



Bowdun Offshore Wind Farm Offshore EIA Report

Volume 2, Chapter 22: Climatic Change

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Contents

22 Climatic Change	1
22.1 Introduction	1
22.2 Climate Change Study Area	1
22.3 Legislative and Policy Context.....	4
22.4 Consultation	9
22.5 Data Sources	11
22.6 Baseline Environment	12
22.7 Key Parameters for Assessment.....	16
22.8 Methodology for Assessment of Effects.....	22
22.9 Embedded Mitigation	28
22.10 Assessment of Significance	29
22.11 Inter-Related Effects.....	44
22.12 Cumulative Effects Assessment	45
22.13 Proposed Monitoring	54
22.14 Transboundary Effects.....	54
22.15 Summary of Impacts, Mitigation, Likely Significant Environmental Effects and Monitoring.....	54
References.....	58

List of Tables

Table 22.1: Summary of Legislation Relevant to Climate Change	4
Table 22.2: Summary of Policy Relevant to Climate Change	5
Table 22.3: Summary of UK MPS Relevant to Climate Change (Defra, 2011)	6
Table 22.4: Summary of UK Climate Change Policy Relevant to Climate Change	7
Table 22.5: Summary of Key Consultation Issues Raised During Consultation Activities Undertaken for the Proposed Development Relevant to Climate Change	10
Table 22.6: Summary of Key Data Sources	11
Table 22.7: MDS Considered for Each Potential Impact on Climate Change	17
Table 22.8: Impact Scoped Out of the Assessment for Climate Change	22
Table 22.9: Guidance Definitions of Significance in Relation to GHG Emissions (IEMA, 2022)	26
Table 22.10: Hazard, Exposure and Vulnerability Factor Definitions	27
Table 22.11: Scoring Matrix for Climate Risk	28
Table 22.12: Embedded Mitigation Adopted as Part of the Proposed Development	28
Table 22.13: Construction Phase GHG Emissions	32
Table 22.14: O&M Phase GHG Emissions.....	35
Table 22.15: Energy Flows for the Proposed Development	35
Table 22.16: Total Avoided Emissions Sensitivity Test	37
Table 22.17: Summary of Proposed Development Net GHG Emissions	42
Table 22.18: GHG Impacts in the Context of the UK’s Carbon Budgets	42
Table 22.19: MDS Considered for Each Impact on Climate Change	47
Table 22.20: Net Whole Life GHG Emissions.....	49
Table 22.21: Cumulative GHG Impacts in the Context of the UK’s Fifth and Sixth Carbon Budgets	53
Table 22.22: Summary of Assessment of Significance.....	56
Table 22.23: Summary of Cumulative Effects Assessment	57

List of Figures

Figure 22.1: Climate Change Study Area	3
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Glossary

Defined Term	Definition
Additional Mitigation	Also referred to as secondary mitigation which is defined by The Institute of Sustainability and Environmental Professionals (ISEP) (formerly Institute of Environmental Management and Assessment (IEMA) as: Actions that will require further activity in order to achieve the anticipated outcome. These may be imposed as part of the planning consent, or through inclusion in the EIA Report (sic).
Applicant (the)	Bowdun Offshore Wind Farm Limited (BOWFL).
Array Area	The Array Area is the area in which the Offshore Generation Assets will be located.
Blue Carbon	Carbon captured by the world's ocean and coastal ecosystems. Typically includes carbon stored within ocean sediments and ocean vegetation such as seagrasses or kelp.
Bowdun Offshore Wind Farm Limited (BOWFL)	A Special Purpose Vehicle (legal entity) for the purpose of developing the Project. BOWFL are the Applicant for the Offshore Application.
Cumulative effects	The effects of the Proposed Development assessed together with effects from the Onshore Infrastructure forming the Project as well as one or more different projects on the same receptor/resource.
Effect	Term used to express the consequence of an impact (i.e. the result of change or changes on specific environmental resources or receptors). The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity of the receptor or resource in accordance with defined significance criteria.
Embedded Mitigation	<p>Measures that are adopted as part of the Proposed Development and therefore assessed within the EIA. The proposed approach for the EIA for the Proposed Development is that Embedded Mitigation includes both primary mitigation and tertiary mitigation. These are defined by the ISEP as follows:</p> <p>Primary: Modifications to the location or design of the development made during the pre-application phase that are an inherent part of the project, and do not require additional action to be taken.</p> <p>Tertiary: Actions that would occur with or without input from the EIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects.</p>
Environmental Impact Assessment (EIA)	Process for the assessment of the likely significant environmental effects of a project on the physical, biological, and human environment during construction, Operations and Maintenance (O&M) and decommissioning.
Export Cable Corridor	The area seaward of MHWs which connects the Array Area with the Landfall within which the Offshore Export Cables will be installed.

