MachairWind Offshore Windfarm

Appendix 14 Outline Carbon Management Plan

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Glossary of Acronyms

Term	Definition
BSI	British Standards Institute
CH_4	Methane
CMP	Carbon Management Plan
CO_2	Carbon dioxide
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
GHG	Greenhouse gas
GW	Gigawatts
HFC	Hydrofluorocarbons
IEMA	Institute of Environmental Management and Assessment
ISEP	Institute of Sustainability and Environmental Professionals
N_2O	Nitrous Oxide
NF_3	Nitrogen Trifluoride
O&M	Operation and Maintenance
OnTDA	Onshore Transmission Development Area
PFC	Perfluorocarbons
SF_6	Sulphur Hexafluoride
SPR	ScottishPower Renewables
WDA	Wind Development Area
WTG	Wind Turbine Generator

Glossary of Terms

Term	Definition
Cable protection	Protective measure to minimise the effects of scour and hazards along the offshore cables (e.g. to prevent cable exposure or snagging of vessel anchors or fishing gear), as well as for protecting these cables at infrastructure crossing points.
Environmental Impact Assessment (EIA)	The process of evaluating the likely significant environmental effects of a proposed development over and above the existing circumstances (or 'baseline').
Greenhouse gas	A gas in the Earth's atmosphere that traps heat by absorbing and emitting infrared radiation, a process known as the greenhouse effect. Also known by the collective shorthand "carbon".
MachairWind Offshore Windfarm	An offshore windfarm capable of exporting around 2 GW of renewable energy to the National Electricity Transmission System. MachairWind Offshore Windfarm comprises three Development Areas: • The Windfarm Development Area (WDA) – located on the west coast of Scotland to the northwest of Islay and west of Colonsay; • The Offshore Export Cable Corridor – a preliminary boundary extending from the WDA to mean high water springs at a landfall location near Girvan, South Ayrshire; and • The Onshore Transmission Development Area – a preliminary boundary which extends landward from mean low water springs and includes the land required for the landfall of the offshore export cable(s) and their route up to but not including the proposed high voltage direct current switching station which will be developed and constructed by Transmission Owner, ScottishPower Transmission. Separate consent and licence applications will be submitted for each Development Area.
National Electricity Transmission System	The high-voltage electricity power transmission network serving Great Britain which receives electricity from generators (such as offshore windfarms) and transmits that electricity to anywhere on the National Electricity Transmission System to satisfy demand.
Offshore export cable	Armoured cable containing electrical cores between the offshore substation platform(s) and landfall. Offshore export cable(s) will include bundled fibre optic cables. The offshore export cable(s) are subject to Marine Licence applications under the Marine (Scotland) Act 2010. The portion of the offshore export cable(s) located within the WDA is assessed as part of this MachairWind WDA EIA and a marine licence application to construct, alter or improve this portion has been submitted alongside the WDA application. A separate marine licence application will be submitted for the portion of the offshore export cable(s) from the WDA boundary to mean high water springs.
Offshore Export Cable Corridor (ECC)	The preliminary boundary extending from the WDA to mean high water springs near Girvan, South Ayrshire and within which the offshore export cable(s) will be located. A separate marine licence application will be submitted for the offshore export cable(s) located within the Offshore ECC.
Offshore Substation Platform (OSP)	An offshore platform with a fixed foundation located within the WDA which houses electrical equipment such as transformers, switchgear, protection and control systems, and enables the windfarm's renewable electricity to be collected via inter-array cables and exported to the National Electricity Transmission System via offshore export cable(s).
Offshore Substation Platform (OSP) link cables	Electrical cables which link OSPs (if more than one OSP is required). These cables will include fibre optic cores or bundled fibre optic cables. OSP link cables will be wholly located within the WDA.

