



LLYR

LLYR FLOATING OFFSHORE WIND PROJECT

Llŷr 1 Floating Offshore Wind Farm

Environmental Statement

Volume 6: Appendix 23D – Night-time Visual Assessment

August 2024

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FLOVENTIS
ENERGY



Document Status

<u>Version</u>	<u>Authored by</u>	<u>Reviewed by</u>	<u>Approved by</u>	<u>Date</u>
FINAL	AECOM	AECOM	AECOM	August 2024

Approval for Issue

Prepared by AECOM
 Prepared for Llŷr Floating Wind Limited
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Acronyms and abbreviations

Acronym or abbreviation	Definition	Acronym or abbreviation	Definition
ANO	Air Navigation Order	OnECC	Onshore Export Cable Corridor
CAA	Civil Aviation Authority	PCNP	Pembrokeshire Coast National Park
cd	Candela	S.36	Section 36 of the Electricity Act
HAT	Highest Astronomical Tide	SLVIA	Seascape, Landscape and Visual Impact Assessment
MLT	Marine Licensing Team	TJB	Transition Joint Bays
NRW	Natural Resources Wales	WTG	Wind Turbine Generator
OfECC	Offshore Export Cable Corridor		

Glossary of project terms

Term	Definition
The Applicant	The developer of the Project, Llŷr Floating Wind Limited
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.
proposed Project	All aspects of the Llŷr 1 development (i.e. the onshore and offshore components).
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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23-D- NIGHT-TIME VISUAL ASSESSMENT

23.1 Introduction

1. This appendix provides supporting information to aid understanding of the seascape, landscape and visual impact assessment (SLVIA), particularly in relation to lighting and potential night-time effects resulting from the Llŷr 1 Floating Offshore Wind Farm (the proposed Project). It provides background information relating to the requirements for aviation lighting and an overview of the approach taken for the proposed Project. It then provides an assessment of potential night-time visual effects based on night-time viewpoint locations agreed with Natural Resources Wales (NRW). This appendix should be read in conjunction with **Chapter 23 – Seascape, Landscape and Visual** and **Appendices 23A – SLVIA Methodology** and **23C – SLVIA Detailed Assessment**.

23.2 Requirements for Lighting

2. In the interest of aviation safety offshore wind turbine generators (WTG) with a height of 60 m or more above the level of the sea at Highest Astronomical Tide (HAT) are required to include visible lighting. The proposed Project includes up to 10 WTGs with a maximum blade tip height of up to 325.5 m above sea level and therefore visible aviation lighting would be required.
3. The statutory requirement for lighting of offshore wind farms of 60 m or greater in height in the UK is defined in Article 223 of the Air Navigation Order (ANO) 2016. This sets out the necessity for medium intensity steady red lights to be positioned as close as possible to the top of the structure.
4. The Civil Aviation Authority (CAA) *Policy and Guidance on Wind Turbines* (2016) provides additional guidance and clarifies the required intensity and positioning of the lighting as follows: medium intensity (2000 candela (cd)) steady red aviation warning light positioned on the nacelle of the turbine.
5. Article 223 of the ANO also allows lighting to operate at a lower intensity (a minimum of 10% of the specified peak intensity) when the horizontal meteorological visibility in all directions from the hub height of the WTGs is more than 5 km. This means that the medium intensity (2000 cd) lights are permitted to be reduce to 200 cd in fair atmospheric conditions, such as when there is no low cloud cover, mist or fog, or rain or snow at or around the hub height of each WTG.
6. In addition to the visible aviation lighting, and in line with Ministry of Defence requirements, infra-red lighting would also be positioned on the WTGs. However, this type of infra-red lighting would not be visible to the naked eye and therefore is not considered further in this assessment.

