



## **Balmeanach Wind Farm Limited**

**Balmeanach Wind Farm**

**Technical Appendix 13.3  
Wind Turbine Data**

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# 1 Introduction

- 1.1.1 This Technical Appendix provides the sound power data and coordinates used for the turbines within the Proposed Development and other wind farms within the cumulative assessment.

## 2 Sound Power Data

### 2.1 Nordex N133 4.8 MW

- 2.1.1 The Nordex N133 4.8MW turbine data has been used for the Proposed Development and Glen Ullinish Wind Farm. The two wind farms would have slightly different versions of this machine: the Proposed Development has a 83.4m hub and would be fitted with serrated trailing edges (STE) and Glen Ullinish Wind Farm has a 83m hub height and no STE.
- 2.1.2 Overall sound power data has been provided by Nordex for the N133 4.8 MW turbine in document F008\_272\_A13\_EN Revision 5 dated 13 January 2022 which represent the values that the manufacturer specify will not be exceeded in practice. Relevant extracts of this document are included below. The document does not specify the allowance necessary to account for uncertainty; therefore, a further correction factor of +2 dB was added to the specification data in line with advice in the IOA GPG.
- 2.1.3 Octave band sound power data has also been provided by Nordex for the N133 4.8 MW turbine in document F008\_272\_A14\_EN Revision 5 dated 13 January 2022. Relevant extracts of this document are included below.



## Noise level, Power curves, Thrust curves

Nordex N133/4.8

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Noise level measurement requirements

**Nordex N133/4.8 – Noise level measurement requirements**

**Basis:** The specified sound power levels are expected values in terms of statistics. Results of single measurements will be within the confidence interval according to IEC 61400-14 [4].

**Remarks:**

**Verification according to:** Measurements are to be carried out by a measuring institute accredited for noise emission measurements at wind turbines according to ISO/IEC 17025 [3] at the reference position as defined in IEC 61400-11 [1]. The data analysis must be carried out according to the preferred method 1 of IEC 61400-11 [1]. The tonal penalties in the vicinity of wind turbines  $K_{TN}$  based on these measurements are to be determined according to „Technische Richtlinien für Windenergieanlagen“ [2].

**Tonality:** The noise can be tonal in the vicinity of wind turbines. The specified sound power level includes potential tonal penalties according to „Technische Richtlinien für Windenergieanlagen“ [2], without taking into account any tonality  $K_{TN} \leq 2$  dB.

- [1] IEC 61400-11 ed. 2: Wind Turbine Generator Systems - Part 11: Acoustic Noise Measurement Techniques; 2002-12
- [2] Technische Richtlinie für Windenergieanlagen - Teil 1: Bestimmung der Schallemissionswerte, Revision 18; FGW 2008-02
- [3] ISO/IEC 17025: General requirements for the competence of testing and calibration laboratories; 2017-11
- [4] IEC 61400-14, Wind turbines - Part 14: Declaration of apparent sound power level and tonality values, first edition, 2005-03

**Abbreviations:**

- $L_{WA}$  ... A-weighted sound power level
- $v_s$  ... wind speed converted to reference conditions  
(hub height 10 m, roughness length 0.05 m) using a logarithmic profile
- $v_H$  ... hub height wind speed
- STE ... Serrated Trailing Edge



Noise level – Mode 0

Nordex N133/4.8 – Noise level – Mode 0

Standardized wind speed [m/s]	hub height 78 m			hub height 83 m		
	apparent sound power level [dB(A)]		hub height wind speed [m/s]	apparent sound power level [dB(A)]		hub height wind speed [m/s]
	$L_{WA}$ (w/o STE)	$L_{WA}$ (with STE)	$v_H$	$L_{WA}$ (w/o STE)	$L_{WA}$ (with STE)	$v_H$
$v_s$						
3.0	94.5	93.0	4.2	94.5	93.0	4.2
4.0	95.6	94.1	5.6	95.7	94.2	5.6
5.0	101.0	99.5	6.9	101.2	99.7	7.0
6.0	105.2	103.7	8.3	105.4	103.9	8.4
7.0	106.0	104.5	9.7	106.0	104.5	9.8
8.0	106.0	104.5	11.1	106.0	104.5	11.2
9.0	106.0	104.5	12.5	106.0	104.5	12.6
10.0	106.0	104.5	13.9	106.0	104.5	14.0
11.0	106.0	104.5	15.3	106.0	104.5	15.4
12.0	106.0	104.5	16.7	106.0	104.5	16.8

