Caudwell Solar Farm

Noise Impact Assessment

Client:	Green Energy International
Project/Proposal No:	6036
Version:	V1
Date:	2023-02-09

Document Information

Project Name:	Caudwell Solar Farm
Document Title:	Noise Impact Assessment
Client Name:	Green Energy International
Client Contact:	Mathew Bayley
Client Address:	Trinity House, Newby Road, Stockport, SK7 5DA
Document Status:	Final for Issue
Author:	Gregor Massie
Reviewed:	Alasdair Baxter
Approved:	Alasdair Baxter
Date:	2023-02-09
Version:	V1
Project/Proposal Number:	6036
ITPEnergised Office:	4th Floor, Centrum House, 108-114 Dundas Street, Edinburgh, EH3 5DQ

Revision History

Version	Date	Authored	Reviewed	Approved	Notes
V1	2022-12-07	Gregor Massie	Alasdair Baxter	Alasdair Baxter	Final for Issue

Contents

1. Introduction

1.1 Background

Green Energy International ('the Applicant') is seeking planning permission to develop a solar farm at Caudwell Farm, north-east of Holbeach, in the South Holland District of Lincolnshire. The main noise sources from the solar farm are associated with the proposed Battery Energy Storage site (BESS) located in the west of the site. ITPEnergised has been appointed by the Applicant to undertake an assessment of potential noise impacts associated with operation of the BESS.

The BESS will comprise 48 Sungrow battery storage units and 8 Sungrow STS inverter units in an open-air layout, as well as a DNO substation. The batteries will store electrical energy at times of high supply/low demand and release energy at times of low supply/high demand.

The BESS lies adjacent to Eastern Road and Marsh Road and is located approximately 430 metres away from the nearest Noise Sensitive Receptor (NSR).

1.2 Scope of Assessment

The scope of this assessment comprised the following:

- Consultation with South Holland Council (SHC) to agree the scope and approach of the assessment;
- Modelling prediction of operational noise using proprietary software CadnaA;
- Evaluation of predicted noise levels in accordance with British Standard BS4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound; and
- Specification of mitigation, if required.

Additional traffic flows associated with the construction phase of the BESS will be minimal and of short duration and will occur during weekday daytimes only. Construction noise can be minimised through adoption of best practice methods and appropriate techniques. Noise associated with construction of the BESS has therefore been scoped out of the noise assessment.

1.3 Study Area and Noise Sensitive Receptors

Maps and aerial imagery have informed the selection of an appropriate study area for the assessment. The closest noise sensitive receptors (NSRs) in each direction were identified, and a study area adopted which includes these NSRs.

Noise levels due to the BESS at more distant NSRs will be lower than at the closest NSRs, therefore compliance with criteria at the closest NSRs will entail compliance at those more distant. The identified NSRs are provided in **Table 1** and shown on **Drawing 1.**

Table 1 – Noise Sensitive Receptors

NSR ID	NSR name	Rationale for selection
NSR1	Residential property – Woodstock House	Representative of closest dwelling 430 m to the east of the BESS
NSR2	Residential property – Home Farm	Representative of closest dwelling 790 m to the south of the BESS

2. Relevant Guidance and Advice

2.1 National Planning Policy Framework (NPPF)

The NPPF (Department for Communities and Local Government, 2021) provides planning guidance for local planning authorities in England. The NPPF states that planning policies and decisions should aim to:

- Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability;
- Mitigate and reduce to a minimum, potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;
- Avoid noise from giving rise to significant adverse noise impacts on health and quality of life as a result of new development; and
- Mitigate and reduce to a minimum adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life.

With regard to the avoidance of significant adverse effects on quality of life, the NPPF references the Noise Policy Statement for England (2010).

2.2 Noise Policy Statement for England (NPSE)

The NPSE provides the following guidance regarding the SOAEL:

> *"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times."*

And:

> *"Increasing noise exposure will at some point cause the SOAEL boundary to be crossed. Above this level the noise causes a material change in behaviour such as keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present. If the exposure is above this level the planning process should be used to avoid this effect occurring, by use of appropriate mitigation such as by altering the design and layout. Such decisions must be made taking account of the economic and social benefit of the activity causing the noise, but it is undesirable for such exposure to be caused.*

2.3 "British Standard BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings[1]

BS8233:2014 provides guidance on the control of noise in and around buildings. The standard sets out acceptable noise levels for new and refurbished buildings and amenity areas according to their use.

