Westport Energy Storage Project

Acoustic Impact Assessment

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Revision History

Issue	Date	Name	Latest Changes	File References
01	04/03/2025	Stuart Hill	First Draft	05200-9565239 05200-9803592

1 Introduction

This report contains an assessment of the acoustic impact of the proposed Westport Battery Energy Storage System (the 'Proposed Development') in terms of potential operational and construction impacts. Two Members of the Institute of Acoustics have been involved in its production. Details of their experience and qualifications can be found in Appendix A.

An assessment of the sound generated by the equipment to be installed has been undertaken in accordance with guidance provided by the Environmental Protection Team at East Ayrshire Council (EAC).

2 Planning Policy, Guidance & Standards

2.1 Planning Advice Note 1/2011: Planning and Noise

Within Scotland, the treatment of noise is defined in the planning context by 'Planning Advice Note (PAN) 1/2011: Planning and Noise' [1]. This document details the Government's planning policies and how these are expected to be applied. The PAN provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise, stating that planning policies and decisions should aim to avoid noise giving rise to significant adverse impacts, whilst at the same time mitigating and reducing other adverse impacts on health and quality of life to a minimum.

2.2 Technical Advice Note: Assessment of Noise

The online documentation 'Technical Advice Note (TAN): Assessment of Noise' [2] provides guidance to assist in the technical evaluation of noise assessments and aims to assist in assessing the significance of impacts associated with various development. The guidance refers to a since superseded version of BS 4142 in terms of assessing the impact of new sound generating development on neighbouring residences (the latest and previous version of which are discussed herein) and provides various matrices as to the significance and sensitivity of residences resulting from the introduction of certain facilities. The document states, at Paragraph 3.20, that '… the Scottish Government consider impacts are normally not significant (in a quantitative sense only) [if] the difference between the Rating and background noise levels is less than 5 dB(A), and that usually the threshold of minor significant impacts is when the difference between the Rating and background noise levels is at least 5 dB(A); and commonly do not become sufficiently significant to warrant mitigation until the difference between the Rating and background noise levels is more than 10 dB(A)'. The documentation also refers to publications released by the World Health Organisation (WHO) in terms of general internal and external absolute noise criteria for the protection of health, amenity, and sleep disturbance.

2.3 BS 8233 Guidance on Sound Insulation and Noise Reduction for Buildings

British Standard BS 8233:2014 [3] provides information on the design of buildings to ensure they have internal acoustic environments appropriate to their functions. The standard specifies guideline indoor ambient sound levels for buildings for different activities, locations and times of day and states that it is desirable that

these guideline values are not exceeded. Therefore, in practice the guidelines specify absolute limits for sound levels in specific environments. The most conservative applicable values specified are those conducive to sleeping or daytime resting in a house bedroom where the internal sound level should not exceed 30 dB $L_{Aeq,\ 8\ hour}$ at night. If a 15 dB reduction is assumed for attenuation through an open window, then a maximum outdoor sound level of 45 dB $L_{Aeq,\ 8\ hour}$ is applicable. The criteria for residential properties are shown in **Table 1**.

Table 1 – Indoor Ambient Noise Levels for Residential Properties

Criterion	Typical Situation	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35 dB $L_{Aeq,16h}$	-
Dining	Dining Room	40 dB $L_{Aeq,16h}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$

BS 8233:2014 provides guidance on acceptable levels within external areas such as gardens and patios. BS 8233 states that "*it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments*".

BS 8233:2014 also includes a methodology for assessment to noise rating (NR) values. This is a method for assigning a single-number rating to a noise spectrum. It can be used to specify the maximum acceptable level in each octave band of a frequency spectrum.

2.4 WHO Guidelines

The '*Guidelines for Community Noise*' document (WHO, 1999) [4] recommend guideline noise levels regardless of the current noise environment. The WHO suggests suitable noise levels for both indoor and outdoor living areas during daytime and night-time periods, and these levels are set regardless of the noise type or noise source, i.e. '*benchmark*' levels. It advises on the minimum levels of noise before critical health effects, including annoyance, occur.