Standardized wind speed [m/s]	hub height 90 m			hub height 110 m		
	apparent sound power level [dB(A)]		hub height wind speed [m/s]	apparent sound power level [dB(A)]		hub height wind speed [m/s]
	$L_{WA}$ (w/o STE)	$L_{WA}$ (with STE)	$v_H$	$L_{WA}$ (w/o STE)	$L_{WA}$ (with STE)	$v_H$
$v_s$						
3.0	94.5	93.0	4.2	94.5	93.0	4.4
4.0	95.9	94.4	5.7	96.5	95.0	5.8
5.0	101.5	100.0	7.1	102.1	100.6	7.3
6.0	105.7	104.2	8.5	105.8	104.3	8.7
7.0	106.0	104.5	9.9	106.0	104.5	10.2
8.0	106.0	104.5	11.3	106.0	104.5	11.6
9.0	106.0	104.5	12.7	106.0	104.5	13.1
10.0	106.0	104.5	14.1	106.0	104.5	14.5
11.0	106.0	104.5	15.6	106.0	104.5	16.0
12.0	106.0	104.5	17.0	106.0	104.5	17.4

Standardized wind speed [m/s]	hub height 125 m			hub height 135 m		
	apparent sound power level [dB(A)]		hub height wind speed [m/s]	apparent sound power level [dB(A)]		hub height wind speed [m/s]
	$L_{WA}$ (w/o STE)	$L_{WA}$ (with STE)	$v_H$	$L_{WA}$ (w/o STE)	$L_{WA}$ (with STE)	$v_H$
$v_s$						
3.0	94.5	93.0	4.4	94.5	93.0	4.5
4.0	96.8	95.3	5.9	97.0	95.5	6.0
5.0	102.6	101.1	7.4	102.8	101.3	7.5
6.0	105.9	104.4	8.9	106.0	104.5	8.9
7.0	106.0	104.5	10.3	106.0	104.5	10.4
8.0	106.0	104.5	11.8	106.0	104.5	11.9
9.0	106.0	104.5	13.3	106.0	104.5	13.4
10.0	106.0	104.5	14.8	106.0	104.5	14.9
11.0	106.0	104.5	16.2	106.0	104.5	16.4
12.0	106.0	104.5	17.7	106.0	104.5	17.9

+2 dB uncertainty has been added to the highlighted values for:

Balmeanach - 83m hub height data with STE.

Glen Ullinish – 83m hub height without STE.



## Octave sound power levels

Nordex N133/4.8

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**Nordex N133/4.8 – Octave sound power levels without serrated trailing edge**

Basis:

The expected octave sound power levels of the Nordex N133/4.8 are to be determined on basis of aerodynamical calculations and expected sound power levels. These values are valid for 78 m, 83 m, 90 m, 110 m, 125 m, 135 m and 164 m (see available hub heights on pg. 2).  
The expected octave sound power levels are only for information and will not be warranted.





