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Solar a Storio Ynni



Preliminary Environmental Information Report Volume III

Appendix 10-5: Operational Phase Assessments

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lightsourcebp



10.5 Operation Phase

10.5.1 Assessment of Fixed Plant and Equipment

10.5.1.1 The results of the baseline noise survey (**Appendix 10.3**) have been used as a basis for assessing the operation phase effect of the Project. This assessment considers noise from proposed fixed plant to be installed at the Project at the NSRs.

10.5.1.2 A high-level assessment has been undertaken based on notional distances between the fixed plant and NSRs to provide a high-level indication of the potential impact and resultant effect.

Prediction Methodology

10.5.1.3 In the absence of detailed information, the assessment has been undertaken based on the following assumptions:

- The Project will operate 7 days a week, during the daytime and core night-time, and early morning periods, which have been defined as:
 - Daytime 0700 to 2300 hours;
 - Core Night-time 2300 to 0500 hours; and
 - Early Morning 0500 to 0700 hours.
- There will be a maximum of 10 inverters, 3 transformers and 1 substation per field parcel nearest to a notional NSR.

Calculating the Specific Sound Level

10.5.1.4 In the absence of specific noise data relating to the proposed operational equipment, noise data has been gathered from other representative sources, including publicly available information informing DCOs for solar sites and library data.

10.5.1.5 **Table 10.5.1** sets out the typical fixed plant type used to inform the assessment.

Table 10.5.1: Octave band data for Noise Sources, dB

Source	Octave Band Centre Frequency								
	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz	A
Inverter 215kTL	-	-	-	-	-	-	-	-	76
Transformers	81	87	87	77	66	54	49	44	73
Substations within the Solar PV Site	65	65	62	58	49	46	46	41	52

10.5.1.6 Predictions have been carried out to determine noise levels likely to be generated during the operation stage. The above noise inputs above have been calculated at nominal NSR locations assuming point source attenuation. No acoustic barriers such as local buildings have been included, thus informing a worst-case assessment.

Table 10.5.1: Predicted specific sound level at NSR, Ls dB

Distance (m)	Noise Source (dB)			
	Inverters	Transformers	Substation	Cumulative
25	50	42	16	51
50	44	36	10	45
100	38	30	4	39
150	34	26	-	35
200	32	24	-	33

Background Sound Level

10.5.1.7 The background sound level used within the following assessment has been derived following statistical analysis of the LA90 values. For a given Measurement Location, the lowest period LA90,T levels were determined. For daytime 07:00 – 23:00 the levels ranged from 21 to 32 dB LA90,T; for night-time 23:00-05:00 the

levels ranged from 18 to 31 dB LA90,T; and for the early morning 05:00 – 07:00 period the levels ranged from 19 to 32 dB LA90,T. Measured levels at ML8 were higher (daytime of 41 dBLA90,T, night-time of 45 dBLA90,T and early morning of 43 dBLA90,T), however, broadly speaking, the quietest periods are around the background levels of what might be considered to be “very low” by the 1997 version of BS4142 i.e. 30 dB. The Standard

Table 10.5.2: Determination of Operation Phase Noise Limits – Existing NSRs, dB(A)

Receptor	Typical background in Accordance with BS4142, dB LA90		
	Daytime (0700 – 2300)	Night-time (2300 – 0500)	Early Morning (0500 – 0700)
ML8	41	45	43
All other MLs	21-32 ¹	18-31 ¹	19-32 ¹
¹ Backgrounds below 30 dB are considered to be “very low” and reasonably the lower cutoff for a BS4142 style assessment.			

Rating Level

10.5.1.8 In accordance with BS 4142: 2014+A1:2019, penalties are applied to the specific sound level in order to provide the rating level. These penalties relate to the acoustic features of the sound source.

