OAKLANDS FARM SOLAR PARK

Applicant: Oaklands Farm Solar Ltd

Environmental Statement
Appendix 11.3 – Operational Source Noise Data
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Oaklands Farm Solar Park - Environmental Statement Volume 3

Appendix 11.3: Operational Source Noise Data

Final report
Prepared by LUC
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Appendix 11.3
Operational Source Noise Data

A11.3.1 This appendix sets out examples of typical solar farm equipment that has been used to inform the assessment of operational noise effects.

Solar Plant

A11.3.2 The Proposed solar plant consists of string inverters situated at the end of rows of solar panels and medium voltage (MV) transformer stations distributed around the Site. The Applicant has provided information on potential equipment. The final selection of equipment will be confirmed post consent.

String inverters

A11.3.3 The Applicant has indicated Sungrow SG250HX inverters represent a likely worst case noise output. Typically there may be in the order of 14 inverters for each MV transformer station. The actual number may vary depending on the capacity of the actual inverter used.

A11.3.4 Solar inverter cooling fans will not operate during the night, but in summer will have a prolonged operation due to early sunrise/late sunset. The inverter supplier has stated that the fans will come on when the ambient temperature is above approximately 20°C and the solar power output is approximately 70kW. It has previously been determined that these conditions are not likely to occur before 7am and therefore it is assumed that the cooling fans would not be operating before 7am.

A11.3.5 The manufacturer has previously informed the Applicant that without the active cooling system operating, the sound power level would be similar to the SUN2000-105KTL unit. Data for this unit has therefore been assumed for summer operation before 7am (i.e. the maximum noise level during the night-time period).

Table 1: Noise data for storage inverters with similar capacity to proposed inverters

Model or reference	Sound power level
SUN2000-105KTL (no cooling fan)	62 dBA
Sungrow SG250HX (with cooling fan)	84 dBA

A11.3.6 No frequency data is available for the inverter units, however for the purposes of the assessment it is assumed that the inverters may have intermittent character depending on whether the cooling fans are operating.

A11.3.7 The effective noise source height is assumed to be 1m above ground.

Distributed MV transformers

A11.3.8 Sound power output data supplied by the Applicant for the distributed MV transformer units is shown below. It is currently considered more likely that 1000kVA and 1600kVA units will be selected, however, as the specification is not known at this stage, data for the 3150kVA units has been used in the assessment.

Plate 1: Sound power levels for MV distributed transformers

S_r kVA	AAAo W	L_{Wa} dB(A)	AAo W	L_{Wa} dB(A)	Ao W	L_{Wa} dB(A)
≤ 25	35	48	63	36	70	37
50	45	50	81	38	90	39
100	75	52	130	40	145	41
160	105	55	189	43	210	44
250	150	58	270	46	300	47
315	180	60	324	48	360	49
400	220	61	387	49	430	50
500	260	62	459	50	510	51
630	300	63	540	51	600	52
800	330	64	585	52	650	53
1000	390	66	693	54	770	55
1250	480	67	855	55	950	56
1600	600	69	1080	57	1200	58
2000	730	71	1305	59	1450	60
2500	880	74	1575	62	1750	63
3150	1100	76	1980	63	2200	64

A11.3.9 The transformer cabinets are assumed to be between 2.4m and 3m high with the noise source centred around the core of the transformer. The effective noise source height is assumed to be 1.5m above ground.

Battery Energy Storage System

A11.3.10 The proposed Battery Energy Storage System (BESS) currently consists of containerised battery storage units and outdoor inverter cabinets. The final selection of equipment will be confirmed post consent.