Term	Definition
Onshore Transmission Development Area (OnTDA)	The preliminary boundary which extends landward from mean low water springs and includes the land required for the landfall of the offshore export cable(s) and their route up to but not including the proposed high voltage direct current switching station which will be developed and constructed by Transmission Owner, ScottishPower Transmission. This Transmission Owner is responsible for consenting the high voltage direct current switching station. Onward connections to the National Electricity Transmission System will be consented by National Grid Electricity Transmission and ScottishPower Transmission. Where relevant, these are considered as part of cumulative effects assessment in the EIA.
The Applicant	The legal entity submitting consent applications for the MachairWind Offshore Windfarm, namely MachairWind Limited.
The Project	MachairWind Offshore Windfarm including all its Development Areas and associated infrastructure.
Windfarm Development Area (WDA)	The application boundary within the OAA where consent will be sought for the proposed WDA infrastructure. The WDA infrastructure is subject to Section 36 consent and marine licence applications (generation and transmission) which are being applied for separately from the Offshore ECC infrastructure and OnTDA infrastructure.
WDA infrastructure	The offshore generation and transmission infrastructure located within the WDA including but not limited to: WTGs, WTG fixed foundations (and associated scour protection), OSP(s), OSP fixed foundations (and associated scour protection), IACs, OSP link and offshore export cable(s) and their associated external cable protection (insofar as these are located within the WDA) and fibre optic cables.
Wind Turbine Generator (WTG)	A wind turbine generator which converts wind energy into electrical energy. Each wind turbine generator is a complex system composed of a high number of components. Typically, the main components include the rotor assembly (composed of three blades and a hub); the nacelle (containing a generator, shaft and gearbox, power electronic converter and transformer); and the tower (containing lifting equipment and the switchgear).

1 INTRODUCTION

1.1 PROJECT SUMMARY

1. The MachairWind Wind Development Area (WDA) infrastructure comprises part of the offshore element of the MachairWind Offshore Windfarm Project (hereinafter referred to as "the Project"). MachairWind Limited (the "Applicant") is seeking the necessary approvals, including Section 36 consent under the Electricity Act 1989 and marine licences under the Marine (Scotland) Act 2010, from the Scottish Ministers via the Marine Directorate – Licensing Operations Team.

2. The WDA infrastructure is anticipated to achieve a capacity of approximately 2 gigawatts (GW), generated by up to 144 Wind Turbine Generators (WTGs). This capacity has the potential to supply renewable electricity to around two million homes across the UK, thereby contributing significantly to the nation's transition to Net Zero and enhancing the UK's energy security.

3. The Project encompasses three distinct development areas: the WDA, the Offshore Export Cable Corridor (ECC), and the Onshore Transmission Development Area (OnTDA). It should be noted that separate applications will be submitted for the ECC and OnTDA. Further details on the WDA are outlined in **Chapter 3 Project Description** of the WDA Environmental Impact Assessment (EIA) Report (EIAR).

1.2 PURPOSE OF THE OUTLINE CARBON MANAGEMENT PLAN

4. The purpose of this Outline Carbon Management Plan (CMP) is to present an initial approach for managing and reducing greenhouse gas (GHG) emissions associated with the Project. In this Outline CMP, the terms 'GHG' or 'carbon' are used interchangeably and encompass carbon dioxide (CO_2) and the six other gases as referenced in the Kyoto Protocol including, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). This plan provides a foundational framework to ensure that carbon considerations are integrated into the Project from the outset. The Outline CMP should be read in conjunction with **Chapter 19 Greenhouse Gas Assessment** of the WDA EIAR.

5. The Outline CMP aims to align with the principles of PAS 2080: Carbon Management in Infrastructure (BSI, 2023) and to support the UK's legally binding commitment to achieve net zero emissions by 2050. By doing so, it ensures that the Project contributes positively to national climate objectives while delivering renewable energy infrastructure.

6. This plan establishes a preliminary carbon baseline, which will be refined further should the Project receive consent. It also identifies key emission sources or carbon hotspots within the Project, to prioritise reduction efforts where they will have the greatest impact. Additionally, the plan highlights opportunities for further carbon reduction that can be explored during the design and delivery phases.

7. Overall, the Outline CMP serves as a foundation for continued carbon management for the Project. It demonstrates a commitment to proactive carbon management and continuous improvement, ensuring that the Project reduces its carbon footprint throughout its lifecycle.

8. The Outline CMP will inform the development of a detailed CMP that will be created during the post-consent phase of the WDA. The development of the detailed CMP will be an iterative process, with updates linked to key milestones in the WDA programme, including work stages, detailed design, procurement, pre-construction, construction, commissioning, handover, operation and maintenance (O&M), as well as end-of-life/decommissioning

1.3 STRUCTURE OF THE OUTLINE CARBON MANAGEMENT PLAN

9. The remainder of the Outline CMP is structured as follows:

- **Section 2 Background to the Outline Carbon Management Plan**: sets out the standards, policy and guidance that have been used to inform the Outline CMP;
- **Section 3 Preliminary Carbon Baseline**: sets out the preliminary carbon baseline;
- **Section 4** Carbon Reduction Target Setting: sets out the carbon reduction targets associated with the WDA;
- **Section 5** Carbon Reduction Opportunities: sets out potential carbon reduction opportunities;
- **Section 6** Roles and Responsibilities: sets out the roles and responsibilities for the Outline CMP;
- **Section 7** Monitoring and Reporting Requirements: summarises the monitoring and reporting requirements with reference to the Outline CMP; and
- **Section 8 Training and Communication**: sets out requirements for training and communication to support the carbon emission reductions.

