



LLYR

LLYR FLOATING OFFSHORE WIND PROJECT

Llŷr 1 Floating Offshore Wind Farm

Environmental Statement

Volume 6: Appendix 15A – Human Hearing and Acoustic Terminology

August 2024





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Acronyms and abbreviations

Acronym or Abbreviation	Definition	Acronym or Abbreviation	Definition
dB	Decibels	OnECC	Onshore Export Cable Corridor
Hz	Hertz	Pa	Pascals
MLT	Marine Licensing Team	SPL (Lp)	Sound Pressure Level (measured in Lp)
NRW	Natural Resources Wales	TJB	Transition Joint Bays
OfECC	Offshore Export Cable Corridor		

Glossary of project terms

Term	Definition
The Applicant	The developer of the Project, Llŷr Floating Wind Ltd.
Array	All wind turbine generators, inter array cables, mooring lines, floating sub-structures and supporting subsea infrastructure within the Array Area, as defined, when considered collectively, excluding the offshore export cable(s).
Array Area	The area within which the wind turbine generators, inter array cables, mooring lines, floating sub-structures and supporting subsea infrastructure will be located
Floventis Energy	A joint venture company between Cierco Ltd and SBM Offshore Ltd of which Llŷr Floating Wind Limited is a wholly owned subsidiary.
Landfall	The location where the offshore export cable(s) from the Array Area, as defined, are brought onshore and connected to the onshore export cables (as defined) via the transition joint bays (TJB).
Llŷr 1	The proposed Project, for which the Applicant is applying for Section 36 and Marine Licence consents. Including all offshore and onshore infrastructure and activities, and all project phases.
Marine Licence	A licence required under the Marine and Coastal Access Act 2009 for marine works which is administered by Natural Resources Wales (NRW) Marine Licensing Team (MLT) on behalf of the Welsh Ministers.
Offshore Development Area	The footprint of the offshore infrastructure and associated temporary works, comprised of the Array Area and the Offshore Export Cable Corridor, as defined, that forms the offshore boundary for the S36 Consent and Marine Licence application
Offshore Export Cable	The cable(s) that transmit electricity produced by the WTGs to landfall.
Offshore Export Cable Corridor (OfECC)	The area within which the offshore export cable circuit(s) will be located, from the Array Area to the Landfall.
Onshore Development Area	The footprint of the onshore infrastructure and associated temporary works, comprised of the Onshore Export Cable Corridor and the Onshore



Term	Definition
	Substation, as defined, and including new access routes and visibility splays, that forms the onshore boundary for the planning application.
Onshore Export Cable(s)	The cable(s) that transmit electricity from the landfall to the onshore substation
Onshore Export Cable Corridor (OnECC)	The area within which the onshore export cable circuit(s) will be located.
Project	All aspects of the Llŷr development
Onshore Substation	Located within the Onshore Development Area, converts high voltage generated electricity into low voltage electricity that can be used for the grid and domestic consumption.
Section 36 consent	Consent to construct and operate an offshore generating station, under Section 36 (S.36) of the Electricity Act 1989. This includes deemed planning permission for onshore works.

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15-A NOISE MODEL SETTINGS

15.1 Human Hearing

1. Sound is the sensation caused in the ear by tiny variations in air pressure. The rate of these variations is expressed as the frequency of the sound and is measured in Hertz, abbreviated to Hz. A frequency of 1Hz is equivalent to one variation in air pressure per second. Human hearing has a frequency range from 16Hz to 16,000Hz.
2. The pressure range detected by the human ear as sound covers an extremely large range. In practice the decibel (dB) unit is used to condense this range into a manageable scale by taking the logarithm of the ratio of the sound pressure to a reference sound pressure. The resulting quantity is termed the Sound Pressure Level (SPL) and is given the symbol Lp. Generally sound units measured in decibels are given the symbol L with a subscript used to identify the specific quantity. Expressed as SPL, the threshold of hearing would be an Lp of 0dB and the threshold of pain is taken to be an Lp of 140dB.
3. Human hearing sensitivity varies with the frequency of the sound; it is at its greatest between 2,000Hz and 5,000Hz. When measuring sound an ‘A’ weighting is often applied to the dB value. This weighting is a bias built into the frequency response of the sound level meter that aims to match the frequency sensitivity of the meter to that of the human ear. An SPL that has been ‘A’ weighted is indicated by the symbol LAp.
4. When two sound sources at the same level are combined the resulting level will be 3 dB higher than the single source. A 3 dB change in noise is usually considered just discernible; a 5 dB change in noise is usually considered as 'clearly discernible. When two sounds differ by 10 dB the higher will generally be perceived as being twice as loud as the lower.
5. Between the quietest audible sound and the loudest tolerable sound, there is a ten million to one ratio in sound pressure (measured in pascals, Pa). Because of this wide range, a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB. Examples of sound levels in common situations are presented in **Table 15A-1**.

Table 15A-1 Sound pressure level in db lpa for common situations

Typical Noise Level, dB LpA	Example
0	Threshold of hearing
30	Rural area at night, still air
40	Public library, Refrigerator humming at 2 m
50	Quiet office, no machinery, Boiling kettle at 0.5 m
60	Normal conversation
70	Telephone ringing at 2 m, Vacuum cleaner at 3 m
80	General factory noise level
90	Heavy goods vehicle from pavement, Powered lawnmower, operator’s ear
100	Pneumatic drill at 5 m
120	Discotheque – 1 m in front of loudspeaker



15.2 Acoustic Terminology

6. A summary of acoustic terminology used in the assessment are presented in **Table 15A-2**.

Table 15A-2 Acoustic terminology

Term	Description
Noise	Unwanted or unexpected sound.
Frequency (Hz)	The number of cycles per second (i.e., the number of vibrations that occur in one second); subjectively this is perceived as pitch.
Frequency Spectrum	The relative frequency contributions that make up a noise.
"A" Weighting (dB(A))	The human ear does not respond uniformly across the audible frequency range. The "A" weighting is commonly used to simulate the frequency response of the ear.
Decibel (dB)	The decibel is a logarithmic ratio of two values of a variable. The range of audible sound pressures is approximately 2×10^{-5} Pa to 200 Pa. Using decibel notation presents this range in a more manageable form, 0 dB to 140 dB.
Sound Pressure Level (Lp)	Equal to 20 times the logarithm to the base 10 of the ratio of the root mean squared (RMS) sound pressure to the reference sound pressure. In air the reference sound pressure is 2×10^{-5} Pa. Mathematically: $Sound\ Pressure\ Level\ (dB) = 20 \log_{10} \{p(t) / P_0\}$ Where $P_0 = 2 \times 10^{-5}$ Pa
Ambient Noise Level, LAeq,T	The equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time that is usually composed of sound from many sources near and far.
Background Noise Level LA90,T	The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval, T, measured using the fast time weighting, F, and quoted to the nearest whole number.
Reference Time Interval, Tr	The specified interval over which an equivalent continuous A-weighted sound pressure level is determined.
Specific Noise Level, LAeq,Tr	The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval.
Rating Level, LAr,Tr	The specific noise level plus any adjustment for any characteristic features of the noise.
Level LA10,T	The A-weighted sound pressure level exceeded for 10% of a given time interval, T, measured using the fast time weighting, F.
Peak Particle Velocity	The peak speed of particle movement in the ground due to vibration and used to assess impacts from construction activity induced vibration. The Peak Particle Velocity is defined as millimetres per second (mm/s)