23.3 Proposed Aviation Lighting

7. As set out above, each of the proposed WTGs are required to be fitted with medium intensity aviation lighting. Seascape, landscape and visual aspects have been taken into consideration as part of siting and design of the proposed Project. The proposed WTGs have been sited at considerable distance (greater than 35 km) offshore from the Pembrokeshire coast and therefore away from locations likely to be frequented by people at night for appreciation of the night sky.
8. The proposed lighting on the WTGs would be fitted with sensors to monitor the surrounding atmospheric conditions. When fair conditions (visibility greater than 5 km in all directions) are present the lighting would automatically switch to a lower intensity mode, 10% of the peak



intensity, in line with CAA guidance. This would mean that in periods of fair atmospheric conditions the intensity of the lighting, and therefore potential seascape, landscape and visual effects, would be reduced. In poor atmospheric conditions, when visibility is less than 5 km from the hub of a WTG, the lighting would be in the higher intensity mode. However, in this scenario the lighting would often be at least partially obscured, particularly from locations greater than 5 km.

9. The above measures would be incorporated into the proposed Project as embedded mitigation measures and are therefore considered as part of the assessment.

23.3.1. *Radar or Transponder Activated Lighting*

10. In the future it may be possible in some circumstances to include an aircraft proximity warning system as part of a wind farm design. These systems use radar to detect the presence of approaching aircraft and then activate the aviation obstruction lighting. This allows the aviation lighting to be switched off for the majority of time, only activating when an aircraft approaches, therefore minimising potential seascape, landscape and visual effects.
11. These systems are now in use in wind farms in Europe and North America, often in flat landscapes where radar coverage can be high by utilising just a single radar unit. However, radar activated lighting systems have not yet been approved for use in the UK by the CAA and as such cannot currently be developed for the proposed Project. The potential for including this type of system would be considered in more detail once the CAA is in a position to provide further guidance.
12. A similar system that detects the presence of aircraft transponders may also be possible in the future. It would likely operate in a similar way to the radar activated system, allowing the lights to be switched off for the majority of the time and only activating when an aircraft approaches. Aircraft transponders are not currently required for all types of aircraft in the UK and as such this type of system cannot currently be incorporated into the proposed Project but could be considered in the future if aircraft regulations were to change.

23.4 **Assessment Methodology**

13. The following provides an overview of the methodology used to assess the potential night-time impacts, with greater details provided in **Appendix 23A – SLVIA Methodology**.
14. The night-time assessment follows the same key steps as that of the overall SLVIA, considering the value and susceptibility, sensitivity and magnitude of impact, leading to an overall judgement of the level and significance of effects.
15. The value and susceptibility, and therefore sensitivity, of receptors at a location at night are likely to vary from that during the day and therefore specific night-time criteria are used to help guide and inform night-time assessment.
16. Many of the factors such as scale, distance, duration and extent remain relevant, although in the night-time assessment are focused solely on the visible aviation lighting rather than the WTGs which would be less apparent.
17. Details of the approach to night-time assessment, the criteria used and the method of combining and analysing sensitivity and magnitude to reach judgements on the significance of effects are set out in **Appendix 23A – SLVIA Methodology**.

23.5 **Scope of the Assessment**

18. This assessment focuses on potential visual impacts resulting from the aviation lighting on the proposed WTGs. Potential impacts related to identified dark sky characteristics of seascape and landscape character are considered as part of the overall judgements of potential effects



of the proposed Project on seascape and landscape receptors, including the Pembrokeshire Coast National Park (PCNP). A separate assessment of night-time seascape and landscape effects is therefore not provided.

19. A range of factors, including distance, atmospheric conditions, intensity of lights and the vertical angle of the view influence the potential visual effects of visible lights. As set out in **Chapter 23 – Seascape, Landscape and Visual, Section 23.6** and **Appendix 23A – SLVIA Methodology**, a ‘worst case’ approach has been taken to this assessment, based on excellent visibility conditions and on the assumption that the lights are operating at peak intensity (2000 cd). It is important to note that this approach tends to overstate the likely change experienced for the following reasons:
- the peak intensity mode of the lighting is only intended to be used during periods of poor atmospheric conditions and visibility, during which times some or all of the lights are likely to be at least partially obscured, particularly given the distance from the Pembrokeshire coast and visual receptors locations; and
 - The intensity of lighting, and therefore impression of change, reduces with distance due to a range of factors, including filtering of light by the atmosphere. The majority of the viewpoints from which the lights would potentially be visible are at considerable distance, 35 km or greater from the nearest WTG and therefore aviation light.
20. Depending on the selected technology there may be some vertical movement of the WTGs and therefore aviation lighting with changes in sea level. While this vertical movement is considered as part of the assessment it is likely to be largely imperceptible due the distance between the proposed WTGs and potential night-time receptors.