2 BACKGROUND TO THE OUTLINE CARBON MANAGEMENT PLAN

2.1 POLICY AND GUIDANCE

10. The following standards and guidance were used to inform the Outline CMP:

- PAS 2080:2023 – Carbon Management in Buildings and Infrastructure (BSI, 2023); and
- Institute of Environment Management and Assessment (IEMA[1]) Guide: Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2022).

2.1.1 PAS 2080:2023

11. PAS 2080:2023 Carbon Management in Infrastructure (BSI, 2023) is a global standard for the management of carbon in infrastructure. It outlines a carbon management process applicable to buildings and infrastructure to support organisations in reducing their GHG emissions and meet climate change commitments. It covers the whole lifecycle of emissions from a project, and consists of the following core steps and principles:

- **Target setting**: Setting appropriate carbon reduction targets that align with project ambition and wider climate goals.
- **Baseline Development**: Defining baselines against which carbon performance and reduction progress can be measured.
- **Monitoring and KPIs**: Establishing metrics and key performance indicators to monitor carbon performance through a project's lifecycle.
- **Carbon Quantification**: Quantifying emissions by applying consistent methodologies, defining system boundaries and applying suitable cut-off rules.
- **Reporting**: Reporting carbon performance at appropriate programme and project work stages to ensure transparency and informed decision-making.
- **Continual Improvement**: Driving continuous improvement by challenging assumptions, embedding learning and identifying further opportunities to reduce whole-life carbon.

2.1.2 IEMA Guidance on Assessing Greenhouse Gas Emissions and Evaluating their Significance

12. The IEMA[1] guidance document 'Assessing Greenhouse Gas Emissions and Evaluating their Significance' (2022) informs the evaluation and significance of GHG emissions from the Project.

13. The potential to implement changes for reducing GHG emissions diminishes over time. Therefore, it is essential to consider emissions reduction measures from the beginning or as early as practically possible. This aligns with the IEMA's guidance[1], which advises that mitigation should be integrated at an early stage through the evaluation of GHG reduction measures appropriate for incorporation in the design of a project.

14. The need to ensure that GHG mitigation measures are implemented does not end at the pre-application EIA stage but extends after consent has been granted.

[1] IEMA has recently changed their name to ISEP (Institute of Sustainability and Environmental Professionals)

3 PRELIMINARY CARBON BASELINE

3.1 APPROACH

15. The carbon baseline for the Outline CMP is obtained from the GHG assessment presented in **Chapter 19 Greenhouse Gas Assessment** of the WDA EIAR. The GHG assessment considered known activities from the construction, O&M and decommissioning of the WDA infrastructure based on the available data at the stage of preparation. The assessment considered a maximum design scenario, which represents a conservative assessment of activities and resulting emissions. Therefore, the outcomes presented in **Chapter 19 Greenhouse Gas Assessment** of the WDA EIAR are likely to present an overestimation of emissions associated with the WDA. In addition, a high-level estimation of emissions from the OnTDA and ECC was presented in a whole project assessment.

16. To account for all the relevant emission sources associated with WDA, emission sources have been categorised in accordance with the PAS 2080:2023 life cycle modules (BSI, 2023) outlined in Section 19.5.2.2.1 of **Chapter 19 Greenhouse Gas Assessment** of the WDA EIAR.

17. Each applicable lifecycle stage is attributed to the construction, O&M, and decommissioning phases as detailed below:

- Pre-construction: Lifecycle stage A0;
- Construction: Lifecyle stages A1-A5;
- O&M: Lifecycle stages B1-B5; and
- Decommissioning: Lifecycle stages C1-C4.