Defined Term	Definition
Impact	A change caused by an action that occurs during a project's lifetime.
Inter-Array Cables (IACs)	Cables which link the Wind Turbines to each other and with the OSPs.
Inter-Related Effects	The potential effects of multiple impacts from the construction, O&M and decommissioning of the Project, affecting one receptor.
Interconnector Cables	Cables which will connect individual OSPs to each other to provide redundancy against cable failure elsewhere.
Landfall	The area in which the Offshore Export Cables make landfall and is also the transitional area between the Offshore Transmission Assets and the Onshore Transmission Assets. Located in the Intertidal Area at Benholm.
Marine Directorate (MD)	The Marine Directorate of the Scottish Government, formerly known as Marine Scotland. The planning and licensing authority for Scotland's seas and custodian of Scotland's National Marine Plan (NMP). The Marine Directorate – Licensing Operations Team (MD-LOT) are specifically responsible for managing Section 36 Consent and Marine Licence Applications seaward of MHWS.
Maximum Design Scenario (MDS)	The scenario within the design envelope likely to result in the greatest impact on a particular topic receptor, and therefore the one that should be assessed for that topic receptor.
Mean High Water Springs (MHWS)	The average tidal height throughout the year of two successive high waters during those periods of 24 hours when the range of the tide is at its greatest.
Mean Low Water Springs (MLWS)	The average tidal height throughout the year of two successive low waters during those periods of 24 hours when the range of the tide is at its greatest.
Mitigation	Measures to avoid, prevent, reduce or control effects on the environment. See also definitions for Embedded Mitigation and Additional Mitigation.
National Grid	The national electricity transmission network.
Offshore Application	Term used to refer to the applications associated with the Proposed Development. The Applicant will apply for: <ul style="list-style-type: none"> • A Section 36 Consent under the Electricity Act 1989; and • Marine Licence(s) under Marine Scotland Act 2010 and Marine and Coastal Access Act 2009.
Offshore Environmental Impact Assessment (EIA) Report (hereafter, 'Offshore EIA Report')	Document prepared to report the findings of the EIA for the Proposed Development and produced in accordance with the EIA Regulations. The Offshore EIA Report is submitted to support the Offshore Application for the Proposed Development, and to comply with EIA Regulations.
Offshore Export Cables	Subsea cables used to transmit electricity generated offshore by the Wind Turbines from the OSPs to shore. The Transition Joint Bay (TJB) is the location where the Offshore Export Cables terminate, and the onshore cabling begins.
Offshore Generation Assets	The infrastructure of the Proposed Development required to generate electricity comprising of the Wind Turbines, Wind Turbine foundations and associated infrastructure (e.g. IACs).

Defined Term	Definition
Offshore Infrastructure	All of the Offshore Infrastructure associated with the Proposed Development that is located seaward of MHWS, comprising the Offshore Generation Assets and the Offshore Transmission Assets.
Offshore Scoping Report	The report that presents the findings of the EIA scoping process undertaken for the Proposed Development with the purpose of obtaining a Scoping Opinion. The Offshore Scoping Report defines what is intended to be assessed and reported as part of the EIA.
Offshore Substation Platform(s) (OSPs)	OSPs comprise the support structure, topside and electrical components used for collecting and/or converting electricity generated by the Wind Turbines for transmission by the Offshore Export Cables.
Offshore Transmission Assets	The infrastructure of the Proposed Development required to transmit the generated electricity comprising of the OSPs, Offshore Export Cables and associated infrastructure up to MHWS.
Onshore Scoping Report	Document prepared to comply with The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 in order to provide information on the potential impacts of the Onshore Transmission Assets.
Onshore Substation	Part of an electrical transmission and distribution system. Substations transform voltage from high to low, or the reverse by means of electrical transformers.
Onshore Transmission Assets	The transmission infrastructure associated with the Project above MLWS which is subject to the Planning Permission in Principle (PPP) Application submitted to Aberdeenshire Council (REF: APP/2025/1952).
Operation and Maintenance (O&M)	The phase of the Proposed Development following completion of construction. This phase of development includes routine inspections, repairs and replacement of infrastructure and equipment (including Interconnector Cables and IACs), Scour Protection replenishment or replacement, major component replacement, painting and/or other coating works, removal of marine growth, and replacement of access ladders.
Project (the)	An overarching term for the Bowdun Offshore Wind Farm (Bowdun OWF) comprising the offshore and onshore infrastructure required to generate and transmit electricity from the Array Area to the onshore GCP. The Project includes the Offshore Generation Assets, the Offshore Transmission Assets and the Onshore Transmission Assets.
Project Design Envelope (PDE)	A description of the range of possible elements that make up the design options for the Proposed Development under consideration when the exact engineering parameters are not yet known.
Proposed Development	Term used to define the Offshore Infrastructure associated with the Project seaward of MHWS for which consent is being sought. Further details of the parameters are included in Volume 1, Chapter 3: Project Description.