For external amenity areas BS8233:2014 specifies a "desired" level of 50 $dBL_{Aeq,T}$ and an "upper guideline level" of 55 $dBL_{Aeq,T}$.

[1] British Standard BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

The standard provides noise limits for rooms within buildings by type of use; (bedroom, living room, office) and by time of day. Methods are provided for simplified calculation of internal noise levels from external levels, and for detailed calculations. The simplified method relies on a reduction to façade levels provided either by open or closed windows, which are assumed to provide attenuation of approximately 15 dB and 33 dB respectively.

This assessment refers to habitable rooms, which include bedrooms and living rooms.

2.4 BS4142:2014+A1:2019 Methods for Rating and Assessing Industrial and Commercial Sound[2]

BS4142:2014 describes methods for rating and assessing sound from industrial or commercial premises. The methods detailed in the standard use outdoor sound[3] levels to assess the likely effects on people inside or outside a residential dwelling upon which sound is incident.

The standard provides methods for determining the following:

- Rating levels for sources of industrial and commercial sound;
- Ambient, background and residual sound levels; and
- The audibility of tones in sound: 1/3 octave method.

These may be used for assessing sound from proposed, new, modified or additional sources of sound of a commercial or industrial nature or to assess the suitability of introducing a receptor near an existing commercial or industrial site.

The standard makes use of the following terms:

- **Ambient sound level, La = $L_{Aeq,T}$** – the equivalent continuous sound pressure level of the totally encompassing sound in a given situation at a given time, usually from multiple sources, at the assessment location over a given time interval, T.
- **Background sound level, $L_{A90,T}$** – the A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90 percent of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
- **Specific sound level, Ls = $L_{Aeq,Tr}$** – the equivalent continuous sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T.
- **Rating level, $L_{Ar,Tr}$** – the specific sound level plus any adjustment for the characteristic features of the sound.
- **Residual sound level, Lr = $L_{Aeq,T}$** – the equivalent continuous sound pressure level at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound, over a given reference time interval, T.

The standard determines the degree of noise impact by comparison of the background noise level at noise sensitive receptors (NSRs) in the absence of the industrial or commercial facility (the specific source) with the ambient sound level when the specific source is operational.

Where particular characteristics such as tones, intermittency or impulsivity are present in the noise emissions of the specific source and perceptible at the receptor, the standard requires that "penalties" be added to the specific sound level to account for the increased annoyance that these can cause.

[2] BS4142:2014+A12019 Methods for Rating and Assessing Industrial and Commercial Sound (2019)

[3] The standard refers to sound levels, rather than noise levels, however, these terms can be used interchangeably, as noise is defined as "unwanted sound". This assessment uses the term "noise".

The following evaluation impact significance identifiers are provided in the standard, in which the difference between the specific sound level and measured background level are considered:

- The greater the difference, the greater the magnitude of impact;
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact;
- A difference of around + 5 dB is likely to be an indication of a low adverse impact;
- The lower the rating level, relative to the measured background level, the less likely that the specific sound source will have an adverse (or significant adverse) impact; and
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

The standard also makes the following comments:

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

   The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

   Where background sound 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. This is especially true at night.

   Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

2. *The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/ or commercial nature is likely to be perceived and how people react to it.*

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) facade 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."

Whilst the latest revision of BS 4142 does not provide definition of low or very low background and rating levels an earlier (1997) version considered that background levels of 30 dBA and rating levels of 35 dBA could be considered low. Numerous studies by Moorhouse, Berry, Flindell, etc for the Health Protection Agency and for Defra (referenced within the Further Reading Section of BS 4142) and supported by the recent ANC Working Group report on BS4142 application conclude that impacts at rating levels below 35 dB are unlikely. At night, particularly, where potential sleep disturbance is the key issue, a rating level of below 35 dB results in internal levels significantly below the WHO guideline values.

2.5 ISO 9613; Attenuation of sound during propagation outdoors, Part 1 and Part 2[4]

ISO 9613 1&2 describe a method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions.

3. Method

3.1 Consultation with South Holland Council (SHC)

ITPEnergised consulted with SHC Environmental Health on the 25th of January to agree the scope and approach of the noise assessment. The following approach was proposed:

The consultation proposed assessment in accordance with BS4142 at any potentially affected noise sensitive receptor.

