MORGAN AND MORECAMBE OFFSHORE WIND FARMS: TRANSMISSION ASSETS

Annex 5.5 to the Applicants response to Hearing Action Points: ISH1 20 Comparable Onshore Substation Platform Footprints

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Glossary

Term	Meaning
Applicants	Morgan Offshore Wind Limited (Morgan OWL) and Morecambe Offshore Windfarm Ltd (Morecambe OWL).
Maximum design scenario	The realistic worst case scenario, selected on a topic-specific and impact specific basis, from a range of potential parameters for the Transmission Assets.
Morecambe OWL	Morecambe Offshore Windfarm Ltd is a joint venture between Zero-E Offshore Wind S.L.U. (Spain) (a Cobra group company) (Cobra) and Flotation Energy Ltd.
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	The offshore export cables, landfall, and onshore infrastructure for the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm. This includes the offshore export cables, landfall site, onshore export cables, onshore substations, 400 kV grid connection cables and associated grid connection infrastructure such as circuit breaker compounds. Also referred to in this report as the Transmission Assets, for ease of reading.
Morgan OWL	Morgan Offshore Wind Limited is a joint venture between bp Alternative Energy Investments Ltd. and Energie Baden-Württemberg AG (EnBW).
Onshore substations	The onshore substations will include a substation for the Morgan Offshore Wind Project: Transmission Assets and a substation for the Morecambe Offshore Windfarm: Transmission Assets. These will each comprise a compound containing the electrical components for transforming the power supplied from the generation assets to 400 kV and to adjust the power quality and power factor, as required to meet the UK Grid Code for supply to the National Grid.
Substation	Part of an electrical transmission and distribution system. Substations transform voltage from high to low, or the reverse by means of electrical transformers.
Transmission Assets	See Morgan and Morecambe Offshore Wind Farms: Transmission Assets (above).

Acronyms

Acronym	Meaning
AIS	Air Insulated Switchgear
GIS	Gas Insulated Switchgear

Units

Unit	Description
m^2	Metres squared

1 The Applicants' Submission at Deadline 1 on 20 May 2025

1.1 Introduction

1.1.1.1 This note is provided in response to 'Issue Specific Hearing 1 (ISH1), agenda item 5(a)(vii), referring to action point 20 (ISH1_20) within EV4-018) which states:

'Provide a note explaining the footprints for the two onshore substations which also compares the size and footprint of the Morgan and Morecambe application with other DCO applications with examples being the applications at Dogger Bank A and B and Hornsea One and Two and also Mooir Vannin D'.

1.1.1.2 A comparison of the platform footprints of the Morgan and Morecambe Offshore Wind Farms: Transmission Assets onshore substations has been made against other nationally significant infrastructure projects for offshore wind in **Table 1.1** that also utilise the same technology, i.e., High Voltage Alternating Current (HVAC), noting that as Dogger Bank A and B contain High Voltage Direct Current (HVDC) converter stations, a comparison with that project has not been included.

1.1.1.3 It should also be noted that the Development Consent Order (DCO) application for Mooir Vannin D (i.e., the East Irish Sea Transmission Project which would connect the Mooir Vannin Offshore Wind Farm) has not been submitted to the Planning Inspectorate and therefore information on the proposed onshore substation parameters is not available. For this reason, it is not considered further.

1.1.1.4 The list of offshore wind projects include:

- The Crown Estate's Offshore Wind Round 4:
  - Outer Dowsing Offshore Wind Farm, and
  - Mona Offshore Wind Project;
- The Crown Estate's Round 3 Offshore Wind Extensions:
  - Awel y Môr Offshore Wind Farm,
  - Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects, and
  - Rampion 2 Offshore Wind Farm; and
- The Hornsea Round 3 Zone:
  - Hornsea Projects One, Two and Three.

1.1.1.5 The information provided within **Table 1.1** reflects each project's maximum design scenario (onshore substation platform footprint, and assumed generation capacity) as presented within each respective Environmental Statement. The platform footprint refers to the area for the substation excluding landscaping and drainage works. This information

may have been amended (reduced for the above parameters) since each identified project's Examination or following detailed design.

1.1.1.6 There are a variety of factors that influence the size of an onshore substation including:

- Capacity (measured in megawatts, MW). Higher capacity substations require more or larger equipment such as transformers and switchgear units which increases the size and complexity of the substation (see 'Technology', below). In addition, higher capacity substations may generate more heat, necessitating additional cooling solutions.
- Voltage of electrical system, independent of capacity. Higher Voltage (275kV and 400kV) systems often have stricter safety regulations which can influence the spacing between equipment and overall design of the substation. And lower voltage electrical cable systems often require greater step up in voltage to reach the 400kV needed on the network often necessitating in larger substations.
- Air insulated or gas insulated switchgear (AIS or GIS). AIS typically requires more space than GIS because it relies on air as the insulating medium between electrical phases, which necessitates larger spaces between components for safety. In contrast, GIS is typically more compact, as it uses gas for insulation, allowing for smaller clearances between components and a reduced footprint , however, GIS switchgear is installed indoors within a dedicated GIS building.
- Technology as influenced by grid connection requirements. HVDC systems are typically for higher capacity (MW) connections with long offshore cable runs (>100km) to avoid the need for intermediate offshore compensation stations. HVAC substations typically require transformers to step up or step down voltage levels. An HVAC connection (as is proposed for the Morgan and Morecambe projects) will normally require compensation equipment including large reactors to offset the AC cable capacitance, harmonic filters and Static Synchronous Compensator (STATCOMs) to help achieve grid code compliance. This equipment is normally required per cable circuit. These reactors, harmonic filters, STATCOMs and transformers are usually large, requiring more space for safety reasons, and potentially more space for cooling solutions. As such, for comparative purposes, this document focuses on HVAC technology as reflective of the Transmission Assets Project Design Envelope (PDE) in comparison with other HVAC offshore wind farms (see also **paragraph 1.1.1.2**).
- Environmental considerations would include soil type and topography, which can influence the design and layout of a substation. The platform footprints presented in **Table 1.1** refer to the area of substation excluding landscaping and drainage works.