Table 10.5.3: Identification of acoustic penalties

Penalty	Applicable?	Attributable penalty	Comment
Tonality	No	-	Transformers can have tonal features, although noise emissions from central inverters will be dominated by the cooling fans such that any tonal features of the transformers will not be noticeable.
Impulsivity	No	-	Plant will operate continuously so there will not be any noticeable impulsive characteristics.
Intermittency	No	-	Plant will operate continuously so there will not be any noticeable intermittent characteristics. It is not considered that there will be a distinguishable on/off activity during a single assessment period of 1-hour during the daytime and 15 minutes during the night-time.
Other Sound Characteristics	Yes	3	Overall plant noise emissions noise will likely be experienced at receptors as a distinctive continuous and steady hum; therefore a 3 dB correction to account for noise that is distinctive against the residual acoustic environment has been applied.

10.5.1.9 Therefore, a 3dB correction has been applied to the specific sound level to determine the rating level at NSRs in accordance with BS 4142.

Assessment of Impact

10.5.1.10 As detailed in the Noise and Vibration PEIR Chapter, the magnitude of effect is defined in accordance with Table 10.5.5. below.

Table 10-5.5 Magnitude of Effect Applicable to Noise from Operational Equipment

Difference Between Rating Level (L _A r,Tr) and Background Sound Level	Magnitude of Impact
≥+9	High
+4 to +8	Medium
0 to +3	Low
≤-1	Very Low
Subject to a lower cut-off of 35 dB as a rating level and 30dB as a background sound level in accordance with BS 4142:1997 (See paragraph 9.94) + indicates rating level above background sound level - indicates rating level below background sound level	

Table 10.5.6: BS 4142 Assessment of Operational Noise at set distances, Daytime and Early Morning Period

Description	Daytime (07:00 – 23:00) and Early Morning (05:00 – 07:00) Noise Levels dB					Relevant BS 4142 Clause
	25m	50m	100m	150m	200m	
Specific sound level $L_{Aeq,15min}$	51	45	39	35	33	7.3.5
Acoustic feature correction ¹	+3	+3	+3	+3	+3	9.2
Rating level $L_{Ar,15min}$	54	48	42	38	36	9.2
Background sound level (on the basis of a lower cut-off value) $L_{A90,15min}$	30	30	30	30	30	8
Excess over background	+24	+18	+12	+8	+6	-
Magnitude of Impact	High	High	High	Medium	Medium	-

10.5.1.11 A review of **Table 10.5.6** shows that NSRs located between 25m and 200m from operational noise sources, the magnitude of impact is between Medium to High during daytime and early morning periods.

10.5.1.12 Therefore, there is likely to be a **permanent, long-term, adverse effect** which is considered to be **low** for NSRs more than approximately 200m from the source and a **major** for receptors as close as 100-150m away from the source, before context is taken into consideration.

Table 10.5.7: BS 4142 Assessment of Operational Noise at set distances, Core Night-time Period

Description	Core Night-time (23:00 – 05:00) Noise Levels (dB)					Relevant BS 4142 Clause
	25m	50m	100m	150m	200m	
Specific sound level $L_{Aeq,15min}$	42	36	30	26	24	
Acoustic feature correction ¹	+3	+3	+3	+3	+3	9.2
Rating level $L_{Ar,15min}$	45	39	33	29	27	9.2
Background sound level $L_{A90,15min}$	30	30	30	30	30	8
Excess over background	+15	+9	+3	-1	-3	-
Magnitude of Impact	High	Medium	Low	Very Low	Very Low	-

10.5.1.13 A review of **Table 10.5.7** shows that NSRs located between 25m and 200m from operational noise sources, the magnitude of impact is between Very Low to High during night-time periods.

10.5.1.14 Therefore, there is likely to be a **permanent, long-term, adverse effect** which is considered to be **negligible** for NSRs more than 150m from the source and a **major** for receptors at closer than 50m from the source. The result effect is considered potentially significant for receptors up to 100m from the source, before context is taken into consideration.