In this regard, the WHO guidelines state:

- *"In dwellings, the critical effects of noise are on sleep, annoyance, and speech interference. To avoid sleep disturbance, indoor guideline values for bedrooms are 30dB $L_{Aeq,8h}$ for continuous noise and 45dB L_{Amax} for single sound events;*
- *To protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55dB $L_{Aeq,16h}$ for a steady, continuous noise; and*
- *To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50dB $L_{Aeq,16h}$."*

It must be noted that if the lower external noise limit of 50dB L_{Aeq} is achieved, it would equate to an internal noise level of 35dB L_{Aeq}, when accounting for the attenuation provided by an open window. An internal noise level of 35dB L_{Aeq} is the daytime noise limit for resting within living rooms as per BS 8233:2014.

For night-time, and to achieve an internal noise limit of 30dB L_{Aeq}, the external noise limit would be 45dB L_{Aeq} (when accounting for an open window).

2.5 Noise Rating Curves

The Noise Rating curves were developed by the International Organization for Standardization (ISO) to determine the acceptable indoor environment for hearing preservation, speech communication and annoyance. The curves determine the acceptable sound pressure levels at different frequencies for a variety of internal environments. In accordance with guidance provided by EAC, the acceptable sound pressure levels at different frequencies for NR Curve 25 are shown in Table 2.

Table 2 - Noise Rating Curves - Maximum Sound Pressure Levels, dB

NR Curve	Octave Band Mid-Frequency (Hz), dBZ							
	63	125	250	500	1000	2000	4000	8000
NR 25	55	44	35	29	25	22	20	18

2.6 Consultation with East Ayrshire Council

EAC have been consulted to ensure that this acoustic assessment meets their requirements. RES and EAC agreed the following:

- RES sent an email to EAC, dated 28th November 2024, detailing the proposed methodology for the Proposed Development. The proposed methodology included that there would likely be some temporary noise during the construction phase of the development, largely associated with site activities and vehicle movements, however, this noise can be controlled to a negligible level through a Construction Environmental Management Plan. EAC confirmed that they were satisfied with the proposed methodology.
- EAC provided a Pre-application response (Application No: 24/0033/PAA) dated 9th January 2025 which offered the following comments with regards to operational and construction noise from the Proposed Development:
    - *"Noise from the works during construction and in operation should at no time cause the ambient noise level to exceed 50dB(A)1hr at the façade of any noise-sensitive location having the potential to be affected by the development. In addition, once in operation night-time noise during the hours of 11pm – 7am should not cause the internal noise level in any affected property to exceed NR25."*
- RES consulted with EAC (email sent 09/01/2025) to seek their advice with regards to whether there were any nearby developments in planning, consented or under construction that should be included in a cumulative assessment. EAC confirmed that there were no developments that they aware of near this location, therefore no cumulative assessment would be required.

- RES consulted with EAC (email sent 04/02/2025) to confirm that there would be no requirement for a BS 4142 assessment and therefore no requirement for a background sound survey following their Pre-application response. This was confirmed by EAC (email received 05/02/2025).

- EAC requested some commentary around numbers, locations and sound output from any emergency back-up diesel generators to be installed on the site (email received 05/02/2025). RES confirmed that this site wouldn't have any back up diesel generators and that back up supply for this type of site has to be of permanent position and therefore this must be attained via the distribution network. (email sent 06/02/2025).

3 Baseline Environment

A list of the residential assessment locations considered representative of those located closest to the Proposed Development is provided in **Table 3**, as also shown in **Figure 1, Section 5**.

Table 3 - Assessment Locations

Property Name	Property ID	Co-ordinates (OSGB36)	
		Easting	Northing
Creoch House	H01	247626	620983
Ardmhor	H02	247632	621102
Creoch Farm	H03	247777	621176
Corselet	H04	248463	621653
Corselet Bungalow	H05	248880	621557
Torview	H06	248914	620817
High Tarbeg Farm	H07	248652	620731
Laigh Tarbeg	H08	248757	620485
Killoch	H09	247913	620255
Killochside	H10	247389	620184

The current sound environment at properties surrounding the site is considered typical of a rural environment, sources of which include farm stock, the sound of water flowing from streams and burns, localised human and animal activities, birdsong, occasional aircraft passing overhead and traffic passing along local roads. Activities from the industrial site directly to the south of the Proposed Development will also contribute to the sound environment.