Defined Term	Definition
Scoping Opinion	A document produced by MD-LOT which is issued in response to submission and review of the Offshore Scoping Report. The Scoping Opinion is supported with feedback and advice from consultees, which details what is expected to be included in the Offshore EIA Report and what can be scoped out of the EIA process.
Scour Protection	Protective materials installed to avoid sediment being eroded away from the base of the foundations and/or buried subsea cable due to the flow of water.
Significance	Effect factor that is determined by the magnitude of impact along with the sensitivity of the receptor.
Site Boundary	The boundary within which all elements of the Proposed Development will be located. The Site Boundary comprises the Array Area and Export Cable Corridor which ends at MHWS.
Study Area	For each environmental topic, the baseline environment will be characterised, and the potential environmental impacts will be described within a topic-specific study area. Specific study areas are defined for each topic and are based on the maximum spatial extent across which potential impacts of the Project may be experienced by the relevant receptors (i.e. Zone of Influence).
Thistle Wind Partners (TWP)	Company established for the development of the Project.
Wind Turbines	Structures comprising of a tubular tower, rotor blades, and a nacelle which houses the Wind Turbine generator.

Acronyms

Acronym	Definition
BOWFL	Bowdun Offshore Wind Farm Limited
BEIS	Department for Business Energy and Industrial Strategy
CBAM	Carbon Border Adjustment Mechanism
CCC	Climate Change Committee
CCRA	Climate Change Risk Assessment
CEA	Cumulative Effects Assessment
CMS	Construction Method Statement
CoCP	Code of Construction Practice
CO₂e	Carbon Dioxide equivalent
Defra	Department for Environment Food and Rural Affairs
DESNZ	Department for Energy Security and Net Zero
DUKES	Digest of UK Energy Statistics
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESO	Energy System Operator
GHG	Greenhouse Gas
GWP	Global Warming Potential
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
HM	His Majesty
IAC	Inter-Array Cable
ICCI	In-combination Climate Impact
ICE	Inventory of Carbon and Energy
IEMA	Institute of Environmental Management and Assessment
INNS	Invasive Non-Native Species
IPCC	Intergovernmental Panel on Climate Change
ISEP	Institute of Sustainability and Environmental Professionals
LCA	Landscape Character Area
MD-LOT	Marine Directorate-Licensing Operations Team
MDS	Maximum Design Scenario
MPCP	Marine Pollution Contingency Plan
MPS	Marine Policy Statement
NDC	Nationally Determined Contribution
NMP	National Marine Plan
O&M	Operation and Maintenance
OMP	Operations and Maintenance Programme

Acronym	Definition
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSP	Offshore Substation Platform
OWF	Offshore Wind Farm
PDE	Project Design Envelope
RCP	Representative Concentration Pathway
SEA	Strategic Environmental Assessment
TJB	Transition Joint Bay
UK	United Kingdom
UKCP18	United Kingdom Climate Projections 2018
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UPVC	Unplasticized Polyvinyl Chloride
UXO	Unexploded Ordnance
WBCSD	World Business Council for Sustainable Development
WMP	Waste Management Plan
WRI	World Resources Institute

Table of Units

Units	Definition
%	Percent
°C	Degree Celsius
CO ₂ e	Carbon Dioxide equivalent
gCO ₂ /kWh	Grams of Carbon Dioxide per Kilowatt-Hour
GW	GigaWatt
kg	Kilogram
km	Kilometre
km ²	Square kilometre
kV	Kilovolt
m	Metre
m ²	Square Metre
mm	Millimetre
MW	MegaWatt
MWh	MegaWatt Hour
tCO ₂ e	Tonnes of Carbon Dioxide equivalent

22 Climatic Change

22.1 Introduction

22.1.1 This chapter of the Offshore Environmental Impact Assessment (EIA) Report presents the assessment of the likely significant environmental effects on and from climate change, that may potentially occur as a result of offshore elements of the Bowdun Offshore Wind Farm (OWF) (hereafter referred to as the Proposed Development) during the construction, Operations and Maintenance (O&M), and decommissioning phases.