18. As the WDA is currently in the early stages of design and development, data related to site-specific design metrics is currently unavailable. This includes details such as the selected manufacturers for wind turbines and offshore substations. As such, the emissions associated with the WDA have been calculated using a range of methodologies, as presented in Section 19.5.2.2 of **Chapter 19 Greenhouse Gas Assessment** and **Appendix 19.1 Greenhouse Gas Assessment Methodology** of the WDA EIAR.

19. The carbon baseline should be revisited post-consent once more detailed information becomes available to verify its accuracy.

3.2 CARBON ASSESSMENT RESULTS AND HOTSPOT ANALYSIS

20. This section sets out the anticipated GHG emissions released from activities during the pre-construction, construction, O&M, and decommissioning phases of the WDA.

3.2.1 Whole Life WDA Emissions

21. The results of the GHG emissions assessment for the WDA based on the reasonable worst-case scenario outlined in Section 19.4.2 of **Chapter 19 Greenhouse Gas Assessment**. The total emissions associated with WDA over its lifetime are anticipated as 7,235,075 tonnes CO_2e. **Plate 3.1** illustrates the distribution of whole life emissions from the different phases of the WDA. The emissions from construction (including pre-construction activities), O&M, and decommissioning account for 66%, 26% and 8% of the total, respectively. It should be noted that the estimation of emissions during the decommissioning phase is based on a conservative assumption that emissions are equivalent to those from constructing the WDA.