4 Predictions

4.1 Operation

A model of the proposed battery storage facilities and the surroundings has been developed using CadnaA[1] software. The ISO 9613-2 [5] propagation/prediction methodology has been employed to predict the sound levels resulting from the development at nearby residential properties, incorporating various assumptions and factors which are considered appropriate for use here:

- The plant to be installed as part of the development has been modelled as point sources and these are assumed to be operating at their maximum potential output for all time periods as a conservative basis of assessment;
- Soft ground conditions have been assumed (i.e. G=1) as representative of the farmland surrounding the Proposed Development. The ISO 9613-2 standard allows for a range of ground conditions to be applied, from porous ground conditions (G=1), which includes surfaces suitable for the growth of vegetation (i.e. farmland), to hard ground (G=0), such as paving, water and concrete;
- The receptors have been assigned a height of 1.5 m;
- Atmospheric attenuation corresponding to a temperature and relative humidity of 10 °C and 70 % respectively, as defined within ISO 9613-1 [6], which represents relatively low levels of sound absorption in the atmosphere; and
- The topography of the site and surroundings has been included within the model.

Furthermore, ISO 9613-2 is a downwind propagation model. Where conditions less favourable to sound propagation occur, such as when the assessment locations are upwind of the Proposed Development, the resultant levels would be expected to be less and the downwind predictions presented as part of this report would be regarded as conservative, i.e. greater than those likely to be experienced in practice.

The predominant sources of sound to be introduced as part of the Proposed Development are the 52 inverters (INV) , 28 transformers (TRA), 208 battery storage containers (BESS) and 2 substation transformers (Sub_Tx).

The assumed sound power data in octave bands for the equipment to be installed as part of the Proposed Development are provided in **Table 4**. The overall levels correspond to the maximum anticipated sound output for each of the respective plant, as advised by a candidate manufacturer and from RES's experience of typical equipment. The propagation modelling therefore represents a relatively conservative scenario and actual sound levels would be expected to be less when the site is not operating at maximum capacity.

[1] https://www.datakustik.com/

Table 4 - Octave Band Sound Power Levels, dB L_{WA}

ID	Overall, dB L_{WA}	Octave Band Centre Frequency, Hz							
		63	125	250	500	1k	2k	4k	8k
BESS	72	54	58	60	67	65	63	62	62
INV	80	55	65	75	73	73	72	69	63
TRA	76	41	62	70	74	64	57	51	49
Sub_Tx	93	58	80	88	91	81	74	68	67

The combination of assumptions detailed above are considered to provide a conservative prediction/modelling basis overall. The results of the predictions at the various residences surrounding the Proposed Development are shown in **Section 5**.

The site has been designed on an iterative basis with a view to minimising, as far as practicably possible, the projected operational sound levels with due regard to the relative sensitivity of neighbouring premises and all other site constraints.