23.5.1. *Impacts scoped out of assessment*

21. This assessment focuses on potential effects during the operation and maintenance stage of the proposed Project when the WTGs would be in place and aviation lighting operational. Any impacts from lighting during construction would be temporary in nature and of a short duration and as such would not be significant and therefore have not been considered further in this assessment.
22. The proposed Project would also include lighting on structures within the Array Area for shipping navigation purposes. This type of lighting tends to be at lower levels and with a shorter range such that is unlikely to be visible from the Pembrokeshire coast and as such is not considered further in this assessment.

23.6 Night-time Baseline

23. Visual receptors with the potential to experience views of the aviation lighting at night are largely located along the Pembrokeshire coast. The night-time visual assessment is based on representative viewpoints, selected in consultation with NRW, PCC and PCNP Authority. Details of stakeholder engagement and consultation relevant to the SLVIA are provided in **Section 23.3** of **Chapter 23 – Seascape, Landscape and Visual**. The selected locations are places where people are likely to frequent at night to experience views of the night-time sky, as set out in **Table 23D-1** and shown in **Volume 5: Figure 23.10**. A baseline description for each is provided below the table and baseline photography and visualisations are provided in **Volume 5: Figures VP N1.2 to VP N3.7**.



Table 23D-1. Night-time visual assessment viewpoint locations

Viewpoint reference	Location	Reason for inclusion
VP N1	Martin's Haven car park	Representative of night-time views from a recognised dark skies discovery site.
VP N2	Kete car park	Representative of night-time views from a recognised dark skies discovery site.
VP N3	Freshwater West Beach	Representative of night-time views from the beach and adjacent coastal path.

- 24. An additional night time viewpoint at Broad Haven Beach South car park was also considered. However, it was scoped out of the assessment following initial desk and field based review due to a lack of potential visibility of the aviation lighting as a result of screening by an intervening landform.

23.6.1. *Baseline description*

Viewpoint N1: Martin’s Haven car park

- 25. This viewpoint is located adjacent to the Martin’s Haven National Trust car park on the Marloes Peninsula and is representative of visitors to this location at night which is promoted as a dark sky discovery site.
- 26. There are relatively open views to the north and south from this location, with views east and west more restricted by rising topography. Views to the south are across open grassland to the irregular outline of the coast, with the dark low outline of Skokholm Island within the sea beyond. Existing light sources are predominantly limited to the lighthouse on Skokholm Island and ships out to sea and as such this is a dark location at night.
- 27. It’s recognition as a dark sky discovery site and location within the PCNP indicate a **very high** value of the night-time view.

Viewpoint N2: Kete car park

- 28. This viewpoint is located within the Kete National Trust car park on the Dale Peninsula north of St Ann’s Head and is representative of visitors to this location at night which is promoted as a dark sky discovery site.
- 29. There are open and expansive views across the surrounding gently undulating farmland in most directions from this location. Views south and west include open seas, interrupted by the low dark profiles of Skokholm and Skomer Island to the west. Existing light sources are largely limited to the nearby and more distant houses, the lighthouse at St Ann’s and on Skokholm Island and ships out at sea, and although lights on the distant Pembroke Oil Refinery are apparent to the east, this is overall a predominantly dark location at night.
- 30. Value of the night-time view is considered to be **very high** due to recognition of this location as a dark sky discovery site.

Viewpoint N3: Freshwater West Beach

- 31. This viewpoint is located at the edge of the beach at Freshwater West and is representative of visitors to the beach and local area at night, many of which would be people who visited during daylight and remain after sunset.
- 32. There are open low level views across and along the beach and out to the open sea to the west and south, broadly framed by the dark outlines of Linney Head to the south and the



Angle peninsula to the north. Existing light sources are largely limited to navigational lights within the nearshore waters, lights on passing ships and the lighthouse at St Ann's Head and although the red lights on top of the Pembroke Oil Refinery stacks are visible from the adjacent road, this is predominantly a dark location at night.