Octave sound power levels without serrated trailing edge – Mode 0

**Mode 0**

**hub height 78 m – 106.0 dB(A)**

octave sound power levels [dB(A)] at standardized wind speeds $v_s$										
Frequency	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
31.5 Hz	63.8	64.9	70.3	74.5	75.3	75.3	75.3	75.3	75.3	75.3
63 Hz	74.5	75.6	81.0	85.2	86.0	86.0	86.0	86.0	86.0	86.0
125 Hz	81.6	82.7	88.1	92.3	93.1	93.1	93.1	93.1	93.1	93.1
250 Hz	86.4	87.5	92.9	97.1	97.9	97.9	97.9	97.9	97.9	97.9
500 Hz	88.8	89.9	95.3	99.5	100.3	100.3	100.3	100.3	100.3	100.3
1000 Hz	89.4	90.5	95.9	100.1	100.9	100.9	100.9	100.9	100.9	100.9
2000 Hz	86.9	88.0	93.4	97.6	98.4	98.4	98.4	98.4	98.4	98.4
4000 Hz	79.4	80.5	85.9	90.1	90.9	90.9	90.9	90.9	90.9	90.9
8000 Hz	67.1	68.2	73.6	77.8	78.6	78.6	78.6	78.6	78.6	78.6
<b>Total sound power level</b>	<b>94.5</b>	<b>95.6</b>	<b>101.0</b>	<b>105.2</b>	<b>106.0</b>	<b>106.0</b>	<b>106.0</b>	<b>106.0</b>	<b>106.0</b>	<b>106.0</b>

**hub height 83 m – 106.0 dB(A)**

octave sound power levels [dB(A)] at standardized wind speeds $v_s$										
Frequency	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
31.5 Hz	63.8	65.0	70.5	74.7	75.3	75.3	75.3	75.3	75.3	75.3
63 Hz	74.5	75.7	81.2	85.4	86.0	86.0	86.0	86.0	86.0	86.0
125 Hz	81.6	82.8	88.3	92.5	93.1	93.1	93.1	93.1	93.1	93.1
250 Hz	86.4	87.6	93.1	97.3	97.9	97.9	97.9	97.9	97.9	97.9
500 Hz	88.8	90.0	95.5	99.7	100.3	100.3	100.3	100.3	100.3	100.3
1000 Hz	89.4	90.6	96.1	100.3	100.9	100.9	100.9	100.9	100.9	100.9
2000 Hz	86.9	88.1	93.6	97.8	98.4	98.4	98.4	98.4	98.4	98.4
4000 Hz	79.4	80.6	86.1	90.3	90.9	90.9	90.9	90.9	90.9	90.9
8000 Hz	67.1	68.3	73.8	78.0	78.6	78.6	78.6	78.6	78.6	78.6
<b>Total sound power level</b>	<b>94.5</b>	<b>95.7</b>	<b>101.2</b>	<b>105.4</b>	<b>106.0</b>	<b>106.0</b>	<b>106.0</b>	<b>106.0</b>	<b>106.0</b>	<b>106.0</b>

**hub height 90 m – 106.0 dB(A)**

octave sound power levels [dB(A)] at standardized wind speeds $v_s$										
Frequency	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
31.5 Hz	63.8	65.2	70.8	75.0	75.3	75.3	75.3	75.3	75.3	75.3
63 Hz	74.5	75.9	81.5	85.7	86.0	86.0	86.0	86.0	86.0	86.0
125 Hz	81.6	83.0	88.6	92.8	93.1	93.1	93.1	93.1	93.1	93.1
250 Hz	86.4	87.8	93.4	97.6	97.9	97.9	97.9	97.9	97.9	97.9
500 Hz	88.8	90.2	95.8	100.0	100.3	100.3	100.3	100.3	100.3	100.3
1000 Hz	89.4	90.8	96.4	100.6	100.9	100.9	100.9	100.9	100.9	100.9
2000 Hz	86.9	88.3	93.9	98.1	98.4	98.4	98.4	98.4	98.4	98.4
4000 Hz	79.4	80.8	86.4	90.6	90.9	90.9	90.9	90.9	90.9	90.9
8000 Hz	67.1	68.5	74.1	78.3	78.6	78.6	78.6	78.6	78.6	78.6
<b>Total sound power level</b>	<b>94.5</b>	<b>95.9</b>	<b>101.5</b>	<b>105.7</b>	<b>106.0</b>	<b>106.0</b>	<b>106.0</b>	<b>106.0</b>	<b>106.0</b>	<b>106.0</b>

+2 dB uncertainty has been added to the highlighted values for a 90m hub height with STE and apply to Glen Ullinish Wind Farm turbines.

**Nordex N133/4.8 – Octave sound power levels with serrated trailing edge**

**Basis:**

The expected octave sound power levels of the Nordex N133/4.8 are to be determined on basis of aerodynamical calculations and expected sound power levels. These values are valid for 78 m, 83 m, 90 m, 110 m, 125 m, 135 m and 164 m (see available hub heights on pg. 2).  
The expected octave sound power levels are only for information and will not be warranted.