A11.3.11 It is proposed that battery storage is arranged with 6 battery containers to 1 inverter unit. To achieve 37.5MW / 112.5MWh capacity, 13 inverter units and 78 battery storage containers are expected to be required. This provides for a 3 hour duration system. This

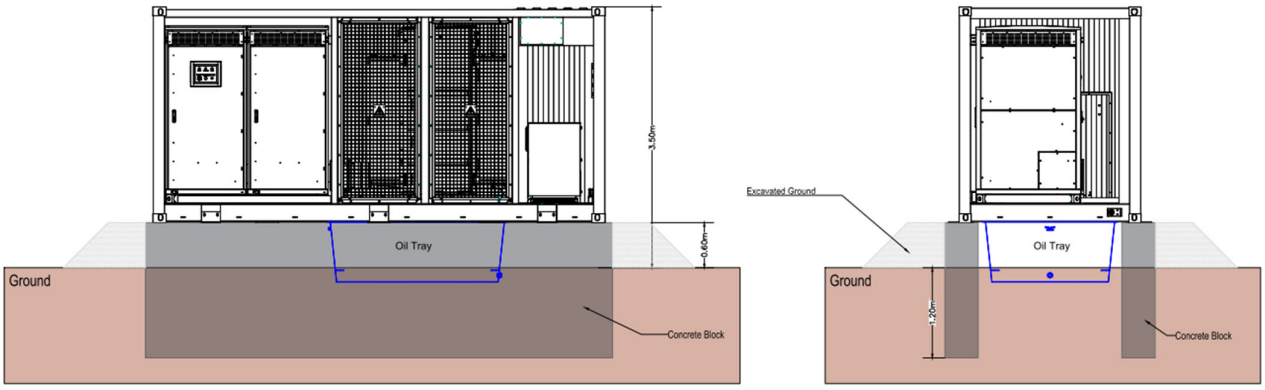
represents a maximum, worst-case to ensure some flexibility to re-arrange and optimise for battery operation. Representative plant selected for the assessment is shown below:

Sungrow SC2500UD storage inverter in outdoor cabinet

A11.3.12 Outdoor inverter cabinets housed in 20-foot long open-sided shipping container, delivered pre-assembled and utilising forced air-cooling design. Each cabinet contains 2 sets of inverter, a transformer and switchgear.

A11.3.13 Stated cabinet dimensions for the unit are approximately 6.1m long x 2.4m wide x 2.9m high, and would sit on concrete platform raised up to 0.6m. The effective noise source height for modelling purposes is assumed to be approximately 2.5m.

Plate 2: Illustration of typical storage inverter cabinet



A11.3.14 Noise data for the proposed unit is not available, however a literature search of similar capacity units has identified a typical sound power level, L_w, of approximately 92 dBA as shown in the table below:

Table 2: Noise data for storage inverters with similar capacity to proposed inverter

Model or reference	Approx. dimensions (m)	Manufacturers stated noise level	Sound power level
SMA SCS 2530 UP-XT	2.8x2.3x1.6	63 dBA at 10m	91 dBA (calculated)
SMA SCS3800 UP-XT	2.8x2.3x1.6	65 dBA at 10m	93 dBA (calculated)
Power Electronics FREEMAQ PCSK HEMK	3.7x2.2x2.2	71-79 dBA at 1m 45 dBA at 50m	~95 dBA (estimated) 87 dBA (calculated)
GE RIU-2750MV	6x2.4x2.9	<70dB(A) at 1m	<91 dBA (calculated)
SMA SC-2500 (Lock's Farm Solar and Battery Storage Scheme[1])	2.8x2.3x1.6	Sound power level of 92 dBA	92 dBA

A11.3.15 The frequency spectrum has been assumed to be similar to that used for the SMA-2500 for Lock's Farm as shown below.

Table 3: Octave band sound power level for storage inverters

Unit	**dBA**	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Storage inverter	**92**	86	93	94	89	84	84	81	80