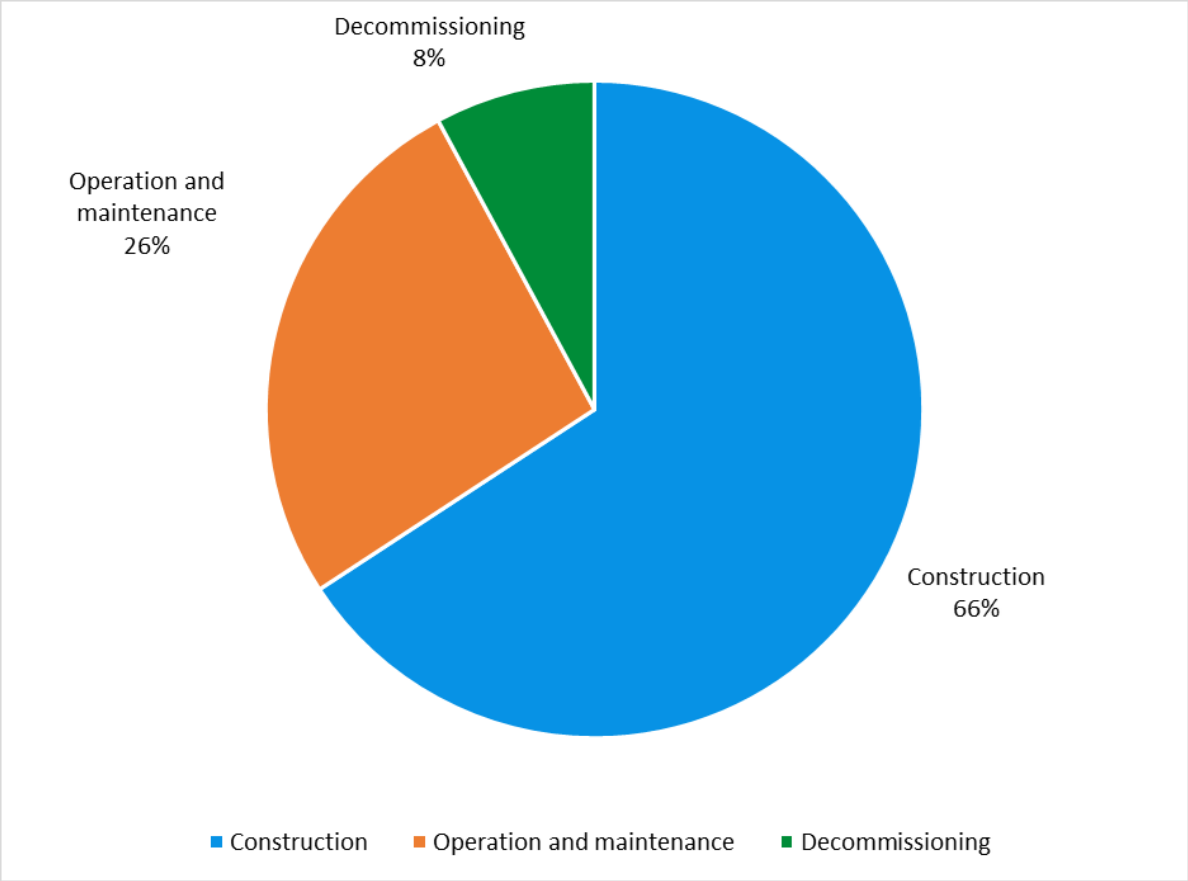

Plate 3.1 Whole life WDA emissions

3.2.2 Carbon Hotspot Analysis

22. The results of the WDA's whole life GHG assessment presented in Section 19.7 of **Chapter 19 Greenhouse Gas Assessment** have been analysed to identify carbon hotspots. Carbon hotspots are assets or activities associated with the WDA that generate a significant proportion of carbon emissions in line with PAS 2080:2023 guidance (BSI, 2023). These hotspots are therefore priority areas for identifying and implementing carbon reduction measures. Due to uncertainties around the decommissioning activities associated with the WDA, the analysis of hotspots is limited to the pre-construction, construction and O&M phases of the WDA.

3.2.2.1 Pre-construction and Construction

23. The emissions predicted to arise during the pre-construction and construction phase of the WDA, are illustrated in **Plate 3.2**. The majority of emissions during this phase result from embodied carbon in materials, making up 88% of total construction emissions. Transportation is the second largest contributor, responsible for 9% of total construction emissions.

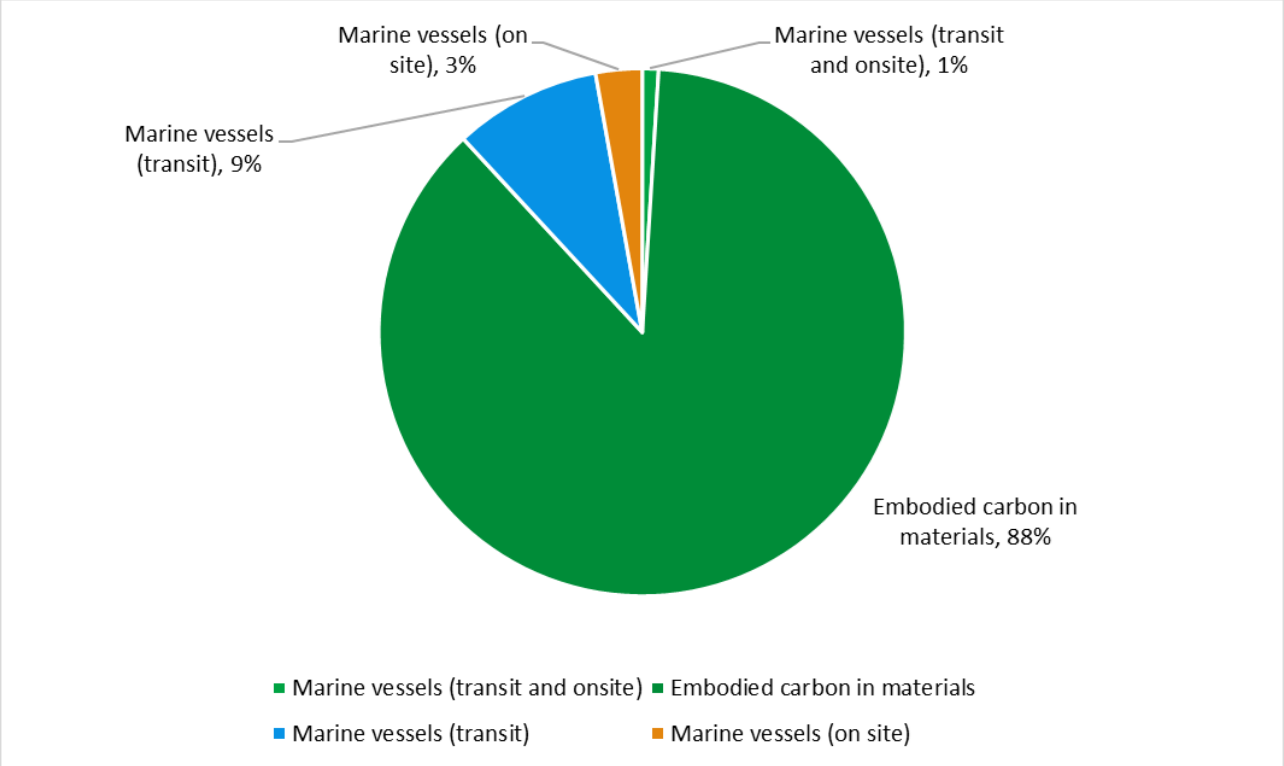

Plate 3.2 WDA construction GHG Emissions

24. As embodied carbon in materials is identified as a hotspot, a breakdown of emissions by each component of the WDA is provided in **Table 3.1**.