Octave sound power levels with serrated trailing edge – Mode 0

**Mode 0**

**hub height 78 m – 104.5 dB(A)**

octave sound power levels [dB(A)] at standardized wind speeds $v_s$										
Frequency	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
31.5 Hz	64.0	65.1	70.5	74.7	75.5	75.5	75.5	75.5	75.5	75.5
63 Hz	74.7	75.8	81.2	85.4	86.3	86.2	86.2	86.2	86.2	86.2
125 Hz	81.7	82.8	88.2	92.4	93.3	93.2	93.2	93.2	93.2	93.2
250 Hz	85.5	86.6	92.0	96.2	97.1	97.0	97.0	97.0	97.0	97.0
500 Hz	86.4	87.5	92.9	97.1	98.0	97.9	97.9	97.9	97.9	97.9
1000 Hz	86.9	88.0	93.4	97.6	98.4	98.4	98.4	98.4	98.4	98.4
2000 Hz	85.6	86.7	92.1	96.3	97.2	97.1	97.1	97.1	97.1	97.1
4000 Hz	81.3	82.4	87.8	92.0	92.9	92.8	92.8	92.8	92.8	92.8
8000 Hz	72.1	73.2	78.6	82.8	83.7	83.6	83.6	83.6	83.6	83.6
<b>Total sound power level</b>	<b>93.0</b>	<b>94.1</b>	<b>99.5</b>	<b>103.7</b>	<b>104.5</b>	<b>104.5</b>	<b>104.5</b>	<b>104.5</b>	<b>104.5</b>	<b>104.5</b>

**hub height 83 m – 104.5 dB(A)**

octave sound power levels [dB(A)] at standardized wind speeds $v_s$										
Frequency	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
31.5 Hz	64.0	65.2	70.7	74.9	75.5	75.5	75.5	75.5	75.5	75.5
63 Hz	74.7	75.9	81.4	85.6	86.3	86.2	86.2	86.2	86.2	86.2
125 Hz	81.7	82.9	88.4	92.6	93.3	93.2	93.2	93.2	93.2	93.2
250 Hz	85.5	86.7	92.2	96.4	97.1	97.0	97.0	97.0	97.0	97.0
500 Hz	86.4	87.6	93.1	97.3	98.0	97.9	97.9	97.9	97.9	97.9
1000 Hz	86.9	88.1	93.6	97.8	98.4	98.4	98.4	98.4	98.4	98.4
2000 Hz	85.6	86.8	92.3	96.5	97.2	97.1	97.1	97.1	97.1	97.1
4000 Hz	81.3	82.5	88.0	92.2	92.9	92.8	92.8	92.8	92.8	92.8
8000 Hz	72.1	73.3	78.8	83.0	83.7	83.6	83.6	83.6	83.6	83.6
<b>Total sound power level</b>	<b>93.0</b>	<b>94.2</b>	<b>99.7</b>	<b>103.9</b>	<b>104.5</b>	<b>104.5</b>	<b>104.5</b>	<b>104.5</b>	<b>104.5</b>	<b>104.5</b>

**hub height 90 m – 104.5 dB(A)**

octave sound power levels [dB(A)] at standardized wind speeds $v_s$										
Frequency	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s
31.5 Hz	64.0	65.4	71.0	75.2	75.5	75.5	75.5	75.5	75.5	75.5
63 Hz	74.7	76.1	81.7	85.9	86.3	86.2	86.2	86.2	86.2	86.2
125 Hz	81.7	83.1	88.7	92.9	93.3	93.2	93.2	93.2	93.2	93.2
250 Hz	85.5	86.9	92.5	96.7	97.1	97.0	97.0	97.0	97.0	97.0
500 Hz	86.4	87.8	93.4	97.6	98.0	97.9	97.9	97.9	97.9	97.9
1000 Hz	86.9	88.3	93.9	98.1	98.4	98.4	98.4	98.4	98.4	98.4
2000 Hz	85.6	87.0	92.6	96.8	97.2	97.1	97.1	97.1	97.1	97.1
4000 Hz	81.3	82.7	88.3	92.5	92.9	92.8	92.8	92.8	92.8	92.8
8000 Hz	72.1	73.5	79.1	83.3	83.7	83.6	83.6	83.6	83.6	83.6
<b>Total sound power level</b>	<b>93.0</b>	<b>94.4</b>	<b>100.0</b>	<b>104.2</b>	<b>104.5</b>	<b>104.5</b>	<b>104.5</b>	<b>104.5</b>	<b>104.5</b>	<b>104.5</b>

