Hill of Fare Wind Farm

Technical Appendix 12.1

Assessment of Battery Energy Storage Facility

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12.1 Assessment of Battery Energy Storage Facility

12.1.1 In addition to the turbines, it is also proposed to include a battery energy storage system (BESS) on-site. An acoustic assessment in accordance with BS 4142:2014+A1:2019[1] has been undertaken to determine the acoustic impact due to the operation of this part of the Proposed Development.

12.1.2 The baseline data adopted is that recorded at a wind speed of 1 ms^{-1} during the background noise surveys made to inform the acoustic assessment of operational noise from the Proposed Development which correspond to the worst case, or quietest, levels.

12.1.3 The main sources of sound within the Proposed Development are the power conversion system (PCS) inverters, PCS transformers and the heating, ventilation and air conditioning system (HVAC) for the energy storage system (ESS) units. The ESS units are expected to be continuously charging and discharging. If there are any rest periods for the inverters these are likely to be infrequent and the ESS HVAC would still be functioning.

12.1.4 Acoustic emission data for the proposed equipment is detailed in **Table 12.1.1**, as well as the number of each units. The data corresponds to the maximum acoustic emission for each device as advised by the manufacturer. Predictions based on this data therefore represent the worst case and the sound levels would be expected to be less when the site is not operating at maximum capacity. The amount of the time that this is the case is unknown at this stage as it depends upon which services the site provides.

Table 12.1.1: Acoustic Emission Data

Equipment	Sound Power Level dB(A)	Number of units
PCS unit (inverter)	93	31
ESS unit HVAC	82	62
PCS unit (MV transformer)	69	31

1 "Methods for rating and assessing industrial and commercial sound", The British Standards Institution 2019. BS 4142:2014+A1:2019

12.1.5 Predicted specific sound levels due to the BESS at nearby residential properties, calculated using the ISO 9613-2 propagation model, are detailed in **Table 12.1.2**. A sound footprint for the BESS is shown in **Figure 12.1.1**.

12.1.6 The propagation model takes account of sound attenuation due to geometric spreading and atmospheric absorption. The assumed temperature and relative humidity are 10˚C and 70% respectively.

12.1.7 Ground effects are also taken into account by the propagation model, with a ground factor of 0.5 adopted to reflect a mix of hard and porous ground between the site and the assessment locations. A 4 m receiver height has been used. The effect of surface features such as buildings and trees has not been considered. There is a degree of conservatism built into the model as a result of the adoption of these settings.

12.1.8 ISO 9613-2 is a downwind propagation model. Where conditions less favourable to sound propagation occur, such as when the assessment locations are crosswind or upwind of the proposed BESS facility, the predicted sound levels would be expected to be less and the downwind predictions presented here would be regarded as conservative.

Table 12.1.2: Predicted Specific Sound Levels

House ID	Sound Pressure Level, dB L_{Aeq}	House ID	Sound Pressure Level, dB L_{Aeq}
H21	15	H105	12
H26	15	H107	13
H28	6	H111	12
H32	14	H113	12
H33	15	H122	12
H34	14	H124	13
H46	17	H126	12
H49	10	H132	13
H51	15	H134	13
H65	10	H135	11
H66	-3	H136	15
H68	19	H137	15
H70	13	H138	10
H71	17	H139	16

House ID	Sound Pressure Level, dB L_{Aeq}	House ID	Sound Pressure Level, dB L_{Aeq}
H76	-4	H140	13
H80	17	H142	16
H82	16	H147	8
H83	4	H148	-5
H87	12	H153	16
H88	17	H155	12
H89	11	H253	12
H91	13	H254	12

12.1.9 The sound emitted by the PCS inverter cooling fans and ESS HVAC units may have a distinctive character. A correction of 2 dB has been applied in the event that tones are just perceptible at the assessment locations. This is a conservative measure as it may not be the case in practice.

12.1.10 The results of an acoustic assessment at the property where the predicted sound level is highest relative to the background sound level, H68, is shown in **Table 12.1.3**. These results represent the worst case as the rating levels would be lower relative to the background sound level at all other properties.

