Technical Appendix 11.1: Assessment of Battery Energy Storage Facility

11.1 In addition to the wind farm, it is also proposed to include a battery energy storage facility on site. An acoustic assessment in accordance with BS 4142:2014+A1:2019[1] has been undertaken in order to determine the acoustic impact due to the operation of this part of the Proposed Development.

11.2 The baseline data adopted is that determined at a wind speed of 1 ms^{-1} during the background noise measurements made to inform the acoustic assessment of operational noise from the proposed wind farm, which correspond to the worst case, or quietest, levels. These are detailed in **Table 11.5** and **Table 11.6** of the main chapter, with the baseline data from each survey location being applied to the properties closest to them.

11.3 The main sources of sound within the battery energy storage facility are the power conversion system (PCS) units, substation transformer and the heating, ventilation and air conditioning systems (HVAC) for the battery energy storage system (BESS) units. The BESS units are expected to be continuously charging and discharging. If there are any rest periods for the PCS units these are likely to be infrequent.

11.4 Acoustic emission data for the proposed equipment is detailed in **Table 11.1.1**. 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 11.1.1: Acoustic Emission Data

Equipment	Sound Power Level, dB(A) L_W	Number of units
PCS unit	96	5
BESS unit HVAC	82	20
Substation transformer	95	1

11.5 Predicted specific sound levels due to the proposed battery energy storage facility at nearby residential properties, calculated using the ISO 9613-2 propagation model, are detailed in **Table 11.1.2**. A sound footprint for the battery energy storage facility is shown in **Figure 11.2**.

11.6 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.

11.7 Ground effects are also taken into account by the propagation model, with a ground factor of 1 adopted to reflect the porous ground conditions between the site and the assessment locations. A 1.5 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.

[1] 'Methods for rating and assessing industrial and commercial sound, British Standards Institution, BS 4142:2014+A1:2019, 2019

11.8 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 battery energy storage facility, the predicted sound levels would be expected to be less and the downwind predictions presented here would be regarded as conservative.

Table 11.1.2: Predicted Specific Sound Levels

Property ID	Sound Pressure Level, dB L_{Aeq}
H15	18
H20	22
H63	18
H72	15
H75	26
H78	23
H83	25

11.9 The sound emitted by the PCS units and BESS HVAC units may have a distinctive character. An acoustic feature 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.

11.10 The predicted specific sound levels and the corresponding rating level at the properties located nearest to the battery energy storage facility are shown in **Table 11.1.3** for daytime and night-time periods respectively. The rating level is compared to the background sound level in order to assess the associated impact at each location.

Table 11.1.3: BS 4142 Assessment Results

Property ID	Specific Level, dB L_{Aeq}	Rating Level, dB L_{Ar}	Background Sound Level, dB L_{A90}	L_{Ar} – L_{A90}, dB	Potential Impact
Daytime					
H15	18	20	30	-10	Low
H20	22	24	30	-6	Low
H63	18	20	30	-10	Low
H72	15	17	30	-13	Low
H75	26	28	28	0	Low
H78	23	25	28	-3	Low
H83	25	27	28	-1	Low
Night-Time					
H15	18	20	24	-4	Low
H20	22	24	24	0	Low

H63	18	20	24	-4	Low
H72	15	17	24	-7	Low
H75	26	28	25	3	Minor
H78	23	25	26	-1	Low
H83	25	27	26	1	Minor

11.11 The proposed battery energy storage facility is predicted to have a low or minor impact during both day and night time periods.

11.12 There is expected to be no change in the ambient sound level during day or at night due to the introduction of the battery energy storage facility, consistent with it having a minor impact.

11.13 In conclusion, the acoustic assessment shows that the impact due to the operation of the proposed battery energy storage facility is not predicted to be adverse.

11.14 Sound emitted during construction of the battery energy storage facility, including that due to associated traffic flows, is not expected to exceed the criteria specified in BS 5228-1[2] as discussed previously, such that significant effects are not anticipated.

[2] 'Code of Practice for Noise and vibration control on construction and open sites - Part 1: Noise', British Standards Institution, BS 5228-1:2009+A1:2014, 2014