Table 3.1 Construction embodied carbon in materials breakdown

Component	GHG Emissions (tonnes CO_2e)	Percentage of Embodied Carbon Emissions (%)
Wind Turbine	1,047,250	25%
Wind Turbine Foundation	2,168,567	52%
Inter-Array Cables	467,296	11%
Offshore Export cable(s) - WDA only	81,845	2%
OSP Link Cables	146,067	4%
OSP Foundation	140,804	3%
OSP	114,221	3%
Total (embodied carbon in materials)	**4,166,050**	

3.2.2.2 O&M

25. The emissions associated with the WDA during the O&M phase are illustrated in **Plate 3.3**. The majority of emissions in the O&M phase result from marine vessel activities on site, contributing 75%. Embodied carbon in spare parts is the second largest contributor, responsible for 13 % of total O&M emissions.

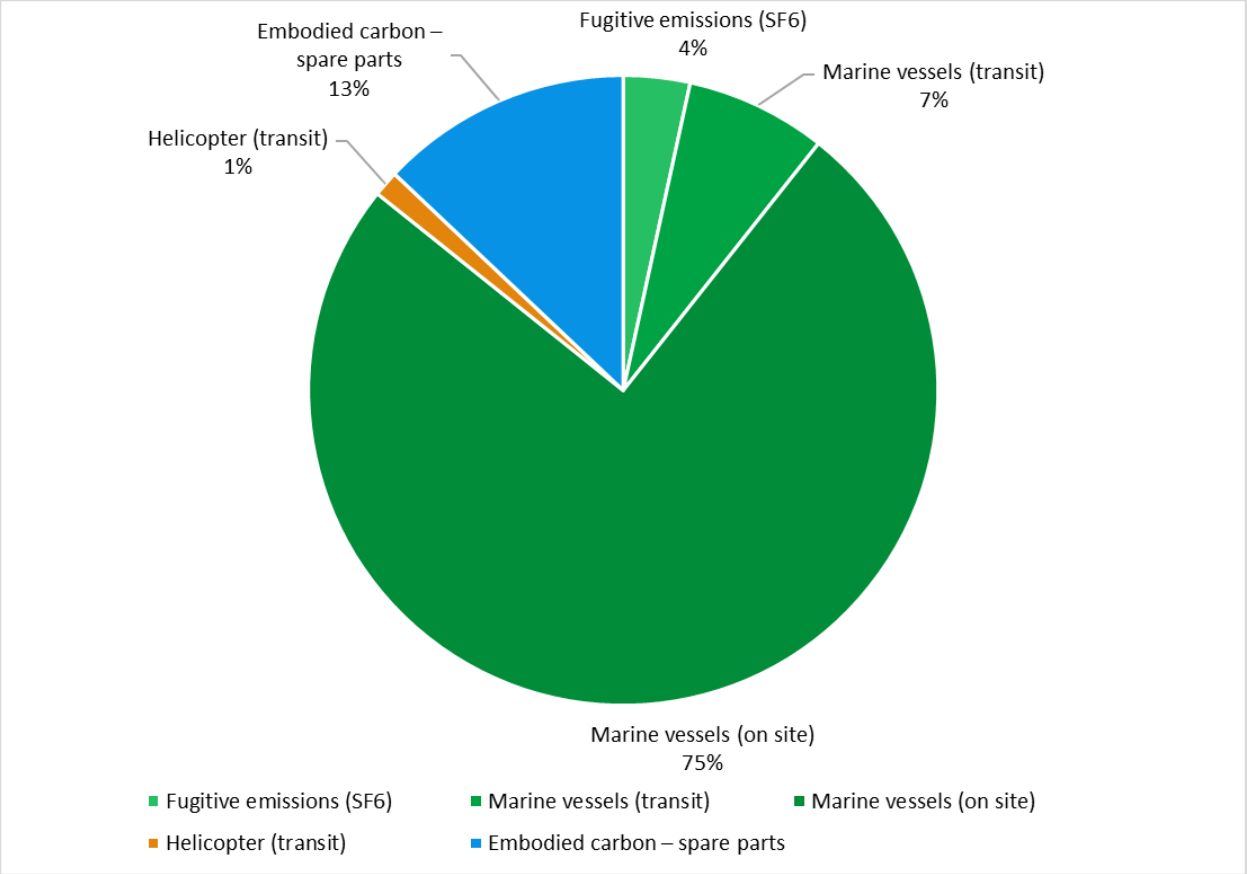

Plate 3.3 WDA O&M GHG emissions[2]