+2 dB uncertainty has been added to the highlighted values for a 83m hub height with STE and apply to the proposed Balmeanach Wind Farm turbines.


## 2.2 Enercon E70

- 2.2.1 The Enercon E70 2.3 MW turbine is installed at Ben Aketil Wind Farm, Ben Aketil Wind Farm Extension and Edinbane Wind Farm. All of these turbines are mounted on 64m high hubs.
- 2.2.2 The same data for the Enercon E70 turbine that was used in the assessments for the extension of life of the Ben Aketil Wind Farm and extension and Ben Sca Wind Farm and extension, has been used in the noise assessment of the Proposed Development.
- 2.2.3 Annex 5 of the noise assessment for the extension of life of Ben Aketil Wind Farm includes a copy of the data used for the Ben Sca Wind Farm noise assessment, as reproduced in the image of the table below. This data appears to have been sourced from Enercon document SA-04-SPL Guarantee\_E-70\_2,3MW-Rev1\_1-ger-eng revision 1.1 dated 17 February 2006. A copy of this document is included below for reference. The Enercon document recommends 1 dB of uncertainty to be applied, which was implemented in the assessments for the extension of life of the Ben Aketil Wind Farm and extension and Ben Sca Wind Farm and extension. The assessment for the Proposed Development also includes 1 dB of uncertainty.

**Table 1-4**  
**Octave Band and Broadband Noise Level Data for Enercon E-70 turbine, dB(A)**

10m Height Wind Speed, m/s	Frequency, Hz								Overall Broad- band Level*
	63	125	250	500	1000	2000	4000	8000	
3	72.9	81.5	84.0	82.6	81.1	77.8	70.9	63.3	89.0
4	75.7	84.3	86.8	85.4	83.9	80.6	73.7	66.1	91.8
5	78.5	87.1	89.6	88.2	86.7	83.4	76.5	68.9	94.6
6	83.7	92.3	94.8	93.4	91.9	88.6	81.7	74.1	99.8
7	86.3	94.9	97.4	96.0	94.5	91.2	84.3	76.7	102.4
8	88.0	96.6	99.1	97.7	96.2	92.9	86.0	78.4	104.1
9	89.4	98.0	100.5	99.1	97.6	94.3	87.4	79.8	105.5
10	89.4	98.0	100.5	99.1	97.6	94.3	87.4	79.8	105.5
11	89.4	98.0	100.5	99.1	97.6	94.3	87.4	79.8	105.5
12	89.4	98.0	100.5	99.1	97.6	94.3	87.4	79.8	105.5

\*logarithmic sum of octave band data, corresponding to the published broadband noise level for each integer wind speed, including a +1dB correction for measurement uncertainty.

 <b>ENERCON</b> ENERGY FOR THE WORLD	Sound Power Level E-70 E4 2.3 MW	page 1 of 1
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Guaranteed Values of the Sound Power Level for the E-70 with 2.3 MW rated power					
Hub height $V_{Wind}$ in 10m Height	58 m	64 m	85 m	98/99 m	113 m
4 m/s	90.7 dB(A)	90.8 dB(A)	91.1 dB(A)	91.3 dB(A)	91.4 dB(A)
5 m/s	93.6 dB(A)	93.6 dB(A)	94.1 dB(A)	94.6 dB(A)	95.1 dB(A)
6 m/s	98.5 dB(A)	98.8 dB(A)	99.7 dB(A)	100.0 dB(A)	100.3 dB(A)
7 m/s	101.3 dB(A)	101.4 dB(A)	101.6 dB(A)	101.7 dB(A)	101.9 dB(A)
8 m/s	102.9 dB(A)	103.1 dB(A)	103.5 dB(A)	103.7 dB(A)	103.8 dB(A)
95% $P_{rated}$	104.5 dB(A)	104.5 dB(A)	104.5 dB(A)	104.5 dB(A)	104.5 dB(A)
10 m/s	104.5 dB(A)	104.5 dB(A)	104.5 dB(A)	104.5 dB(A)	104.5 dB(A)

