



# Technical Appendix 9.4

## Wind Shear Correction

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# 9.1 Wind Shear Correction

## 9.1.1 Approach

1. The IoA GPG advises that the standard procedure should be to reference noise measurement data to standardised 10m height wind speed. The standardised 10m wind speed is obtained from the turbine hub height wind speed correcting it to 10m height using a ground roughness factor of 0.05.
2. Two different methods of determining hub height wind speed are 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. The meteorological data was obtained from the Harestanes South 80m high meteorological mast located within the site boundary (installed at OS grid reference: 299697, 591819).
4. The shear exponent for each 10 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<sub>1</sub> = the wind speed measurement at the lower height

U<sub>2</sub> = the wind speed measurement at the higher height

H<sub>1</sub> = the height of the lower wind speed measurement

H<sub>2</sub> = 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<sub>1</sub> = the upper measured wind speed

U<sub>2</sub> = the hub height wind speed

H<sub>1</sub> = the height of the upper measured wind speed

H<sub>2</sub> = 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<sub>1</sub> = the wind speed at 10m

U<sub>2</sub> = the hub height wind speed

H<sub>1</sub> = 10m

H<sub>2</sub> = the hub height in m

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