5 Assessment

5.1 Predicted Sound Levels

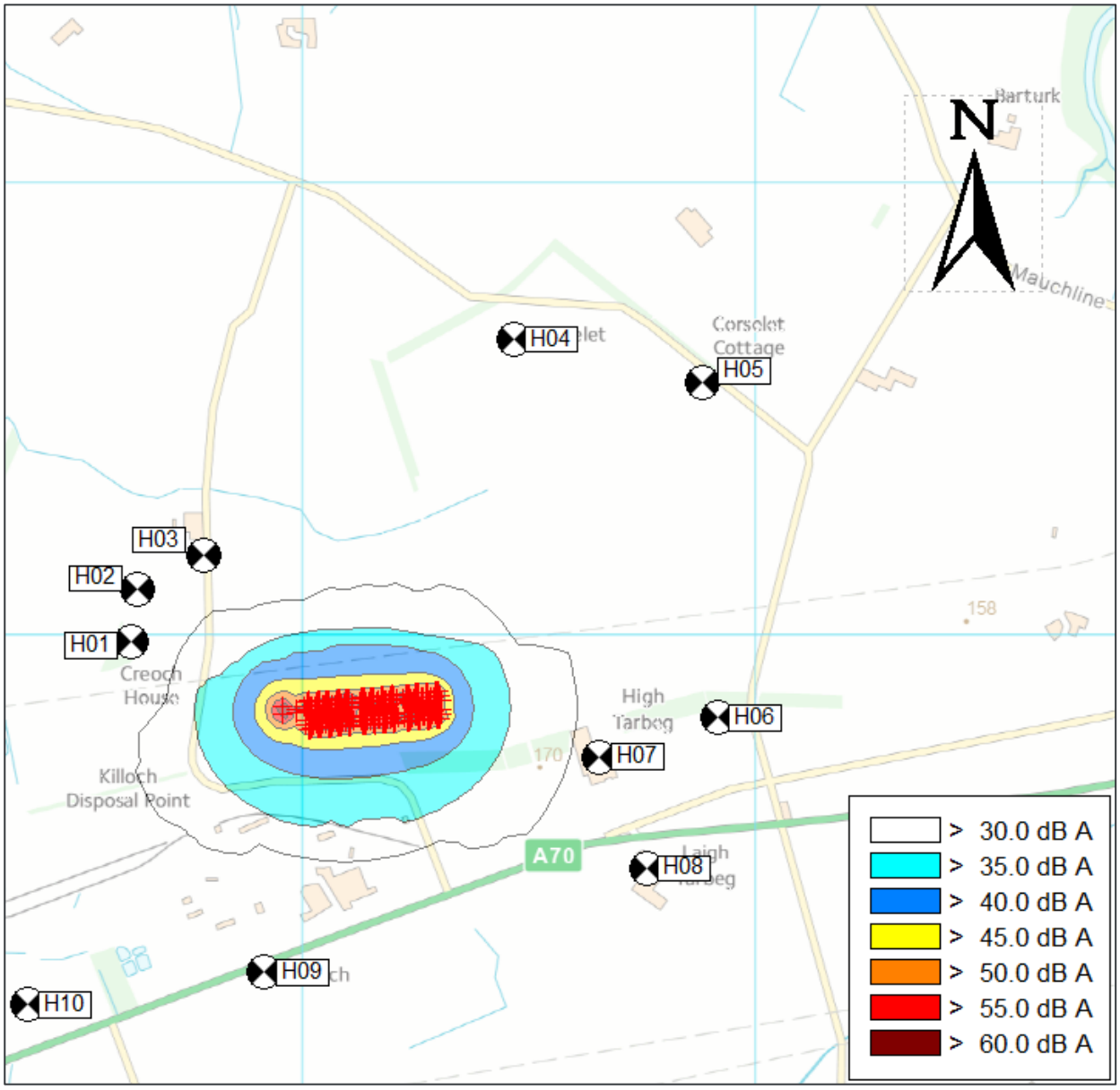
The predicted specific sound levels (L_{Aeq}) due to the Proposed Development at the nearest residential receptor locations are shown in **Table 5** below. The sound levels have been predicted at 1.5 m above local ground level for both daytime and night-time, and the site is assumed to be operating at all times so the predicted sound levels for day and night-time are the same.

Table 5 - Predicted Specific Sound Levels Freefield External to Properties

Property ID	Predicted Specific Sound Level, dB $L_{Aeq,T}$
H01	27
H02	26
H03	27
H04	21
H05	18
H06	24
H07	28
H08	22
H09	24
H10	19

An illustrative sound footprint for the proposed development showing the predicted specific sound level (dB L_{Aeq}) is provided in **Figure 1**.

Figure 1 - Sound Contour Plot, dB L_{Aeq}



5.2 Assessment of Proposed Development

5.2.1 Daytime Assessment

For the daytime assessment, the predicted sound levels at the façade of the nearby properties due to the operation of the Proposed Development are compared to the daytime sound limit of 50 dBA 1hr as specified by EAC. The results are presented in **Table 6**.

Table 6 - Daytime Assessment Results

Property ID	Predicted Specific Sound Level, dB $L_{Aeq,T}$	Daytime sound limit, 50 dBA 1hr	Difference, dB
H01	27	50	-23
H02	26	50	-24
H03	27	50	-23
H04	21	50	-29
H05	18	50	-32
H06	24	50	-26
H07	28	50	-22
H08	22	50	-28
H09	24	50	-26
H10	19	50	-31

The daytime assessment indicates that the predicted noise impact from the Proposed Development at the nearest neighbouring residences would be considered not significant in terms of the guidance provided within the Technical Advice Note (TAN) detailed at Section 2.2, as outlined by the Scottish Government.

5.2.2 Night-time Assessment

The predicted sound levels as octave band unweighted (dBZ) L_{eq} values, external at the nearest residential receptor locations to the Proposed Development are shown in **Table 7**.

Table 7 - Predicted Sound Levels Freefield External to Properties

Property ID	Sound Levels (Leq) dBZ for Octave Frequency Band							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
H01	39	36	26	27	22	15	3	-23
H02	38	35	25	26	21	14	2	-27
H03	40	36	26	27	22	16	4	-23
H04	37	25	19	19	17	10	-7	-54
H05	34	22	17	17	14	5	-14	-68
H06	41	26	20	20	20	15	0	-38
H07	44	32	24	23	25	21	10	-15
H08	37	27	21	20	18	11	-3	-39
H09	38	31	23	23	20	13	-1	-35
H10	34	25	19	19	14	6	-13	-65

An allowance of 15 dB for the attenuation of a partially open window has been used in order to convert between internal and external sound levels and limits.

The night-time assessment, as specified by EAC, indicates that the noise from the Proposed Development should not cause the internal noise level in any affected property to exceed NR25. **Table 8** shows the predicted sound levels free field external to properties, the internal sound levels based on a 15 dBA reduction for a partially open window, the NR25 curve values and the difference between the predicted internal sound levels and the NR25 values.

Table 8 -Predicted Sound Levels External to Properties, Internal, NR25 values and Difference

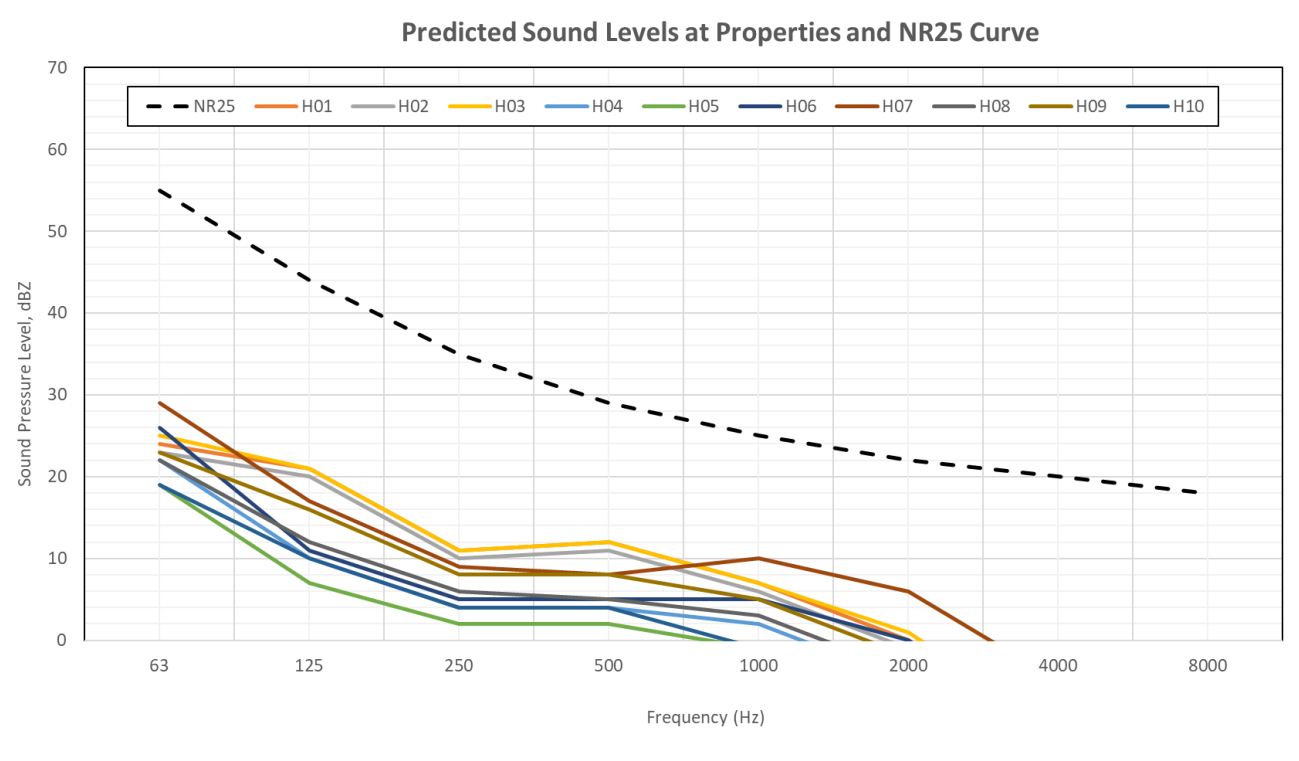
Property ID	Sound	Sound Levels (L_{eq}) dBZ for Octave Frequency Bands							
		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
H01	External	39	36	26	27	22	15	3	-23
	Internal	24	21	11	12	7	0	-12	-38
	NR25	55	44	35	29	25	22	20	18
	Difference	-31	-23	-24	-17	-18	-22	-32	-56
H02	External	38	35	25	26	21	14	2	-27
	Internal	23	20	10	11	6	-1	-13	-42
	NR25	55	44	35	29	25	22	20	18
	Difference	-32	-24	-25	-18	-19	-23	-33	-60
H03	External	40	36	26	27	22	16	4	-23
	Internal	25	21	11	12	7	1	-11	-38
	NR25	55	44	35	29	25	22	20	18
	Difference	-30	-23	-24	-17	-18	-21	-31	-56
H04	External	37	25	19	19	17	10	-7	-54
	Internal	22	10	4	4	2	-5	-22	-69
	NR25	55	44	35	29	25	22	20	18
	Difference	-33	-34	-31	-25	-23	-27	-42	-87
H05	External	34	22	17	17	14	5	-14	-68
	Internal	19	7	2	2	-1	-10	-29	-83
	NR25	55	44	35	29	25	22	20	18
	Difference	-36	-37	-33	-27	-26	-32	-49	-101
H06	External	41	26	20	20	20	15	0	-38
	Internal	26	11	5	5	5	0	-15	-53
	NR25	55	44	35	29	25	22	20	18
	Difference	-29	-33	-30	-24	-20	-22	-35	-71
H07	External	44	32	24	23	25	21	10	-15
	Internal	29	17	9	8	10	6	-5	-30
	NR25	55	44	35	29	25	22	20	18
	Difference	-26	-27	-26	-21	-15	-16	-25	-48
H08	External	37	27	21	20	18	11	-3	-39
	Internal	22	12	6	5	3	-4	-18	-54

Property ID	Sound	Sound Levels (L_{eq}) dBZ for Octave Frequency Bands							
		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
	NR25	55	44	35	29	25	22	20	18
	Difference	-33	-32	-29	-24	-22	-26	-38	-72
H09	External	38	31	23	23	20	13	-1	-35
	Internal	23	16	8	8	5	-2	-16	-50
	NR25	55	44	35	29	25	22	20	18
	Difference	-32	-28	-27	-21	-20	-24	-36	-68
H10	External	34	25	19	19	14	6	-13	-65
	Internal	19	10	4	4	-1	-9	-28	-80
	NR25	55	44	35	29	25	22	20	18
	Difference	-36	-34	-31	-25	-26	-31	-48	-98

Table 8 shows the night-time margins (difference row) by which the predicted operational sound levels resulting from the operation of the Proposed Development meets the NR25 internal night-time noise limits as specified by EAC. A negative number shows that predicted levels are below the NR25 values at each residence. The closest margin to the NR25 internal limit is -15 dBA at property H07 at 1 kHz.

Figure 2 shows the predicted internal sound levels at each of the assessed properties as octave band unweighted (dBZ) L_{eq} values and the night-time NR25 internal limit.

Figure 2 - Predicted Sound Levels & NR25 Curve, L_{eq} dBZ



The assessment indicates that the predicted internal noise levels resulting from the introduction of the Proposed Development, at the nearest neighbouring properties, remain below the night-time noise limits for all receptors.

The wording for a suggested planning condition that would restrict sound associated with the introduction of the Proposed Development, should the site gain planning consent, is provided in **Appendix B**.

The suggested planning condition proposes an external noise level limit at the properties based upon the NR25 curve values for the frequency range specified during the night-time. This has been suggested, as setting an internal noise level limit is particularly difficult to demonstrate compliance against. Monitoring inside a residential property can prove problematic due to a range of factors: it can be perceived as invasive by the occupant of the property and gaining consent to monitor inside their property can be difficult to arrange, additionally the sound levels monitored internally may be subject to interference from other (internal) sound sources.

Therefore, the proposed noise level limits are those derived from a noise rating curve of NR25 for night-time to be applied externally to a property. 15 dB has been added to each of the NR 25 curve frequency values in order to account for the 15 dBA reduction applied for an open window. If required, this would allow for noise level monitoring to be undertaken external to the property, to demonstrate compliance with the noise limits.