Measured values				104,4 dB(A) (at 95% $P_{rated}$ ) WICO 314SEA05/01	
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1. A tonality value  $K_{TN}$  of 0-1 dB is guaranteed over the whole operational range (valid in the near vicinity of the turbine according to IEC).
2. An impulsivity value  $K_{IN}$  of 0 dB is guaranteed over the whole operational range (valid in the near vicinity of the turbine according to IEC).
3. The sound power values given in the table are valid for the **Operational Mode II** (defined through the rotational speed range of 6 – 21 rpm). The respective power curve is the Calculated Power Curve dated May 2005 (Rev. 1.x).
4. The guarantee is based on official and internal measurements of the sound power level. The official measured values are given in this document as a reference. The extracts of the official measurements are available and are valid in combination with this guarantee document. The measurements are being carried out according to the recommended national and international standards and norms (mentioned on the respective extracts).
5. In order to account for the uncertainties of measurement and sound prediction calculations, to increase the acceptance at the authorities and to avoid eventual verification measurements ENERCON recommends a safety factor of 1 dB(A) on the guaranteed values when carrying out sound propagation calculations. In countries where safety factors are already mandatory due to local regulations, the ENERCON recommendation is not applicable.  
Should this recommendation be neglected for any reasons, it is hereby explicitly referred to 6.
6. Due to the measurement uncertainties of sound measurements the verification of the guaranteed values is successful, if the measurement result of a measurement that has been carried out according to the accepted standards is in the range of +/- 1dB(A) of the guaranteed values [guarantee fulfilled when measurement result = guaranteed value +/- 1dB(A)].
7. For noise-sensitive sites it is possible to operate the E-70 with reduced rotational speed and reduced rated power during the night. The reduced sound power levels are given in a separate document.

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## **2.3 Enercon E-115 4MW**

- 2.3.1 The Enercon E-115 4MW turbine data was the candidate turbine for Ben Sca Wind Farm and Ben Sca Wind Farm Extension. The turbines within Ben Sca Wind Farm are proposed to be mounted on 77.5m high hubs and the Extension on 92.4m high hubs.
- 2.3.2 Overall and octave band sound power data has been provided by Enercon for the E-115 4 MW turbine in document D0744492-0/DA Revision 5 dated 01 September 2018 which represent the values that the manufacturer specify will not be exceeded in practice. Relevant extracts of this document are included below. The document specifies that a +1dB allowance should be included to account for uncertainty.

# Data Sheet

**ENERCON Wind Energy Converter E-115 EP3 E3 / 4000 kW  
with TES (Trailing Edge Serrations)  
Operating Mode 0 s**

Subject to technical change without prior notice.





## 2 Sound power level

Allocation of the sound power levels to the standardised wind speed ( $v_s$ ) at a height of 10 m is valid only if based on a logarithmic wind shear law with a roughness length of 0.05 m. Allocation of the sound power levels to the wind speed at hub height ( $v_{HH}$ ) is valid for all hub heights (HH). During measurements, the wind speed is determined based on the power output and the power curve.

The maximum tonal noise KTN across the entire power range is 1 dB (applies to close range acc. to TR 1:2008 of the Federation of German Windpower and DIN 45681:2005) or  $\Delta L_{a,k} < 2$  dB (applies to close range acc. to IEC 61400-11:2012).

The impulse noise KIN across the entire power range is 0 dB (applies to close range acc. to TR 1:2008 and DIN 45645-1:1996).

