European Offshore Wind Deployment Centre
Environmental Statement

Chapter 5: Meteorological Conditions

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5 METEOROLOGICAL CONDITIONS

5.1 Introduction

1 Information on the meteorological conditions is required to inform the design of wind farm projects. This section outlines the baseline data collected to date.

5.1.1 Key Guidance Documents

2 This study uses existing data from Dyce airport and the Met Office, and therefore follows their existing protocols. The guidelines for wind measurements to calculate power performance for turbines (IEC 61400-12-1) is currently being revised to cover remote measuring techniques (such as Light Detection and Ranging device (LIDAR) and Sound (or Sonic) Detection And Ranging (SoDAR). As these guidelines have not been completed the LIDAR measurements followed accepted principles as stated in the installation manual.

5.1.2 Data Information and Sources

3 In 2008a LIDAR was deployed by Natural Power, east of the Bridge of Don, to the north of Aberdeen. This instrument transmits a beam of light upwards, and measures the return signal (reflected from particles in the air) to assess the wind speed and direction at different heights above the sensor. It is therefore a remote sensing device for measuring wind parameters.

4 Wind data were recorded from 31 October 2008 to 22 January 2009, and the results have been reported in the following report:

- Prevailing (2009) Aberdeen Offshore Wind Farm: Analysis of LIDAR Data (00028-001-R: 7 October 2009)

5 A description of the data collection is given in Table 5.1

TABLE 5.1
Summary of LIDAR Measurements

Measurement device	Natural Power ZephIR
Location	OS Grid Reference 395024 810254
Monitoring period	31 October 2008 to 22 January 2009
Wind speed measurement heights*	27 m, 70 m, 90 m, 125 m, 153 m
Data recorded	Horizontal and vertical wind speed, wind direction, turbulence, temperature, pressure, humidity
Configuration	Cloud correction turned on

* Note: 1 m added to the LIDAR measurement heights to account for height of device

6 In addition to the LIDAR data, the following data from the Dyce Meteorological Station were also considered:

- hourly data from 1 November 2008 to 31 January 2009
- wind speed and direction data collected from January 2001 to January 2009

5.2 Baseline Assessment

7 The climate along the east coast of Scotland is heavily influenced by the weather systems and large scale currents in the North Atlantic. Weather patterns are particularly governed by variation in the North Atlantic Oscillation (a difference in pressure between the Icelandic Low and the Azores High). Large scale westerly circulation dominates, bringing frequent depressions across Scotland (DTI, 2004).

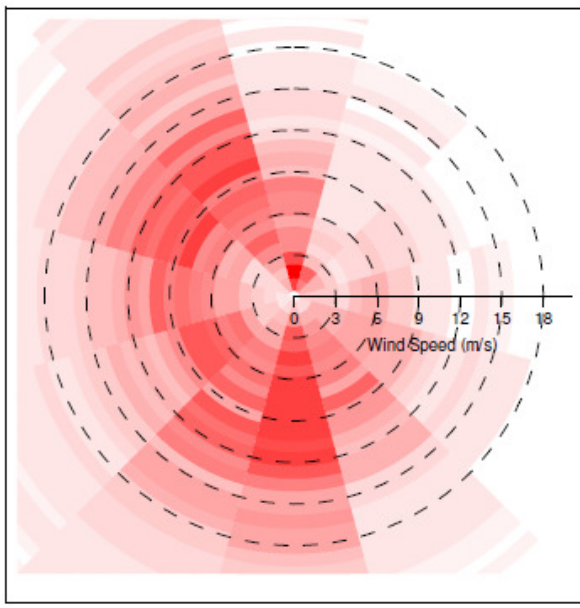
8 The North Sea climate is characterised by large variations in wind direction and speed, a high level of cloud cover and relatively high precipitation (OSPAR, 2000; DTI, 2004). The local climate along the north-east coast is dependent to a large extent on the shelter from winds from the north and west. Predominant winds are from the south and west. Wind strengths along this stretch of coast are variable and generally affected by local topography.