[2] Percentage total does not equal 100% due to rounding

4 CARBON REDUCTION TARGET SETTING

26. The Applicant is part of ScottishPower Renewables (SPR), which in turn is part of the ScottishPower group of companies operating in the UK under the Iberdrola Group, one of the world's largest integrated utility companies and a world leader in wind energy.

27. ScottishPower's revised sustainable development strategy – Action 2030 (ScottishPower, 2025) – which includes the Greenhouse Gas Reduction Plan (ScottishPower, 2025), outlines the GHG emissions reduction goals for SPR. For its near-term targets, ScottishPower commits to reducing absolute scope 1, 2, and 3 GHG emissions from fuel and energy-related activities, and use of sold products by 64% by 2030 from a 2019 base year (market-based[3]). For its long-term targets, ScottishPower aligns with the Iberdrola Group's science-based net zero target of net zero GHG emissions across the value chain by 2039, from a 2020 base year.

28. The Outline CMP supports SPR and ScottishPower's emissions reduction targets by outlining the potential carbon reduction as discussed in **Section 1**, and providing the foundation for the detailed CMP, which will outline the committed carbon reduction measures for the WDA, subject to technical and commercial feasibility. The implementation of these mitigation measures will contribute to the wider organisational pathway to net zero.

29. At present, specific GHG emissions reduction targets have not been established for the WDA or the wider Project. However, the Applicant, during the development of the detailed CMP, will assess the need for specific emissions reduction targets for the WDA. If appropriate, these emissions targets will be set post-consent and will be proportionate to the carbon impacts of the WDA, taking into account sectoral decarbonisation plans, value chain engagement, and organisational commitment.

[3] Market-based reflects emissions from the specific energy that ScottishPower contractually choose to purchase rather than the average emissions associated with electricity from the National Electricity Transmission System

5 CARBON REDUCTION OPPORTUNITIES

30. The identification of carbon reduction measures is aligned with the IEMA[1] GHG management hierarchy (IEMA, 2022), which is to eliminate, reduce, substitute and compensate GHG emissions.

31. The highest priority is the elimination or avoidance of emissions at source. Where this is not possible, the next focus is the reduction of carbon and energy demand through improvements to a project's design. If emissions cannot be eliminated or reduced, substitution measures are recommended, including the use of lower carbon materials, technologies and suppliers with a smaller carbon footprint. Compensation through offsetting should only be considered once all reasonable elimination, reduction and substitution opportunities have been applied.

32. It is recognised that specific emissions reduction measures cannot yet be confirmed, as these will depend on the outcomes of detailed technical and commercial feasibility assessments. As the design of the WDA progresses, opportunities to reduce GHG emissions will continue to be identified, reviewed and incorporated where practicable. This approach ensures that carbon reduction remains an integral consideration throughout the lifecycle of the Project, enabling the development of targeted and achievable measures within the detailed CMP. The sections below outline measures which may apply to the WDA, except where specified as being committed to at this stage. The potential mitigation measures will require evaluation by the Applicant to confirm their viability and the exact level of mitigation that can be achieved.

5.1 DESIGN AND CONSTRUCTION PHASE

33. The Project will incorporate carbon reduction opportunities throughout the design, pre-construction, construction, and O&M phases, where technically and commercially feasible. This includes seeking efficiencies in asset design, selecting lower-carbon material options where feasible, optimising resource use, and identifying opportunities to minimise emissions associated with logistics, transport, and energy use across the WDA's lifecycle.

34. As highlighted in **Section 3.2.2**, the embodied carbon in materials is one of the emissions hotspots. Therefore, some of the potential carbon mitigation measures to reduce the emissions associated with materials include the following:

- Enhancing the design of the WDA infrastructure to minimise asset sizing wherever feasible; and
- Selecting materials and components with a focus on low-carbon alternatives, as suitable.

