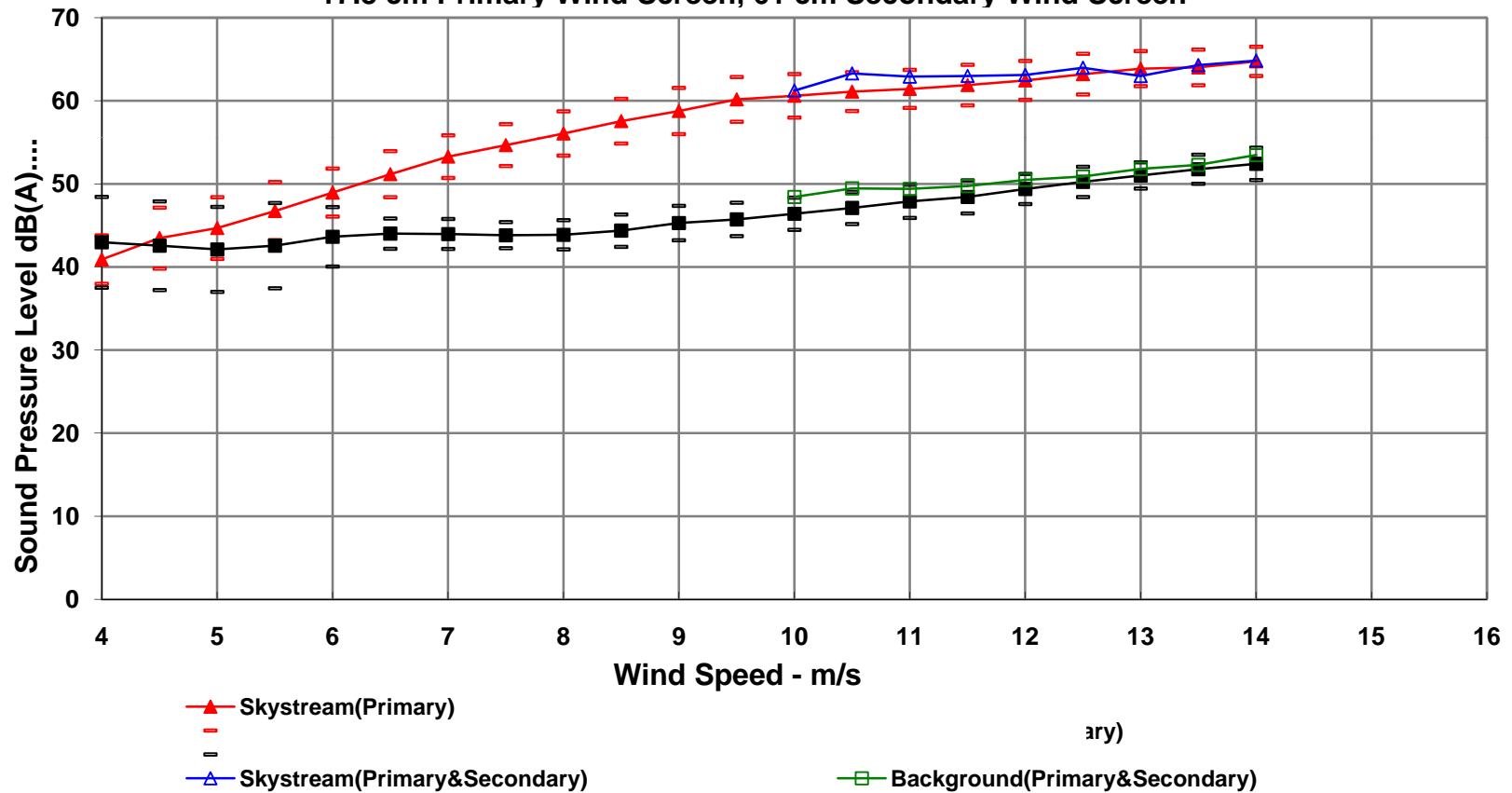


Sound output is measured separately from background sound and turbine sound

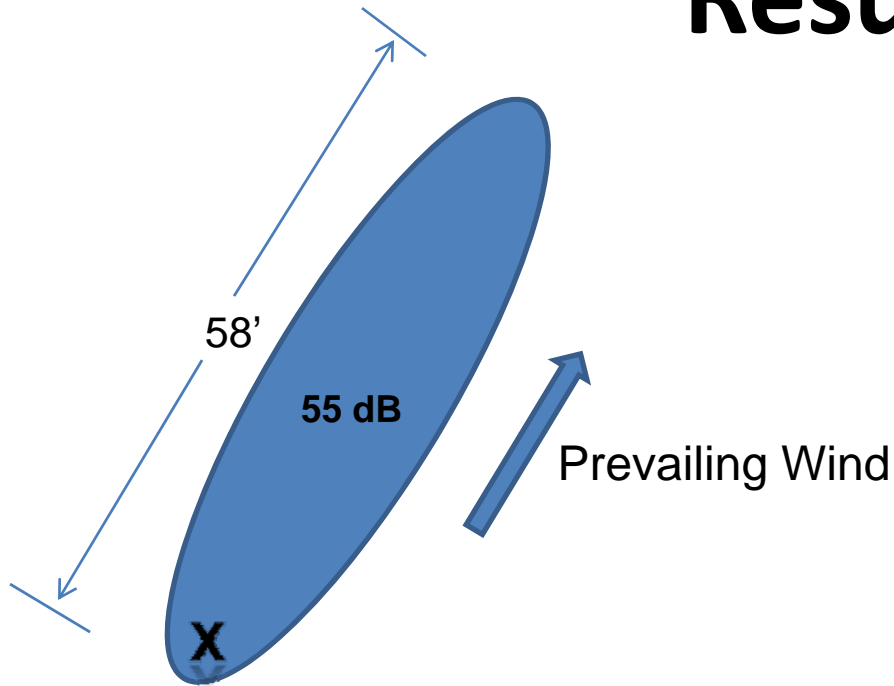
Sound Analysis

Skystream 3.7m Noise Analysis Bushland, TX (2007)

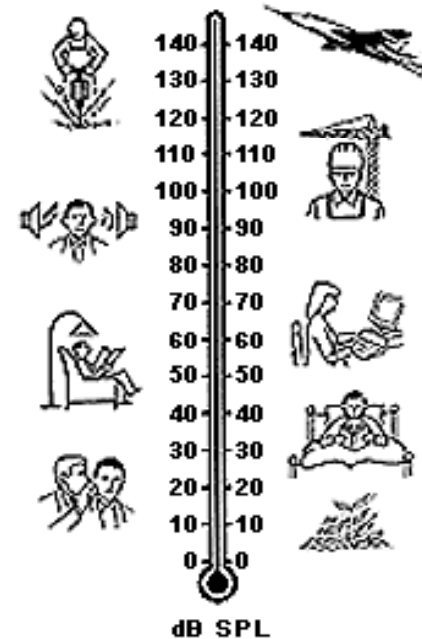
17.8 cm Primary Wind Screen, 61 cm Secondary Wind Screen



Results



Skystream on 33' (10 M) tower



The charts translate to a sound pressure level (observer perception) of 55 dBA at a slant distance of 17.6 m from the rotor hub. For the wind turbine operating in a typical background noise of 44 dBA, the sound pressure level (observer perception) would be 55 dBA at a slant distance of 18.4 m from the rotor hub. Sound perception is heard downwind from the machine and dissipates as the distance increases.