1.1.1.7 The Applicants note that the footprint of the Morgan and Morecambe onshore substation platform footprints are comparable to the onshore

substation footprints of other nationally significant infrastructure projects for offshore wind bearing in mind that in all cases the platform size will be influenced by the specific location of the substation and any identified constraints that it needs to accommodate.

1.2 Comparable Onshore Substation Platform Footprints

Table 1.1: Details of substation footprints of offshore wind farm projects

Project	Assumed Capacity	Maximum area of Onshore Substation Platform Footprint within the Environmental Statement	Source
The Crown Estate's Offshore Wind Round 4 Agreements for Lease			
Morgan Offshore Wind Project (in Examination)	1,500 MW	80,000 m^2 (GIS)	Environmental Statement Volume 1, Chapter 3: Project description (AS-024) Table 3.26
Morecambe Offshore Windfarm (in Examination)	480 MW	29,700 m^2 (AIS or GIS – note same maximum dimensions for both technologies are required at this stage)	Environmental Statement Volume 1, Chapter 3: Project description (AS-024) Table 3.26
Mona Offshore Wind Project (in determination by Secretary of State)	1,500 MW	65,000 m^2 (GIS)	Mona Offshore Wind Ltd (2025), Environmental Statement Volume 1, Chapter 3: Project Description (F02). Available: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010137/EN010137-002052-F1.3_Mona_ES_Project%20Description%20F02%20(Clean).pdf Accessed: May 2025. Table 3.34
Outer Dowsing Offshore Wind (in determination by Secretary of State)	1,500 MW	72,600 m^2 (GIS) or 144,000 m^2 (AIS)	Outer Dowsing Offshore Wind Ltd (2025) Environmental Statement Chapter 3 Volume 1: Project Description. Available: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010130/EN010130-002058-6.1.3%20Chapter%203%20Project%20Description.pdf. Accessed: May 2025.

Project	Assumed Capacity	Maximum area of Onshore Substation Platform Footprint within the Environmental Statement	Source
			Table 8.7
The Crown Estate's Offshore Wind Round 3 Agreements for Lease			
Rampion 2 Offshore Wind Farm (granted consent in April 2025)	1,200 MW	60,000 m^2 (AIS or GIS)	Rampion Extension Development Limited (2023) Environmental Statement Volume 2 Chapter 4: The Proposed Development. Available: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010117/EN010117-000384-6.2.4%20Rampion%202%20ES%20Volume%202%20Chapter%204%20The%20Proposed%20Development.pdf. Accessed: May 2025. Table 4.23
Sheringham and Dudgeon Extension Projects (granted consent in April 2024)	950 MW	60,000 m^2 for each project (AIS)	Sheringham Shoal Offshore Wind Farm Extension Project (SEP) and Dudgeon Offshore Wind Farm Extension Project (DEP) (2023) Environmental Statement Volume 1 Chapter 4: Project Description (RC). Available: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010109/EN010109-001749-6.1.4%20Chapter%204%20Project%20Description%20(Revision%20C)%20(Clean).pdf. Accessed: May 2025. Table 4.33
Awel y Môr Offshore Wind Farm (granted consent in September 2023)	500 MW	30,000 m^2 (GIS) or 50,000 m^2 (AIS)	Awel y Môr Offshore Wind Farm (AyM) Ltd (2022) Environmental Statement Volume 3 Chapter 1: Onshore Project Description. Available: https://nsip-documents.planninginspectorate.gov.uk/published-documents/EN010112-000202-

Project	Assumed Capacity	Maximum area of Onshore Substation Platform Footprint within the Environmental Statement	Source
			6.3.1_AyM_ES_Volume3_Chapter1_OnshorePD_Final.pdf. Accessed: May 2025. Table 14
The Hornsea Round 3 Zone			
Hornsea Project Three Offshore Wind Farm (granted consent in December 2020)	2,900 MW	149,302 m^2 (GIS)	Orsted (2018) Hornsea Project Three Offshore Wind Farm, Environmental Statement: Chapter 3: Project Description. Available: https://nsip-documents.planninginspectorate.gov.uk/published-documents/EN010080-000528-HOW03_6.1.3_Volume%201%20-%20Ch%203%20-%20Project%20Description.pdf . Accessed: May 2025. Table 3.62 and Table 3.63
Hornsea Offshore Wind Farm (Zone 4) - Project Two (granted consent in August 2016)	1,800 MW	60,000 m^2 (GIS)	SMartWind Ltd (2015) Hornsea Offshore Wind Farm Project Two Environmental Statement Volume 1 Chapter 3: Project Description. Tables 3.31 and 3.32
Hornsea Offshore Wind Farm (Zone 4) - Project One (granted consent in December 2014)	1,200 MW	32,200 m^2 (GIS)	SMartWind Ltd (2013) Hornsea Offshore Wind Farm Project One Environmental Statement Volume 1 Chapter 3: Project Description. Tables 3.31 and 3.32