Background noise levels in the area are highly likely to be very low (30dB or below). Section 11 of BS4142 provides details of factors that influence context and of particular note is:

"Where background sound 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. This is especially true at night."

ITPEnergised undertook initial noise modelling which produced predicted levels of 30 dB at NSR1 and 33 dB at NSR2. Based on these predicted noise levels ITPEnergised proposed to scope out a baseline noise survey. ITPEnergised has also undertaken reviews of the literature referenced within BS4142 (numerous studies by Moorhouse, Berry, Flindell, etc for the Health Protection Agency and for Defra and supported by the recent ANC Working Group report on BS4142 application) which conclude that impacts at rating levels below 35 dB are unlikely. At night, particularly, where potential sleep disturbance is the key issue, a rating level of below 35 dB results in internal levels significantly below the WHO guideline values.

Given the above, we would anticipate that noise due to the BESS would be likely to have no impact at a rating level of 35dB or below at those receptors where background noise is particularly low.

A response was received from a SHC EHO on the 27th of January, who accepted the proposed scope and approach to the noise assessment. Records of correspondence are shown in **Appendix A**.

3.2 Prediction of Operational Noise Levels

3.2.1 General Prediction Method

Noise levels due to the BESS have been predicted at identified representative NSRs within noise modelling software CadnaA, using the propagation method set out in ISO9613. The model assumes hard ground conditions for the BESS compound, with absorption set to G=0. For the surrounding area, the model assumes soft ground conditions, with absorption set to G=1. The model considers screening provided by local topography in the form of 50m DTM.

The Sungrow battery storage units and inverters have been modelled using peak sound pressure levels at 1m provided by the Applicant, which are considered 'worst-case'. Actual operational noise levels are likely to be lower. Noise from the batteries will predominantly come from the cooling fans on each unit.

[4] ISO 9613: Attenuation of sound during propagation outdoors, Part 1 and Part 2. ISO, December 1996.

The effective heights of the noise sources (cooling fans) considered in the model were as follows:

- Sungrow battery storage units – 1.5 m; and
- Sungrow inverters – 1.5 m.

The Sungrow battery storage units and inverters have been modelled as point sources on the side of the units, where the cooling fans are located. NSRs have been modelled at 4 m above ground level, representative of a first-floor bedroom window.

The inverter units are the noisiest items of plant within the BESS, with broad-band noise originating from cooling fans within the units. When determining whether any character corrections should apply to the Specific Level for deriving the Rating Level, in accordance with BS4142, this assessment notes the following:

- The octave spectral data for the representative spectrum used in this assessment has been tested for potential tonal components in accordance with the third octave method referenced in BS4142 and found likely to be non-tonal (refer to **Appendix B**); and
- Operation of the BESS will not result in impulsive or intermittent characteristics.

On the basis of the above, no correction has been applied and the Rating Level is therefore equal to the predicted Specific Level.

A typical air temperature of 10°C and relative humidity of 70% have been assumed within the model.

3.2.2 Source data

Details of the BESS were provided by the Applicant, including the proposed layout (shown in **Drawing 1**), and source noise levels for the Sungrow storage units and inverters. The source data was provided as sound pressure levels (SPL @ 1m). The SPLs were as follows:

- Sungrow storage units – Max 75 dB @ 1m; and
- Sungrow inverters – Max 87.7 dB @ 1m.

The Sound Power Level (SWL) for the storage units and inverters has been derived from the SPLs provided. The SWLs are as follows:

- Sungrow storage units – 88 dB; and
- Sungrow inverters – 97.7 dB.

No spectral data has been provided by the Applicant however a representative spectrum has been applied for each point source (and normalised to the SWLs detailed above) and is provided in **Table 2** as octave-band data.

Table 2 – Representative sound power data

Item	Sound power level, dB							
	63	125	250	500	1k	2k	4k	8k
Representative spectrum	-	63	76	75	69	70	68	57

The provided SPLs of Sungrow battery units and inverters has been adopted for this assessment and fitted to the spectral data in **Table 2**.

The model assumes that noise from the BESS will be from the Sungrow storage units and Sungrow inverters only. All other components of the BESS will have a sound power level at least 10 dB lower than the units and inverters and will therefore have a negligible contribution to the total noise emission of the BESS.