Context

10.5.1.15 BS4142 requires context to be considered.

10.5.1.16 BS 4142 states

"Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration including the following:

1) ... *Where background levels and rating levels are low, absolute levels might be as, or more relevant than the margin by which the rating level exceeds the background.*"

"3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions such as:

i) façade insulation treatment;

ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation: and

iii) acoustic screening."

10.5.1.17 To put into context the daytime and early morning assessment, the rating level of noise from operational noise associated with the Project could be compared against a criterion of 50dB $L_{Aeq,16h}$ as recommended in BS 8233 and World Health Organisation (WHO) guidelines for outdoor living areas.

10.5.1.18 To put into context for the night-time, considering that residents are likely to be inside dwellings, and not external amenity areas to which BS 4142 relates, it is considered prudent to assess internal noise levels. Assuming a 15dB loss through a partially opened window, the resultant internal noise level could be compared against the 35dB $L_{Aeq,16h}$ for living areas and bedrooms as recommended by BS 8233.

10.5.1.19 At the ES Stage, further consideration to context will be considered in the final assessment.

Uncertainty

10.5.1.20 In accordance with BS4142, uncertainty has been considered within the assessment. Reasonably practicable steps have been taken to reduce the level of uncertainty with respect to the measurements and assessment calculation methodology. The level of uncertainty of the measurement is considered low given the length of the measurement period and intervals, and the valid weather conditions, as detailed in Appendix 10.2.

10.5.1.21 The level of uncertainty from the calculation is considered low. The resultant levels have been derived using acoustic modelling software, which uses industry recognised standard IOS 9613-2 calculation method. Notwithstanding this, uncertainty in the operation or sound emission characteristics of the specific source remains, albeit a low risk for this particular assessment.

10.5.1.22 There are a number of assumptions in the technology provider's acoustic data regarding acoustic treatment of noise sources, as well as the selection of equipment itself. These are considered in more detail below. It is important to note that the mitigation measures are based on a number of assumptions regarding noise output of candidate items of plant which will be subject to final selection.

10.5.2 Low Frequency Noise

10.5.2.1 Low frequency noise can be very difficult to predict with a high level of certainty and similarly hard to identify and resolve if present. This is because it can be generated by the unexpected interactions between system components and can be amplified by the geometry of the Project and receptor buildings. The issue of low frequency noise will be considered once parameter plans become available and minimised through design, or appropriately mitigated (isolation and attenuation measures) where appropriate.

10.5.3 Tranquillity

10.5.3.1 At the time of writing, the approach to tranquillity is being considered in consultation with stakeholders, but will necessarily draw on the results of the operational phase fixed plant noise assessment.

10.5.4 Further Assessment

10.5.4.1 The following methodology is proposed for the operation phase noise assessment.

Noise Model

10.5.4.2 In order to predict the noise levels from the proposed development at the NSRs, a detailed acoustic model of the Project will be generated using the PC based

CadnaA® noise modelling package, applying the following prediction methodology:

- The noise model was set to apply the noise prediction methodology set out in ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation¹.
- Mapping of the Project and the surrounding area was calibrated into the noise model based on known Ordinance Survey grid reference points.
- Topographical data for the ground levels across the Proposed Development and surrounding area, obtained from the 2020-2022 LIDAR data of 1m resolution, publicly available from DataMapWales.
- To reflect the local ground cover, ground absorption set to $G = 0.5$ (50% acoustically absorptive ground).
- The model set to include second order reflected noise from solid structures.
- The Parameter Plan to be incorporated into the noise model in order to account for screening that is provided by the development itself.

10.5.4.3 Noise contour maps will be generated for outdoor living areas at heights of 1.5m for the daytime and 4m above ground for the night-time. The resultant daytime specific sound levels will be presented as figures in the final ES Chapter.

¹ International Organization for Standardization (1996), ISO 9613-2:1996, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation