

Liverpool Range Wind Farm

Operational Noise Fact Sheet



Why was the assessment undertaken?

When operational, a wind farm has the potential to cause amenity impacts due to mechanical noise produced by the wind turbines, movement of the turbine blades and from substation transformers. In addition, noise from a battery energy storage system (BESS) is typically caused by the operation of the combined battery packs, inverters, air conditioning and fans, and smaller transformers.

A Predictive Noise Impact Assessment (PNIA) was prepared by Sonus Pty Ltd to assess the potential operational noise impacts associated with the following key changes to the approved wind farm layout and design proposed by the Modified Project:

- Increase in maximum blade tip height to 250 metres (m) above ground level (AGL) (increase of 85 m)
- Decrease in maximum number of turbines to 223 (removal of 44 wind turbines)
- Revised turbine layout, including newly proposed turbines in the northwest and northeast of the Project site
- Inclusion of a Battery Energy Storage System (BESS) with an indicative capacity of 150 MW / 300 MWh

The PNIA also undertook a comparative analysis of the Approved Project and the Modified Project and assessed the change in potential operational noise impacts between the two projects.



Operational noise compliance monitoring at Dundonnell Wind Farm, Victoria.

What was the approach?

The PNIA was prepared considering the relevant conditions of Development Consent SSD 6696 that were granted for the Approved Project in 2018 and prepared in accordance with the relevant legislation and guidelines including:

Wind turbine noise:

- NSW Wind Energy: Noise Assessment Bulletin AB02 (EPA/DPE, 2016) (NSW Noise Bulletin)
- South Australian Environment Protection Authority's Wind Farms – Environmental Noise Guidelines (SA EPA, 2009) (SA EPA Guidelines)
- Environmental Noise Guidelines for the European Region (World Health Organisation, 2018) (WHO Guidelines)

Battery Energy Storage System (BESS) and collector substations:

• NSW Noise Policy for Industry (EPA, 2017) (the NPI)

To assess wind turbine noise and substation noise, the PNIA adopted the same assessment methodologies as the original Noise Impact Assessment (and Addendum) prepared in 2014 (and 2017) by SLR Consulting Pty Ltd in support of the Approved Project, so that a like-for-like comparison of the potential operational noise impacts between the Approved Project and Modified Project can be made. As such, the PNIA has adopted the following noise prediction methodologies:

- To predict wind turbine noise levels: *ISO 9613-2:1996 Acoustics — Attenuation of sound during propagation outdoors* (ISO method).
- To predict substation noise levels: the Conservation of Clean Air and Water Europe (CONCAWE) method (accessible from <u>www.concawe.eu</u>).
- Consistent with the assessment of substation noise, to predict BESS noise levels the CONCAWE assessment method was used.

These are considered valid fit-for-purpose noise assessment methodologies by noise specialists and regulators.

WIND TURBINE NOISE

For wind turbine noise predictions the PNIA modelled the GE 158 5.5MW as the indicative wind turbine model which has one of the highest noise emissions of those currently on the market. This turbine model was chosen to enable a conservative 'worst case' prediction of potential wind turbine noise.

Background noise monitoring was undertaken over a six week period in October – November 2020 at four representative residence locations to provide an up-to-date baseline understanding of existing pre-construction noise conditions. The four background noise monitoring locations were at non-associated residences and were chosen by Sonus Pty Ltd as the most appropriate representative locations. The measured background noise levels at the four representative locations were then applied to other similarly located non-associated residences.

Background noise levels are an important factor in determining the applicable noise limits for wind turbine noise. The SA EPA Guidelines and NSW Noise Bulletin specify that the applicable noise limit at each non-associated residence is either:

- 35 dB(A); or
- background noise level plus 5 dB(A), whichever is the greater.

Establishing noise limits in accordance with the relevant guidelines ensures that wind turbine noise levels are compatible with surrounding land uses and do not significantly affect the living experience of people residing in the area. The noise limits set out in the SA EPA Guidelines and NSW Noise Bulletin are some of the most stringent in the world when assessing the noise from wind farms.

In accordance with the SA EPA Guidelines and NSW Noise Bulletin, the results of the background noise monitoring campaign have resulted in increases to the applicable wind turbine noise limits at several nonassociated residences to above the standard 35 dB(A) noise limit.

BATTERY ENERGY STORAGE SYSTEM (BESS) AND SUBSTATION NOISE

The BESS facility is proposed to located at one of 6 potential locations, either co-located with one of the collector substations within the wind farm or at the proposed switchyard at Ulan. Between 6-7 collector substations (depending on which transmission line option is adopted) are proposed to be located at 10 potential locations within the wind farm.

For the BESS facility and collector substations, the relevant noise limits are specified in the Development Consent which requires that operational noise levels do not exceed 35 dB(A) LAeq (15 minute) at any non-associated residence.

To provide a conservative worst-case assessment of the potential noise from collector substations and the BESS facility, the PNIA assumed the presence of noise characteristics that have the potential to be annoying, such as tonality, modulation or dominant low-frequency content. As such a 5 dB(A) correction factor has been applied which effectively reduces the applicable noise limit for the collector substations and BESS facility to 30 dB(A) at non-associated residences, in accordance with the *NSW Noise Policy for Industry*.

PREDICTED TURBINE NOISE LEVELS (MODIFIED PROJECT)





Legend

Modified Site Boundary

Under Negotiation - to be confirmed Dwellings

- Non-associated
- Associated

Modified Project Infrastructure

Wind Turbine Layout (223 WTGs)

Predicted Turbine Noise

- 45 dB(A)
- 40 dB(A)
- 35 dB(A)
- 30 dB(A)

Date: 4 October 2021 CRS: GDA94/MGA Zone 55 Version: A

0 1 2 3 4 5 km

Scale: 1:150,000 @ A3

What did we find and how does it compare to the approved project?

WIND TURBINE NOISE

The PNIA found that the noise levels generated from the operation of the indicative wind turbines is predicted to be below the relevant noise limits at all non-associated residences. A noise contour map showing the highest predicted wind turbine noise levels at all nearby residences is provided at right.

The highest predicted noise level at any non-associated residence for wind turbine noise is 34 dB(A), which is below the applicable noise limit.

Compared to the Approved Project, the Modified Project is expected to result in an increase in predicted noise levels at 11 non-associated residences, which are listed in the table below. The degree of increase at these non-associated residences ranges between 0.1 dB(A) and 1.7 dB(A), which is below the typically audible range of around 2-3 dB(A). All predicted noise levels remain below the applicable noise limits specified in the SA EPA Guidelines and NSW Noise Bulletin.

As the predicted turbine noise levels are below the applicable limits, there is currently no need for noise mitigation measures or a curtailment strategy which would involve operating the turbines in a reduced power mode.

Once the final wind turbine model has been selected and the layout finalised during detailed design phase, an updated pre-construction predictive noise impact assessment will be undertaken to ensure the final turbine model and layout complies with the applicable noise limits.

| Non Associated Dwelling ID | Predicted Turbine Noise Levels dB(A) | | Increase in Predicted Turbine |
|-------------------------------|--------------------------------------|-------------------------------|-------------------------------|
| | Approved Project (SLR 2014,2017) | Modified Project (Sonus 2021) | Noise Levels dB(A) |
| D7-7 | 29.1 | 30.3 | 1.2 |
| E7-1 | 28.2 | 29.1 | 0.9 |
| E7-2 | 28.4 | 28.8 | 0.4 |
| E9-4 | 27.9 | 28.7 | 0.8 |
| F2-1 | 29.3 | 29.4 | 0.1 |
| F2-2 | 29 | 29.6 | 0.6 |
| F2-3 | 29.7 | 30.3 | 0.6 |
| F2-4 | 30.1 | 30.6 | 0.5 |
| F2-5 | 29.9 | 30.3 | 0.4 |
| G2-1 | 26.9 | 28.6 | 1.7 |
| H8-1 | 26.1 | 27.4 | 1.3 |

BATTERY ENERGY STORAGE SYSTEM (BESS) AND SUBSTATION NOISE

For the purposes of predicting conservative worst-case noise levels associated with the proposed BESS facility and collector substations, the PNIA assumed that all 10 potential collector substation locations are constructed (up to 7 substation locations are required, depending on final layout) and all 6 of the potential BESS locations are constructed (only 1 BESS is proposed).

The PNIA adopted a sound power level of 119 dB(A) to predict the noise levels associated with an assumed 150 MW/ 300 MWh BESS capacity at full load and to account for the cumulative effect of the combined battery packs and transformers. Typically, BESS facilities in a regional Australian climate would often operate at much lower loads meaning lower sound power levels, and therefore this approach provides a conservative worst-case estimate.