3.3 Method of Evaluation

The noise level resulting from the operation of the BESS has been predicted at identified representative NSRs.

In accordance with guidance provided in BS4142 this assessment considers that, where the predicted level (including any character corrections) exceeds the background level by 10 dB or more then a significant adverse impact can be expected. Where the predicted level exceeds the background by 5 – 10 dB then a minor adverse impact can be expected. For internal noise this assessment adopts a fixed limit criteria at any noise sensitive receptor (when assessed with windows open).

Table 3 – BS4142 criteria

BS4142 Rating level ($L_{Ar, Tr}$ dB)	Impact magnitude
> up to L_{90} dBA + <5 dB	Negligible
> L_{90} dBA + >5 dB to <9.9 dB	Minor
> L_{90} dBA + >10 dB	Moderate/Major

As background noise levels are likely to be low (in accordance with the guidance within BS4142 and detailed within section 2.4) it is considered that the absolute rating level becomes the main contextual factor and this assessment, therefore, considers that **an absolute rating level of 35dB $L_{Ar,Tr}$ or below is unlikely to result in significant noise impacts**. A **Minor** significance is given to an absolute rating level below 35 dBA.

4. Results

4.1 Predicted Operational Noise Levels

4.1.1 BS4142 Absolute Criteria

The specific noise level resulting from the operation of the BESS has been predicted at identified NSRs. The predicted specific levels at the nearest receptors are presented in **Table 4.**

In accordance with Sections 2.4, and 3.3of this report the predicted rating levels have been compared to the limiting 35dB $L_{Ar,Tr}$ level, below which impacts are considered unlikely.

Table 4 – Predicted noise levels at NMPs

NSR	Predicted rating level, $dBL_{Ar,Tr}$	Limiting $L_{Ar,Tr}$, dB	Difference, Rating – Limiting	Impact Significance
NSR1	30	35	-5	Minor
NSR2	33	35	-2	Minor

Predicted rating levels are below the limiting value at all NSRs indicative (in accordance with the BS4142 guidance) of a minor impact.

Noise contours showing predicted levels are provided in **Drawing 1**.

4.1.2 Uncertainty

Uncertainty exists in the context of the spectral characteristics of the sound power levels provided for the equipment). To minimise uncertainty the frequency spectrum for each item of equipment was chosen from ITPEnergised's database of noise levels from previous projects for similar equipment items.

No noise survey has been undertaken, uncertainty in this regard has been addressed by assuming a low background level (30 dB) which is representative of a very rural area away from busy roads.

4.2 Additional Context

Façade noise levels have been predicted at NSRs. The highest predicted façade levels associated with operation of the BESS are provided in **Table 5**. Internal noise levels have been derived assuming an open window provides 15 dB attenuation to external levels. These are compared with the target night-time maximum noise levels provided in BS8233 for habitable rooms (bedrooms and living rooms).

Table 5 – Predicted façade and internal noise levels at NSR1

NSR	Predicted façade level, $dBL_{Aeq,T}$	Derived internal level via open window attenuation, $dBL_{Aeq,T}$	BS8233 night-time target maximum internal level, $dBL_{Aeq,T}$	Comparison; internal level minus target level, dB
NSR1	30	15	30	-15
NSR2	33	18	30	-12

The internal level due to the BESS is below the target maximum level at all NSRs during the night-time period.

Measured data on the monthly average utilisation of an existing BESS is included in Appendix C. This data indicates that the BESS is likely to only produce audible noise levels during the early morning, between the hours of 1am and 5am, and early evening, between 3pm and 7pm. These periods correspond to when electricity is cheapest (BESS charging up) and when demand on the grid is greatest (BESS discharging).

4.3 Findings

Noise due to operation of the BESS meets the BS4142 criterion at NSR1 and NSR2. At more distant NSRs predicted noise levels are lower and impacts are lesser. Robust assumptions have been made throughout the assessment, and actual noise levels associated with the BESS at NSRs are therefore likely to be lower.

5. Conclusion

ITPEnergised has undertaken an assessment of potential noise impacts associated with the BESS at Caudwell Farm, north-east of Holbeach, in the South Holland District of Lincolnshire. The assessment has comprised prediction of operational noise levels, and evaluation in accordance with BS4142 and fixed limit criteria.

Predicted operational noise levels were within BS4142 derived criteria at NSRs.

Noise impacts will be low at the closest NSRs during the daytime and night-time periods.

Appendix A – Records of Correspondence

From: Gregor Massie <Gregor.Massie@itpenergised.com>
Sent: 25 January 2023 10:00
To: PublicProtection <PublicProtection@sholland.gov.uk>
Subject: FL - Caudwell Solar Farm - BESS - Noise Impact Assessment Scope and Methodology

Good afternoon Sir/Madam,

If this is the incorrect email address I would greatly appreciate this email being forwarded on the appropriate person at environmental health.

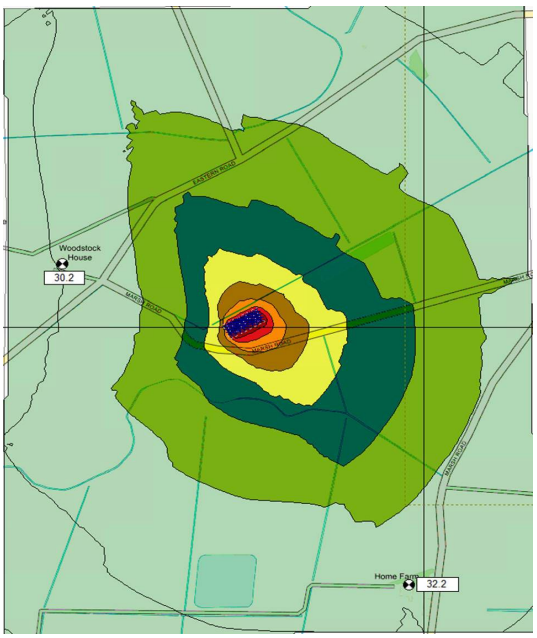
ITPEnergised have been commissioned to undertake the noise assessment for a proposed battery energy storage site (BESS) associated with the proposed solar farm at Caudwell Farm, south-west of Holbeach St Marks within the South Holland District Council (SHDC) administrative area. The BESS will comprise battery storage units, inverter units, a substation and switch rooms.

Assessment Methodology

We propose to assess operational noise from the proposed BESS in accordance with BS4142:2014+A1:2019 guidance. We do not anticipate significant noise associated with construction and installation of the batteries, which we assume will occur during the weekday daytime period, therefore no assessment of construction noise is proposed.

While undertaking initial modelling for the project, it was found that predicted noise levels were low at the nearest Noise Sensitive Receptors (NSRs). The highest predicted level was 32 dB. Based on these predicted noise levels we are therefore proposing to scope out a background noise survey. Figure 1 below presents the noise contours from the BESS at the nearest NSRs.

Figure 1 – BESS Noise Contours



If required, an acoustic fence at 2.5 metres high can reduce predicted noise levels at NSRs to below 30 dB at NSRs.

The proposed scope is as follows:

- Prediction of operational noise levels from the BESS;
- Assessment of the potential impacts associated with the BESS upon existing residential receptors in accordance with BS 4142:2019;
- Specification of mitigation measures if required; and
- Provide a report on the findings, alongside an EIA chapter summarising the noise report, suitable for submission in support of the planning application.

Background noise levels in the area are highly likely to be very low (30dB or below). Section 11 of BS4142 provides details of factors that influence context and of particular note is*:*

"Where background sound 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. This is especially true at night."

We have undertaken reviews of the literature referenced within BS4142 (numerous studies by MOORHOUSE, BERRY, FLINDELL, etc for the Health Protection Agency and for Defra and supported by the recent ANC Working Group report on BS4142 application) which conclude that impacts at rating levels below 35 dB are unlikely. At night, particularly, where potential sleep disturbance is the key issue, a rating level of below 35 dB results in internal levels significantly below the WHO guideline values (whilst not directly applicable, we feel the WHO guidance is a good reference point).

Given the above, we would anticipate that noise due to the BESS would be likely to have no impact at a rating level of 35dB or below at those receptors where background noise is particularly low.

Based on initial noise predictions, it is proposed to scope out a background noise survey. If a survey is required, then it will follow the methodology set out below.

Noise Survey Methodology

The closest noise sensitive receptors (NSRs) are located 450m to the north-west of the BESS. If a noise survey is required a monitoring position representative of the nearest NSRs are shown in the figure 2 below.

Figure 2 – Noise Monitoring Position

We anticipate that the noise environment is likely to comprise of birdsong, sporadic road traffic and wind noise.

Noise monitoring will be undertaken at NMP1 for a duration of 24 hours to provide appropriate background levels against which to assess noise from the BESS. Monitoring will be carried out in accordance with BS7445 and BS4142 methodology during dry and calm weather conditions.

Following characterisation of measured noise levels/assumed background level we will predict operational noise levels at NSRs within noise modelling software CadnaA, and will evaluate predicted noise levels in accordance with the BS4142 method. We consider that a rating level exceeding "measured background +5dB" is indicative of an adverse noise impact, depending on the context. Where appropriate reference will be made to other relevant guidance such as BS8233.

Our previous experience in consideration of similar schemes indicates that noise from the BESS will predominantly be associated with cooling units mounted on the exterior of the battery containers, and that these will only be required during high ambient air temperatures or very high levels of output.

If you are satisfied with our proposed approach I would appreciate it if you could respond with confirmation of acceptance. Alternatively, please do not hesitate to contact me should you wish to discuss any aspect of our proposed method.

Kind regards

Gregor

Gregor Massie| Senior Noise Consultant | ITPEnergised

Mobile: +44 (0) 7483 355626

4th Floor, Centrum House, 108-114 Dundas Street, Edinburgh EH3 5DQ

www.itpenergised.com

Appendix B – Evaluation of Tonality

Appendix C - Typical monthly average utilisation of an existing BESS

	00:00:00	00:30:00	01:00:00	01:30:00	02:00:00	02:30:00	03:00:00	03:30:00	04:00:00	04:30:00	05:00:00	05:30:00	06:00:00	06:30:00	07:00:00	07:30:00
Aug-21	0%	0%	7%	0%	5%	4%	0%	0%	0%	0%	0%	3%	1%	3%	2%	2%
Sep-21	0%	2%	37%	35%	34%	32%	24%	8%	1%	1%	1%	0%	1%	0%	4%	4%
Oct-21	2%	3%	15%	15%	51%	44%	39%	37%	14%	6%	1%	1%	1%	1%	11%	13%
Nov-21	1%	3%	3%	1%	1%	7%	38%	39%	37%	32%	21%	17%	1%	1%	1%	1%
Dec-21	1%	2%	2%	1%	2%	3%	26%	27%	31%	24%	22%	22%	0%	0%	6%	5%
Jan-22	0%	1%	0%	4%	0%	0%	25%	28%	25%	30%	26%	20%	0%	0%	0%	0%
Feb-22	1%	1%	1%	4%	6%	3%	16%	16%	14%	18%	13%	13%	1%	1%	5%	4%
Mar-22	1%	1%	2%	1%	3%	3%	9%	6%	8%	9%	5%	1%	0%	2%	4%	4%
Apr-22	4%	4%	5%	6%	3%	4%	4%	5%	6%	6%	5%	6%	4%	5%	9%	7%
May-22	4%	4%	5%	3%	3%	3%	3%	2%	4%	3%	3%	3%	6%	2%	5%	7%
Jun-22	8%	7%	4%	6%	6%	6%	4%	8%	4%	3%	7%	6%	8%	6%	3%	5%
Jul-22	3%	2%	2%	3%	3%	3%	2%	2%	2%	1%	2%	2%	5%	5%	9%	6%
Aug-22	3%	3%	4%	6%	7%	7%	6%	7%	7%	6%	3%	3%	29%	27%	6%	5%

08:00:00	08:30:00	09:00:00	09:30:00	10:00:00	10:30:00	11:00:00	11:30:00	12:00:00	12:30:00	13:00:00	13:30:00	14:00:00	14:30:00	15:00:00	15:30:00	16:00:00	16:30:00
1%	2%	1%	0%	0%	1%	1%	1%	0%	1%	1%	3%	5%	0%	2%	0%	3%	1%
4%	3%	2%	1%	4%	7%	5%	3%	1%	2%	10%	6%	8%	5%	6%	6%	11%	19%
16%	7%	1%	1%	0%	0%	3%	4%	9%	12%	23%	13%	9%	7%	0%	2%	42%	36%
4%	3%	4%	3%	1%	1%	2%	3%	1%	2%	2%	2%	8%	3%	29%	9%	1%	3%
4%	4%	5%	6%	4%	7%	5%	7%	6%	6%	5%	6%	5%	5%	40%	16%	17%	20%
0%	3%	3%	3%	0%	0%	1%	1%	0%	0%	0%	3%	0%	0%	32%	11%	23%	38%
3%	2%	1%	4%	0%	2%	2%	8%	2%	1%	1%	3%	1%	0%	9%	4%	14%	12%
5%	2%	4%	4%	1%	4%	4%	0%	7%	5%	0%	2%	1%	2%	1%	1%	3%	7%
3%	3%	5%	5%	4%	6%	5%	6%	5%	7%	5%	3%	4%	5%	4%	7%	3%	4%
4%	3%	4%	5%	4%	4%	4%	4%	4%	3%	3%	4%	4%	2%	3%	4%	2%	3%
5%	4%	4%	4%	4%	3%	5%	9%	5%	5%	6%	5%	5%	3%	3%	2%	4%	4%
5%	5%	4%	1%	2%	2%	2%	4%	3%	3%	4%	5%	4%	2%	2%	2%	3%	3%
4%	8%	6%	10%	8%	5%	11%	12%	5%	5%	5%	7%	3%	8%	5%	4%	7%	6%

17:00:00	17:30:00	18:00:00	18:30:00	19:00:00	19:30:00	20:00:00	20:30:00	21:00:00	21:30:00	22:00:00	22:30:00	23:00:00	23:30:00
0%	2%	5%	4%	1%	1%	2%	2%	1%	6%	2%	1%	0%	0%
36%	30%	42%	35%	8%	5%	5%	3%	17%	15%	1%	5%	1%	4%
66%	60%	28%	20%	8%	11%	2%	4%	11%	16%	4%	6%	5%	9%
57%	57%	53%	57%	5%	2%	1%	3%	4%	3%	6%	7%	2%	0%
60%	55%	34%	28%	3%	1%	1%	0%	1%	0%	13%	15%	4%	6%
36%	38%	20%	14%	0%	0%	1%	0%	0%	1%	12%	8%	1%	0%
18%	15%	14%	14%	1%	0%	1%	1%	1%	1%	1%	2%	1%	1%
6%	4%	7%	3%	1%	1%	0%	1%	1%	1%	1%	1%	2%	1%
4%	7%	8%	4%	4%	3%	8%	7%	4%	5%	3%	5%	3%	4%
3%	2%	7%	7%	3%	6%	7%	8%	5%	5%	4%	3%	4%	5%
3%	6%	10%	7%	7%	4%	5%	7%	8%	9%	4%	6%	6%	6%
8%	5%	7%	2%	2%	2%	3%	6%	4%	3%	6%	7%	4%	3%
13%	14%	33%	28%	11%	12%	11%	13%	8%	7%	5%	6%	4%	8%

ITPENERGISED

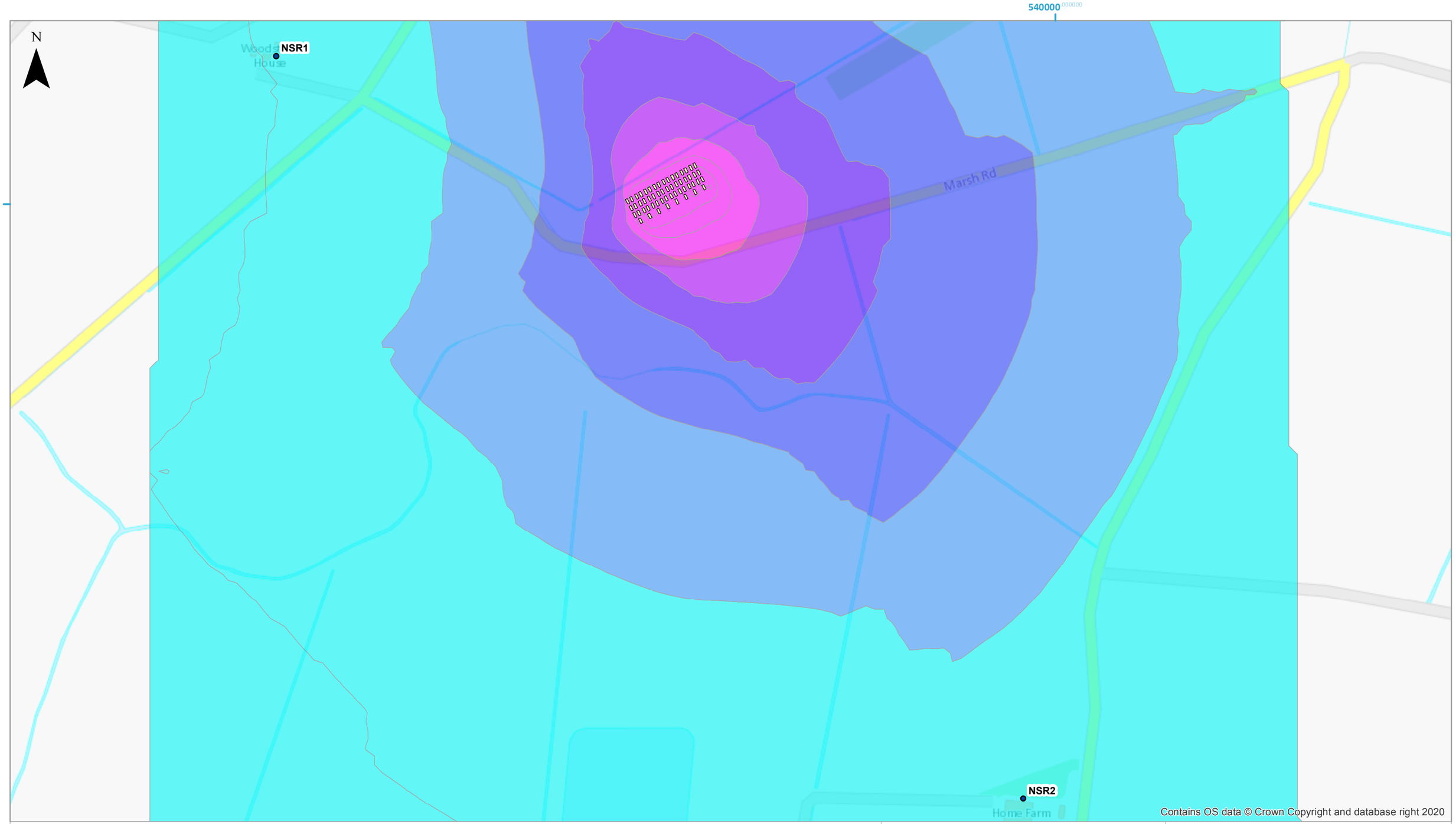
ITPEnergised is a leading international consultancy delivering expert energy, environmental, engineering, technical advisory and asset management services; facilitating the transition to net zero.

Visit the ITPEnergised group offices in:

Bristol, London, Edinburgh, Glasgow, Buenos Aires, Madrid, Delhi, Beijing, Canberra, Auckland

Sectors:

Onshore Renewables & Storage | Offshore Wind & Marine Renewables | Oil & Gas Transition
Property & Urban Regeneration | Corporate, Industrial & Manufacturing



KEY

- NSRs
- Batteries & Inverters

dBA

- <30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- >50

Coordinate System: British National Grid
Projection: Transverse Mercator

Attributions: <attributions go here>

0 25 50 100 150 200 250 Meters

1:4,200

ITPENERGISED

Caudwell Solar Farm
Noise Impact Assessment

Drawing 1
NSRs, Noise Contours & Modelled Items

Date:	Lead:	Review:	Version:
20/02/2023	GM	AB	V1

	15dB								8dB					5dB															
	25 to 125								160 to 400					500 to 10,000															
	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz		
paste here:							64.3	67.5	68.4	68.0	70.9	75.9	70.2	75.6	81.8	77.9	73.3	78.9	75.3	76.1	73.6	73.0	75.5	72.9	68.4	63.4	58.8	52.6	47.1
left		0	0	0	0	0.0	64.3	3.1	1.0	-0.4	2.9	5.0	-5.7	5.5	6.2	-3.9	-4.7	5.7	-3.6	0.7	-2.4	-0.7	2.6	-2.6	-4.5	-5.0	-4.6		
right	0	0	0	0	0	-64.3	-3.1	-1.0	0.4	-2.9	-5.0	5.7	-5.5	-6.2	3.9	4.7	-5.7	3.6	-0.7	2.4	0.7	-2.6	2.6	4.5	5.0	4.6			
Condition	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE		
	25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz		

TONES