6 Conclusions

An acoustic impact assessment of the proposed Westport Energy Storage Project has been undertaken in accordance with the guidance provided by EAC which states that operational noise from the Proposed Development should at no time cause the ambient noise level to exceed 50dB(A)1hr at the façade of any noise-sensitive location having the potential to be affected by the development. In addition, once in operation night-time noise during the hours of 11pm – 7am should not cause the internal noise level in any affected property to exceed NR25. The results of the assessment show that the predicted noise levels resulting from the introduction of the Proposed Development, at the nearest neighbouring properties, remain below the daytime and night-time noise level limits for all receptors and can be considered acceptable in terms of the limits provided by EAC.

7 References

[1] Scottish Government (March 2011) Planning Advice Notice 1/2011: Planning and Noise

[2] Scottish Government (March 2011) Assessment of Noise: Technical Advice Note

[3] British Standards Institution (2014) BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

[4] Guidelines for Community Noise, World Health Organization (1999), WHO Reference Number: a68672, Berglund, B., Lindvall, T., & Schwela, D. H. (Eds.)

[5] International Organisation for Standardisation (1996) ISO 9613-2:1996 Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation

[6] International Organisation for Standardisation (1993) ISO 9613-1:1993 Acoustics - Attenuation of sound during propagation outdoors - Part 1: Calculation of the Absorption of Sound by the Atmosphere

Appendix A – Experience & Qualifications

Table A.1 - Author

Name	Stuart Hill
Experience	Senior Acoustic Specialist, Renewable Energy Systems (RES), 2024-Present Senior Acoustic Consultant, Mabbett, 2022-2024 Senior Environmentalist (Acoustics), Amey, 2021-2022 Associate Consultant – Acoustics, Noise & Vibration, SLR Consulting, 2017-2020 Technical Analyst/Senior Acoustic Analyst, RES, 2013-2017
Qualifications	MIOA, Member of the Institute of Acoustics MInstP, Member of the Institute of Physics MSc Principles and Applications of Radiation in Industry, the Environment and Medicine, University of St Andrews BEng Electronics Engineering, University of Aberdeen

Table A.2 - Checker

Name	Peter Brooks
Experience	Acoustic Lead, Renewable Energy Systems (RES), 2023-Present Senior Acoustic Analyst, RES, 2022-2023 Acoustic Consultant, Arcus Consultancy Services, 2021-2022 Director, 343 Acoustics, 2019–2021 Lead Acoustic Engineer, Tymphany, 2017-2019 Research and Development Engineer, SEAS Fabrikker, 2014-2017 Acoustic Engineer, Premium Sound Solutions, 2011-2013
Qualifications	MIOA, Member of the Institute of Acoustics PGCert Environmental Acoustics, University of Salford BSc (Hons) Audio Technology, University of Salford

Table A.3 - Approver

Name	Karen Anne Hutton
Experience	Technical Director, Renewable Energy Systems (RES), 2023–Present Head of Repowering & Life Extension, RES, 2019-2023 Head of Innovation & Optimisation, RES, 2018-2019 Transformation Manager, RES, 2016-2018 Initiatives Manager, RES, 2015-2016 Prospecting & Development Data Manager, RES, 2012-2015 Technical Manager, RES, 2009-2012 Senior Wind Analyst, RES, 2007-2009 Wind Analyst, RES, 2001-2007
Qualifications	MEng Civil Engineering, Heriot-Watt University

Appendix B – Suggested Planning Condition Wording

The energy storage facility shall be designed and operated to ensure that the noise limits, as shown below, will be met for daytime and night-time.

1. *Noise from the operation of the facility during the daytime hours (7am – 11pm) should at no time cause the ambient noise level to exceed 50 dB(A)1hr at the façade of any noise-sensitive location.*

2. *Noise from the operation of the facility during the night-time hours (11pm – 7am) should at no time exceed the values detailed in Table 1 when measured externally at the nearest occupied residential noise sensitive property, as existing at the time of this consent.*

Table (1): Noise Limits

Time	Descriptor	Frequency (Hz), dBZ							
		63	125	250	500	1000	2000	4000	8000
23:00 – 07:00	Night	70	59	50	44	40	37	35	33