Appendix 9.3

Wind Shear Correction

SCOTTISHPOWER RENEWABLES

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9.1Wind Shear Correction

9.1.1 Approach

1. The Institute of Acoustics': *A good practice guide to the application of ETSU-R-97 for the assessment and rating of wind turbine noise* (IoA GPG) advises that the standard procedure should be to reference noise measurement data to standardised 10 metres (m) height wind speed. The standardised 10 m wind speed is obtained from the wind turbine hub height wind speed correcting it to 10m height using a ground roughness factor of 0.05m.

2. Two different methods of determining hub height wind speed area detailed. The first is to measure directly at hub height with use of a hub height anemometer, or a LIDAR or SODAR system. The second method is to use anemometer measurements to two different heights below hub height, from which wind shear (rate of change of wind speed with height) can be determined and hub height wind speed subsequently deduced.

3. The completed assessment has been based on wind speed data following the second method, as outlined below:

4. The shear exponent for each ten minute measurement period was deduced using the following equation:

   $m = (\text{Log } (U_1/U_2)) / (\text{Log } (H_1/H_2))$

   Where:-

   m = the wind shear exponent to be calculated

   U_1 = the wind speed measurement at the lower height

   U_2 = the wind speed measurement at the higher height

   H_1 = the height of the lower wind speed measurement

   H_2 = the height of the upper wind speed measurement

5. The equation was then rearranged as follows:

   $U_2 = U_1((H_2/H_1)^m)$

   Where:

   m = the calculated shear exponent

   U_1 = the upper measured wind speed

   U_2 = the hub height wind speed

   H_1 = the height of the upper measured wind speed

   H_2 = the hub height.

6. This equation was used to calculate the hub height wind speed, except for periods where a negative shear was determined, in which case the hub height wind speed was assumed to equal the upper measured wind speed.

7. The hub height wind speed was then corrected to 10m using the following equation (roughness length shear profile).

   $U_1 = U_2 (((\text{Log } (H_1/z)) / (\text{Log}(H_2/z)))$

   Where:

   z = The roughness length of 0.05

   U_1 = the wind speed at 10m

   U_2 = the hub height wind speed

   H_1 = 10m

   H_2 = the hub height in m

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