35. Additionally, to support the identification of carbon reduction measures, the Project will explore a range of carbon reduction measures, such as:

- Applying circular economy principles, including opportunities for the potential re-use and recycling of material assets and waste management for the WDA;
- Prioritising local procurement, including sourcing materials locally where feasible to minimise transportation-related emissions;
- Implementing resource-efficient construction, including techniques that prioritise efficiency and reduce resource consumption;
- Strategically managing vessel activity to lower emissions wherever possible;
- Exploring alternative fuels, including low-carbon fuels to decrease emissions from transport and construction activities; and
- Considering the use of SF_6-free electrical equipment where alternatives are technically and commercially feasible.

36. An example of a carbon reduction opportunity that has been considered through the design process is the WTG foundation design. The use of a Gravity-Based Structure foundation was identified early

in the EIA scoping phase as a potential option for the WTG foundation. However, following further evaluation Gravity-Based Structure foundations were removed from the WTG foundation options due to its substantial concrete requirement which would result in considerably higher embodied emissions. Its removal therefore represents a notable carbon reduction and underscores the Project's intention to pursue lower-carbon design alternatives where feasible. This change reduces embodied emissions associated with foundation materials and reflects the Project's intention to pursue lower-carbon solutions where practicable.

5.2 O&M

37. As highlighted in **Section 3.2.2**, vessel use during O&M activities represents a key operational carbon emission hotspot. Although O&M contributes a lower proportion of total lifecycle emissions than construction, its extended duration and the anticipated advancements in vessel fuel types and technologies present meaningful long-term opportunities for carbon reduction. Therefore, the Project will seek to identify and implement practicable carbon mitigation measures throughout the O&M phase, where feasible. This includes the following:

- Considering alternative and low-carbon fuels and efficient vessel technologies as they become technically and commercially feasible;
- Optimising vessel activity to minimise emissions associated with O&M activities; and
- Implementing SF_6 leakage monitoring and detection should any SF_6-containing equipment be required, ensuring any leakage is addressed as soon as reasonably practicable.

6 ROLES AND RESPONSIBILITIES

38. The definition of roles and responsibilities is critical to the implementation of the detailed CMP. The responsibilities required for the implementation of the detailed CMP will be discussed and agreed upon by the Applicant, suppliers, and contractors at the time of their appointment, where appropriate.

39. The Applicant is responsible for establishing the carbon baseline, setting out the WDA infrastructure strategic carbon objectives, as well as specific pre-construction, construction and O&M reduction measures and, if required, the offsetting strategy. The Applicant is also responsible for setting out and implementing the carbon management processes defined in the detailed CMP.

40. Following the Applicant's contractor procurement process, the appointed contractor(s) will be responsible for implementing any applicable carbon mitigation measures required to achieve the carbon reduction measures. A detailed list of the roles and responsibilities will be finalised in the detailed CMP.

7 MONITORING AND REPORTING REQUIREMENTS

41. The Applicant will outline any monitoring and reporting requirements for emissions associated with the construction and O&M of the WDA in line with their internal Project sustainability processes.

42. It is anticipated that the monitoring and reporting process will include specific requirements for suppliers and contractors to effectively track emissions.

43. The Applicant will monitor the progress of carbon reduction opportunities in line with the carbon reduction measures outlined in the detailed CMP, and if appropriate, specific carbon reduction targets for the WDA that will be established in the post consent stage, as detailed in **Section 1**.

8 TRAINING AND COMMUNICATION

44. To support the implementation of the detailed CMP, the requirement for training and communication is recognised. The following are considerations for training to be further explored and agreed upon between the Applicant and contractor(s) in the detailed CMP:

- Role-based assessment to identify training needs across the value chain;
- Carbon-related training tailored to different functions, including general carbon awareness for all personnel and more detailed, task-specific training for data collection, reporting, procurement, or implementation of mitigation measures;
- Delivery of training through mechanisms such as inductions, toolbox talks, targeted briefings and refresher sessions to maintain awareness; and
- Encouragement of suppliers and contractors to adopt similar training approaches to ensure consistent understanding.

45. The following are considerations for the approach to communications to be further explored and agreed upon between the Applicant and contractor(s) in the detailed CMP:

- Establishment of regular communication channels to raise awareness of the carbon management systems and maintain engagement across the value chain;
- Routine briefing of personnel on their carbon-related responsibilities;
- Provision of updates on carbon performance, planned mitigation measures and changes to carbon-related processes to support informed decision-making; and
- Promotion of continuous improvement through encouraging feedback and sharing good practice.

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