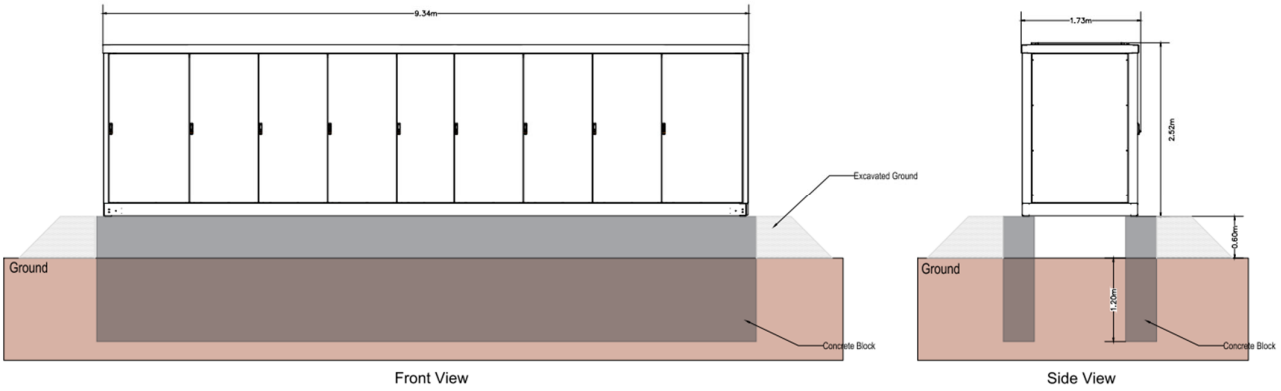
Sungrow ST3727KWH(L) battery storage units

A11.3.16 The battery cell modules are placed within a container along with liquid cooling, fire suppression system and internal cabling.

[1] Winchester City Council Planning application reference 21/01391/FUL https://planning.org.uk/app/62/QTD2BVBPJ5D00 24Acoustics Technical Report: R9180-1 Rev 1 Dated: 14th September 2021

A11.3.17 Stated container dimensions for the unit are approximately 9.3m long x 1.7m wide x 2.5m high, and would sit on concrete platform raised up to 0.6m. The effective noise source height for modelling purposes is assumed to be approximately 2m.

Plate 3: Illustration of typical battery storage



A11.3.18 Noise data for the proposed unit is not available, and a literature search of data available for similar units is limited as shown in the table below.

Table 4: Noise data for similar battery storage containers units

Model or reference	Approx. dimensions (m)	Manufacturers stated noise level	Sound power level
GE RSU-4000 series	6x2.4x2.9	<60dB at 3m	85 dBA (calculated)
BDY BESS (Lock's Farm Solar and Battery Storage Scheme)	n/a	Quoted as a power level of 82 dBA (measured by 24Acoustics)	82 dBA

A11.3.19 The primary source of noise from the battery storage units will be cooling systems. Given the limited data set, a sound power level of 92 dBA has been assumed for the battery storage, to provide a more robust assessment. The frequency spectrum has been assumed to be similar to that measured for the BDY unit (adjusted to 92 dBA):

Table 5: Octave band sound power level for battery storage container units

Unit	**dBA**	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Battery container unit	**92**	89	96	97	92	87	87	84	83