To predict the noise levels associated with the collector substations, the PNIA assumed that each substation would contain a 400 MVA capacity transformer with an associated sound power level of 102 dB(A). Again, this approach represents a conservative worst-case scenario.

The highest predicted noise level associated with the operation of all potential collector substations and potential BESS facility locations at a non-associated residence is 20 dB(A), with the predicted noise levels at most other non-associated residences being less than 15 dB(A).

Operation of the proposed BESS and collector substations will therefore easily achieve the conservatively reduced noise limit of 30 dB(A) at non-associated residences and comply with the requirements of the Development Consent and the NPI.

PREDICTED BESS & SUBSTATION NOISE LEVELS (MODIFIED PROJECT)





Legend

Modified Site Boundary

Under Negotiation - to be confirmed Dwellings

- Non-associated
- A Associated

Modified Project Infrastructure

- Potential Substation Location
- Potential Battery (BESS) Location

Predicted Noise Levels Substations & Battery (BESS)

- -- 45 dB(A)
- -- 40 dB(A)
- -- 35 dB(A)
- 30 dB(A)

Date: 4 October 2021 CRS: GDA94/MGA Zone 55 Version: A



0 1 2 3 4 5 km

Scale: 1:150,000 @ A3

PREDICTED WIND TURBINES NOISE LEVELS (MODIFIED PROJECT)





Legend

Modified Site Boundary

Under Negotiation - to be confirmed

Dwellings

- Non-associated
- Associated

Modified Project Infrastructure

Wind Turbine Layout (223 WTGs)
Predicted Noise Levels
Wind Turbines

- -- 45 dB(A)
- -- 40 dB(A)
- -- 35 dB(A)
- --- 30 dB(A)

Date: 4 October 2021 CRS: GDA94/MGA Zone 55 Version: A



0 1 2 3 4 5 km

Scale: 1:150,000 @ A3

NOISE LOGGERS





Photo top: Background noise monitoring at non-associated residence near LRWF project.

Photo left: Sound level meter used for all kinds of environmental sound measurements.

What are the proposed mitigation strategies?

The modelling included in the PNIA shows that the Modified Project can comply with the noise limits established for the Project in accordance with all relevant guidelines. As a result the PNIA does not include recommendations for mitigation measures to be implemented for wind turbine noise or noise associated with the operation of the BESS facility and substations.

As the Project progresses towards construction and the preferred wind turbine make and model is determined, a revised noise prediction and assessment will be completed, and a noise compliance testing plan will be prepared to confirm that the preferred turbine and final turbine layout will comply with all applicable noise limits at non-associated and Associated residences.

If unintended and undue noise impacts are identified during turbine operations due to temperature inversion, atmospheric stability or other reasons, adaptive management measures may be considered to mitigate or remove the noise impact. These measures may include:

- Receiving, documenting and investigating the noise impact complaint in accordance with Tilt Renewables' complaints handling process available on the website.
- Identifying exactly what conditions or times lead to undue impacts.
- Operating turbines in a reduced 'noise optimised' mode during identified times and conditions (sector management).
- Turning off turbines that are identified as causing the undue impact.
- Providing acoustic upgrades (glazing, façade, masking noise etc) to affected residences.

Assessment against Development Consent

The Modified Project can comply with relevant noise limits for the operation of the wind turbines in accordance with the SA EPA Guidelines and the NSW Noise Bulletin, and for the operation of the substations and BESS facility in accordance with the NSW Noise Policy for Industry.

Following the updated background noise monitoring that was undertaken in October-November 2020, amendments will be required to the Development Consent to reflect the updated noise limits at several Non-associated residences, in accordance with the SA EPA Guidelines and the NSW Noise Bulletin.

The Modified Project can comply with all other operational noise conditions of the Development Consent, in particular:

- Undertaking noise compliance monitoring within 6 months of the commencement of turbine operations to ensure compliance with all relevant noise limits.
- Noise emissions from ancillary infrastructure such as substations and BESS facility do not exceed 35 dB(A) LAeq (15 minute) at any Non-associated residence.

SIGN UP & STAY INFORMED

If you haven't already, please subscribe to our newsletter to ensure you receive all Project updates and information. We understand that not everyone uses email, so we will be working with local businesses to host Project information packs such as the newsletter, fact sheets and maps. Subscribe to receive the newsletter by email or post, by contacting us at: <u>liverpoolrangewindfarm@tiltrenewables.com</u>



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