Due to uncertainty in acoustic measurements and serial product variation, the sound power level values indicated in this document are subject to an uncertainty of  $\pm 1$  dB(A). Therefore, if a measurement is performed in accordance with valid standards, measuring results in the range of the stated values  $\pm 1$  dB(A) may be expected. Standards are TR 1:2008 and IEC 61400-11:2012. If, during measurement, the difference between total noise and extraneous noise is less than 6 dB(A), a greater uncertainty should be assumed.

This data sheet does not constitute a warranty of compliance with project-specific or site-specific sound power levels.

### 2.1 Octave band level

The specified octave band levels of the loudest condition of the tower have been simulated from the one-third octave band level values defined in the frequency bands of DIN EN ISO 266:1997. An octave band level  $L_o$  is calculated from 3 one-third octave band levels  $L_{T1}$ ,  $L_{T2}$  and  $L_{T3}$  according to the following formula:

$L_o = 10 \times \log(10^{L_{T1}/10} + 10^{L_{T2}/10} + 10^{L_{T3}/10})$ . The individual octave band level values cannot be guaranteed. Only the cumulative level of all octave band levels for each wind speed, which corresponds to the sound power level at that particular wind speed, is a guaranteed quantity.

Subject to technical change without prior notice.



**Data Sheet**  
**Operating Mode E-115 EP3 E3 / 4000 kW with TES**



Wind speed ( $v_a$ ) at a height of 10 m	Sound power level in dB(A)					
	HH 67 m	HH 87 m	HH 92 m	HH 122 m	HH 135 m	HH 149 m
95 % of $P_n$	106.0	106.0	106.0	106.0	106.0	106.0

**Tab. 6: Calculated sound power level in dB(A), based on wind speed at hub height**

Wind speed at hub height ( $v_{HH}$ )	Sound power level in dB(A)
5 m/s	91.1
5.5 m/s	93.0
6 m/s	95.0
6.5 m/s	96.7
7 m/s	98.3
7.5 m/s	99.8
8 m/s	101.3
8.5 m/s	102.6
9 m/s	103.9
9.5 m/s	104.4
10 m/s	104.7
10.5 m/s	105.0
11 m/s	105.2
11.5 m/s	105.4
12 m/s	105.5
12.5 m/s	105.9
13 m/s	106.0
13.5 m/s	106.0
14 m/s	106.0
14.5 m/s	106.0
15 m/s	106.0

Subject to technical change without prior notice.

### 3.3 Octave band level in dB(A) of the loudest condition

#### 3.3.1 Octave band level HH

Tab. 7: Octave band level in dB(A), based on wind speed  $v_H$  at hub height

$v_H$ in m/s	Octave band level centre frequency in Hz								
	31.5	63	125	250	500	1000	2000	4000	8000
13	78.0	89.5	95.4	98.4	100.5	100.3	97.7	89.3	68.9

#### 3.3.2 Octave band level at HH 67 m

Tab. 8: Octave band level in dB(A), based on standardised wind speed  $v_s$  at a height of 10 m

$v_s$ at 10 m height in m/s	Octave band level centre frequency in Hz								
	31.5	63	125	250	500	1000	2000	4000	8000
9.5	77.7	89.2	95.0	98.0	100.3	100.2	98.3	91.7	76.8

#### 3.3.3 Octave band level at HH 87 m

Tab. 9: Octave band level in dB(A), based on standardised wind speed  $v_s$  at a height of 10 m

$v_s$ at 10 m height in m/s	Octave band level centre frequency in Hz								
	31.5	63	125	250	500	1000	2000	4000	8000
9.5	77.8	89.3	95.1	98.0	100.2	100.2	98.3	91.3	74.8

#### 3.3.4 Octave band level at HH 92 m

Tab. 10: Octave band level in dB(A), based on standardised wind speed  $v_s$  at a height of 10 m

$v_s$ at 10 m height in m/s	Octave band level centre frequency in Hz								
	31.5	63	125	250	500	1000	2000	4000	8000
9	77.8	89.3	95.2	98.2	100.4	100.3	98.1	90.6	73.7

## 3 Turbine Coordinates

### 3.1 Proposed Development

3.1.1 The coordinates of the wind turbines modelled within the Proposed Development are listed in Table 3-1, in accordance with **Chapter 3: Description of the Development**.