Substation Plant

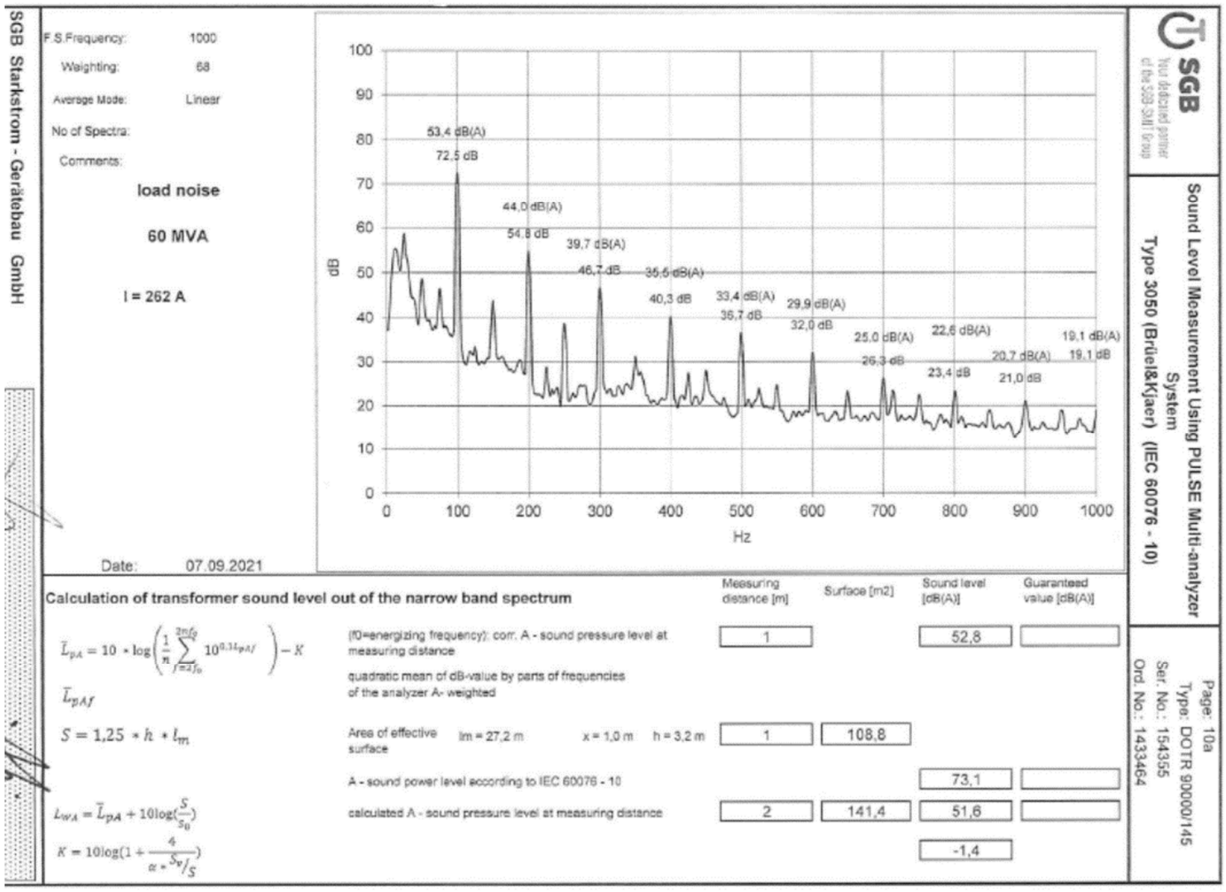
A11.3.20 The Applicant has indicated that significant noise sources at the substation will include; two 132kV 90MVA transformers, harmonic filter, and reactive compensation system with cooling. The final selection of equipment will be confirmed post consent.

132kV 90MVA Transformers

A11.3.21 The transformers are oversized so that they do not run near to maximum capacity. A manufacturers test report for the currently proposed 90MVA transformers operating at a load of 60MVA is shown below. A sound power level of 73 dBA is used as shown in the manufacturers data below.

A11.3.22 Indicative dimensions for the transformer are approximately 3m height to top of core (5.3m to the top of the unit), 3.7m wide and up to 7.2m long, with the noise source assumed to be centred around the core of the transformer. The effective noise source height for modelling purposes is assumed to be approximately 3m.

Plate 4: Noise data for 90MVA transformer



A11.3.23 The octave band frequency spectrum has been taken from the above and is as shown below:

Table 6: Octave band sound power level for 90MVA transformers

Unit	**dBA**	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
90MVA transformer	**73**	66	89	71	59	44	39	36	33

Harmonic filter and Reactive compensation system

A11.3.24 It is assumed that these will be required. Data for these is not available at this stage, and therefore the sound power levels have been taken from data used in the Cleve Hill Solar Park Environmental Statement[2]. Octave band frequency data was not provided and therefore an estimated spectrum with a low-frequency bias has been assumed to provide a robust assessment.

Table 7: Sound power levels other substation plant

Unit	**dBA**	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Harmonic filter compound	**95**	91	96	96	91	91	86	81	81
Reactive compensation system & cooling	**85**	81	86	86	81	81	76	71	71

A11.3.25 The effective noise source height for modelling purposes is assumed to be approximately 2m.

[2] Cleve Hill Solar Park https://infrastructure.planninginspectorate.gov.uk/projects/south-east/cleve-hill-solar-park/ , Appendix 12.9: Cleve Hill Solar Park. ES Appendix A12.9 Energy Storage Noise Data. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010085/EN010085-000421-6.4.12.9%20Energy%20Storage%20Data.pdf [Accessed 18/12/23]