33. Although not a dark sky discovery site, this is a location that people often frequent at night and is within the PCNP where dark skies are recognised as a feature and as such value of night-time views is considered to be **high**.

23.6.2. *Future Baseline*

34. This section highlights any changes to the baseline conditions described above that might occur over the lifespan of the proposed Project, but in its absence (i.e. in the event the proposed Project is not installed).
35. There is potential for a change to the night-time baseline as a result of the introduction of onshore and/or offshore development which includes lighting. Consent has been granted for Project Erebus, an offshore wind farm with aviation lighting located approximately 35 km southwest of Pembrokeshire.
36. It is understood that a number of other offshore wind farm developments are being considered within the Celtic Sea, as part of the Round 5 leasing process. A consent application has recently been submitted for White Cross Offshore Wind Farm, and there are a number of others currently at initial scoping and pre-applications phases.
37. The cumulative assessment presented in **Appendix 23E – SLVIA Cumulative Assessment** considers future baseline scenarios which include consented, application and relevant scoping stage wind farms with aviation lighting.

23.7 **Assessment of Night-time Visual Effects**

38. The impacts and visual effects on receptors at the night-time viewpoints resulting from the proposed Project aviation lighting are set out below. The assessment takes into account the embedded mitigation measures described in **Section 23.3**.

23.7.1. *Sensitivity of the receptor*

39. The recognition and promotion of Viewpoint N1: Martin's Haven car park and Viewpoint N2: Kete car park location as dark sky discovery sites mean that people are likely to be at this location at night to star gaze and/or view the night sky. Susceptibility to change is therefore considered to be very high and when combined with the very high value the sensitivity of receptors at both locations are assessed as **very high**.
40. Viewpoint N3: Freshwater West beach is not promoted as a dark sky discovery site and although people frequent this location at night, the night-time view is generally considered less important although contributes to the overall experience. Susceptibility to change is considered to be high and when combined with high value the sensitivity is assessed as **high**.

23.7.2. *Magnitude of impact*

41. The proposed WTGs would be located at a distance of approximately 38 km or greater from each of the night-time viewpoint locations. At these distances atmospheric conditions are likely to have a strong influence on potential visibility of the proposed WTGs.
42. When visible, the aviation lighting on the proposed WTGs would appear as relatively small and distant features occupying a very small part of the night sky. The aviation lighting would add to existing light sources visible within the sea but would not result in glare on the water



surface or skyglow. The position of the lights low towards the horizon would further limit potential change and would not impede views to the night sky and stars overhead.

43. Overall, although the proposed Project would introduce additional light sources into views from the viewpoint locations, the intervening distance, location low on the horizon and very small part of the night sky and view affected would limit the sense of change. Magnitude of impact is therefore considered to be **small**.
44. People are most likely to be at these locations for an appreciation of the night sky in clearer weather conditions when aviation lighting is likely to be operating in the low intensity mode (200 cd), further reducing the impression of change.

23.7.3. *Significance of effect*

45. The sensitivity of receptors at Viewpoint N1: Martin's Haven car park and Viewpoint N2: Kete car park is considered to be **very high** and at Viewpoint N3: Freshwater West beach is considered to be **high**. The magnitude of the impact from the aviation lighting is assessed as **small**. Significance of effect on receptors at each of the night-time viewpoints would be **minor adverse**, which is **not significant** in EIA terms.

23.8 **Summary of Effects and Conclusions**

46. The assessment has identified that the aviation lighting included as part of the proposed Project would result in **minor adverse (not significant)** effects on each of the night-time viewpoints. Similar or lesser effects are anticipated for other parts of the Study Area which are often less sensitive and/or influenced to a greater extent by existing light sources.



23.9 References

HM Government, 2016. Air Navigational Order, Article 223.

Civil Aviation Authority, 2016. Policy and Guidance on Wind Turbines