**Table 3-1: Proposed Development Wind Turbine Coordinates**

Turbine Reference	Easting	Northing	Hub Height, m
T1	134158.9	847610.1	83.4
T2	134532.9	847431.1	83.4
T3	133955.6	846826.3	83.4
T4	134468.0	846720.0	83.4
T5	133435.6	846328.3	83.4
T6	133925.6	846404.5	83.4
T7	134320.6	846155.2	83.4
T8	133366.7	845915.0	83.4
T9	133778.5	845866.0	83.4
T10	134266.3	845744.0	83.4

### 3.2 Ben Aketil Wind Farm & Extension

3.2.1 The coordinates of the wind turbines modelled within Ben Aketil Wind Farm and Ben Aketil Wind Farm Extension are listed in Table 3-2.

**Table 3-2: Ben Aketil Wind Farm & Extension Turbine Coordinates**

Turbine Reference	Easting	Northing	Hub Height, m
T1	132136	847561	64
T2	132033	847742	64
T3	131903	847897	64
T4	131761	848041	64
T5	131424	848358	64
T6	131599	848178	64
T7	132420	846977	64
T8	132325	847201	64
T9	132245	847386	64
T10	131144	848528	64
T11	130692	848759	64
T12	130985	848685	64

### 3.3 Ben Sca Wind Farm & Extension

3.3.1 The coordinates of the wind turbines modelled within Ben Sca Wind Farm and Ben Sca Wind Farm Extension are listed in Table 3-3.

**Table 3-3: Ben Sca Wind Farm & Extension Turbine Coordinates**

Turbine Reference	Easting	Northing	Hub Height, m
T1	133475	847759	77.5
T2	133277	847997	77.5
T3	133093	848208	77.5
T4	132924	848427	77.5
T5	132758	848680	77.5
T6	132597	848963	77.5
T7	132456	849245	77.5
T8	132262	849473	92.4
T9	132046	849718	92.4

### 3.4 Edinbane Wind Farm

3.4.1 The coordinates of the wind turbines modelled within Edinbane Wind Farm are listed in Table 3-4.

**Table 3-4: Edinbane Wind Farm Turbine Coordinates**

Turbine Reference	Easting	Northing	Hub Height, m
T1	135094	844767	64
T2	135075	845254	64
T3	134975	845874	64
T4	134776	845549	64
T5	134485	845324	64
T6	135428	847925	64
T7	135362	848778	64
T8	135069	847975	64
T9	135072	848365	64
T10	135023	846259	64
T11	134961	847527	64
T12	134997	847154	64
T13	134952	846681	64
T14	135470	845153	64
T15	136458	848847	64
T16	136134	848596	64

Turbine Reference	Easting	Northing	Hub Height, m
T17	135861	848790	64
T18	135764	848398	64

### 3.5 Glen Ullinish Wind Farm

3.5.1 The coordinates of the wind turbines modelled within Glen Ullinish Wind Farm are listed in Table 3-5.

**Table 3-5: Glen Ullinish Wind Farm Turbine Coordinates**

Turbine Reference	Easting	Northing	Hub Height, m
T1	133696	841273	83
T2	133767	841702	83
T3	134072	841577	83
T4	134601	842035	83
T5	134996	842200	83
T6	135361	842493	83
T7	135183	842824	83
T8	135780	842755	83
T9	135399	843240	83
T10	136005	843107	83
T11	135805	843377	83

### 3.6 Source of Turbine Coordinate Data

3.6.1 The source of the coordinate data for turbines outside of the Proposed Development is Annex 7 of the Operational Noise Report for Ben Aketil and Ben Aketil Extension Wind Farms Life Extensions, document number 14299-006 dated 30/10/2020, submitted for planning application 20/04369/S42. That document provides a collated summary of the location of all the turbines associated with the neighbouring wind farms in the assessment area. Subsequent to the submission of the Ben Aketil and Ben Aketil Extension Wind Farms Life Extensions application, two further turbines have been consented in the area, which form the Ben Sca Wind Farm Extension. Coordinates for these turbines were supplied by SLR Consulting Ltd, who undertook the noise assessment and coordinated the planning application reference 21/05767/FUL.