Table 12.1.3: BS 4142 Assessment Results

Results	Day	Night
Residual sound level	32 dB $L_{Aeq,\ 16\ hour}$	26 dB $L_{Aeq,\ 8\ hour}$
Background sound level	23 dB $L_{A90,\ 10\ min}$	23 dB $L_{A90,\ 10\ min}$
Predicted specific sound level	19 dB L_{Aeq}	
Acoustic feature correction	2 dB	
Rating Level	21 dB L_{Aeq}	
Excess of rating level over background	-2 dB	-2 dB
Predicted ambient sound level	32 dB $L_{Aeq,\ 16\ hour}$	27 dB $L_{Aeq,\ 8\ hour}$
Conclusion	Low impact	Low impact

12.1.11 The BESS is predicted to have a low impact during both day and night time periods at all properties, as the rating level is at or below the existing background sound level.

12.1.12 There is expected to be no change in the ambient sound level during the day and a 1 dB increase at night due to the introduction of the BESS, consistent with it having a low impact.

12.1.13 In conclusion, the acoustic assessment shows that the impact due to the operation of the proposed battery energy storage facility is predicted to be low during both day and night-time periods at all houses. No adverse impacts are expected.

12.1.14 Noise emitted during construction of the BESS, including associated traffic flows, is not expected to exceed the criteria specified in BS 5228-1:2009[2] such that significant effects would not be anticipated.

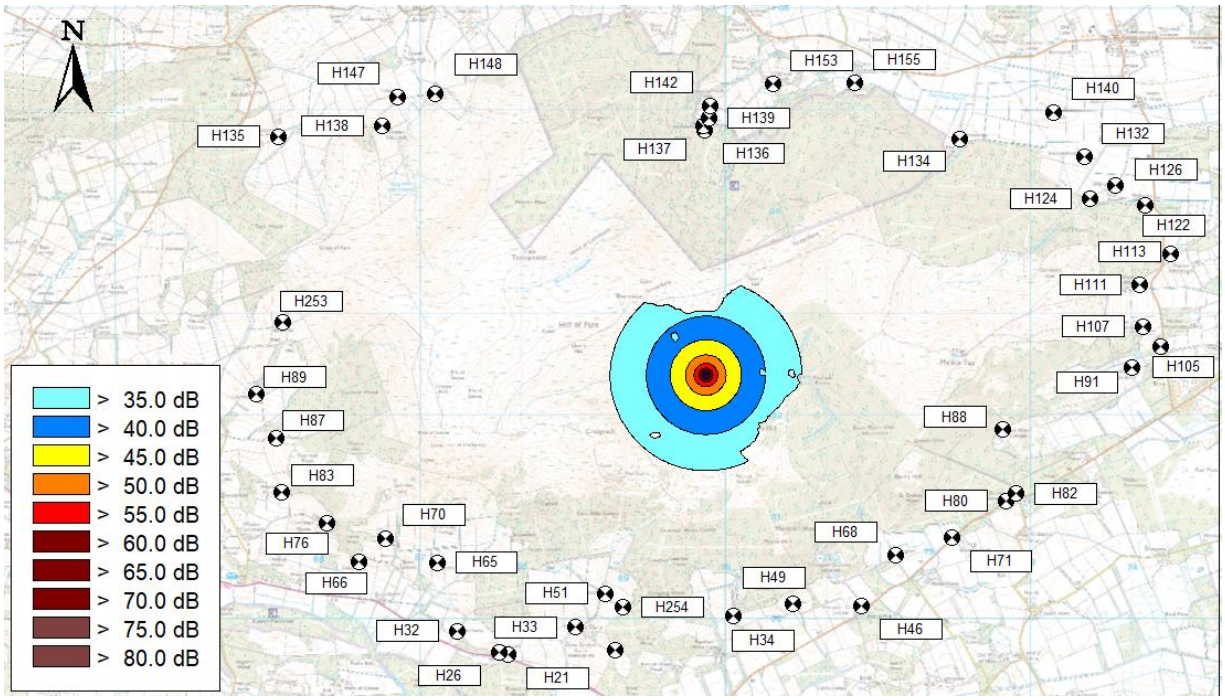

Figure 12.1.1: Predicted BESS Sound Footprint (Specific Sound Level dB LAeq)

2 'Code of Practice for Noise and vibration control on construction and open sites - Part 1: Noise', British Standards Institution, BS 5228-1:2009