9 Mean annual rainfall in the central North Sea is 400 – 600 mm (OSPAR, 2000; DTI, 2004).

10 Coastal fog ("haar") is common during spring and summer along the east coast of Scotland, with up to 14 days per month recorded in exceptional years (North Sea Pilot, 1997; DTI, 2004). Visibility statistics show that fog (visibility less than 1000 m) is most common in July and August. June to August is also when thunderstorms occur (MetOffice, 2011a).

11 Correlations of the concurrent wind speed at Dyce and the LIDAR using hourly, daily and weekly averaging periods were conducted and the daily correlation used to derive the long-term mean wind speed of 8.74 ms^{-1} at a height of 90 m (Prevailing, 2009).

12 Data from the Dyce site have been used to derive the long-term site wind rose using a Measure-Correlate-Predict methodology. The Dyce wind rose was scaled to the predicted long-term mean wind speed of 8.74 ms^{-1} at 90 m at the LIDAR location. The resultant wind rose is shown in Diagram 5.1.2 (source: Prevailing, 2009). This shows that the predominant wind directions are from the south (17.9 %) and north-north-west (13.4 %).



Sector	Probability
0	9.1%
30	2.8%
60	2.0%
90	2.4%
120	4.4%
150	8.4%
180	17.9%
210	12.2%
240	8.8%
270	7.9%
300	10.6%
330	13.4%

Diagram 5.1 Estimated Long-term Wind Rose at the LIDAR LIocation at 90 m

13 The meteorological conditions for the EOWDC area are summarised in Table 5. 2.

TABLE 5. 2 Meteorological Conditions at EOWDC Area	
Long-term wind speed*	8.7 ms^{-1}
Predominant wind speed – summer**	4.6 ms^{-1}
Predominant wind speed – winter**	5.2 ms^{-1}
Prevailing wind direction – summer**	South
Prevailing wind direction – winter*	South
Air temperature – annual average+	4.6 – 11.2 ^{o}C
Days of air frost – annual average+	53.6
Hours of sunshine – annual average+	1409
Rainfall – annual average+	816.3 mm
Days of rainfall ≥1mm – annual average+	134.2

*Long-term wind speed predicted at 90 m above ground level for LIDAR location (Prevailing report). Further offshore data collection would clarify this figure
**Dyce Station; summer (June, July & August), winter (December, January & February) measured at 10 m above ground level
+Craibstone 1971-2000 averages
Sources: *DTI (2004); +MetOffice Website (2011b)

5.3 Impact Assessment

14 The meteorological data are presented for information only, and an analysis of the wake effects is not required within the Environmental Statement (ES).

5.4 Summary

15 Short-term wind data were collected onshore adjacent to the EOWDC site and correlated with long-term data from Dyce Meteorological Station. These showed the average wind speed to be 8.7 ms^{-1} at 90 m height, and the predominant wind direction to be from the south.

16 Haar fog is common in the summer months, with July and August having the highest duration of low visibility.

5.5 References

DTI (2004) SEA 5: Strategic Environmental Assessment of Parts of the Northern and Central North Sea to the East of the Scottish Mainland, Orkney and Shetland. Department of Trade and Industry.

International Electrotechnical Commission (2005) International Standard: Wind Turbines – Part 12-1: Power performance measurements of electricity producing wind turbines. IEC 61400-12-1

MetOffice Website (2011a) Climatological statistics for British Isles airfields http://secure.metoffice.gov.uk/aviation/climatestats/region1.jsp#image [Date accessed: May, 2011]

MetOffice Website (2011b) http://www.metoffice.gov.uk/climate/uk/averages/19712000/sites/craibstone.html [Date accessed: May, 2011]

OSPAR Commission (2000) Quality Status Report 2000. Region II – Greater North Sea. OSPAR Commission, London, 136 +xiii pp.

Prevailing (2009) Aberdeen Offshore Wind Farm: Analysis of LIDAR Data. 00028-001-R: 7 October 2009

UKHO (1997) North Sea (West) Pilot – Admiralty Sailing Directions NP54