22.1.2 The assessment presented is informed by the following technical reports:

- Volume 3, Technical Appendix 7.1: Physical Processes Baseline Environment;
- Volume 3, Technical Appendix 8.1: Benthic Ecology Technical Report;
- Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report; and
- Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report.

22.1.3 Climate change in the context of EIA can be considered broadly in two parts:

- the effect of Greenhouse Gas (GHG) emissions caused directly or indirectly by the Proposed Development, which may have the potential to contribute to climate change; and
- the potential effect of changes in climate on the Proposed Development, which could affect it directly or could modify its other environmental impacts. Consideration of In-combination Climate Impacts (ICCI) is presented within Volume 3, Technical Appendix 22.3: In-Combination Climate Change Impact Assessment.

22.1.4 It should be noted that the Proposed Development will not operate in isolation, it requires the Onshore Infrastructure to allow the exporting of electricity from the Proposed Development to the National Grid. As such, this chapter also assesses the impact of the Project as a whole on climate change, within the Cumulative Effects Assessment (CEA) (Section 22.12).

22.2 Climate Change Study Area

22.2.1 The study area for climate change comprises two parts: the GHG Emissions Study Area (relevant for the GHG assessment) and the Climate Change Risk Assessment (CCRA) Study Area (relevant for the CCRA). The GHG Emissions Study Area is detailed in Paragraphs 22.2.2 to 22.2.4 and the CCRA Study Area is detailed in Paragraph 22.2.5.

22.2.2 The GHG Emissions Study Area has been defined as all elements of the Proposed Development in the context of the domestic and international scope as developed on the basis of established guidance from the Institute of Sustainability and Environmental Professionals (ISEP), formerly the Institute of Environmental Management and Assessment (IEMA). This guidance has been

utilised throughout this chapter (IEMA, 2022). Domestic scope considers the national policy and targets concerning GHG and climate resilience.

- 22.2.3 GHG emissions have a global (international) effect rather than directly affecting any specific local receptor. The impact of GHG emissions occurring due to the Proposed Development on the global atmospheric concentration of the relevant GHGs, expressed in Carbon Dioxide equivalent (CO₂e) is therefore considered within this assessment.
- 22.2.4 The GHG emissions have been assessed on a life cycle basis for activities required for the construction, O&M, and decommissioning of the Proposed Development. This has considered GHG emissions caused directly and indirectly from onsite activities and the associated supply chain. The scope of the assessment includes emissions resultant from all infrastructure contained within the Site Boundary and relevant upstream and downstream emissions such as transport movements and manufacturing processes.
- 22.2.5 Climate change impacts, such as extreme weather events, have a localised impact, directly affecting specific local receptors. The CCRA Study Area is thus concentrated to the Proposed Development.
- 22.2.6 The Climate Change Study Area, as shown in Figure 22.1 is therefore defined in terms of an assessment boundary for the GHG assessment and a geographical boundary for climate resilience. The assessment boundary and relevant sources of GHG emissions are set out in Section 22.8 of this chapter.
- 22.2.7 With regards to CEA, all developments that emit, avoid or sequester GHGs have the potential to impact the atmospheric mass of GHGs as a receptor, and so may have a cumulative impact on climate change, and alongside and upon the Proposed Development. Consequently, cumulative effects due to other specific local development projects are not individually considered but are taken into account when considering the impact of the Proposed Development and probabilistic projections used in the CCRA. As such, no specific study area beyond that of the Site Boundary is relevant for the CEA for climate change.
- 22.2.8 However, the CEA takes the impacts resulting from the Onshore Transmission Assets into consideration, in order to account for the impact of both elements of the Project combined. Therefore, the Cumulative Study Area incorporates the Site Boundary alongside the Onshore Planning Permission in Principle Application Boundary.

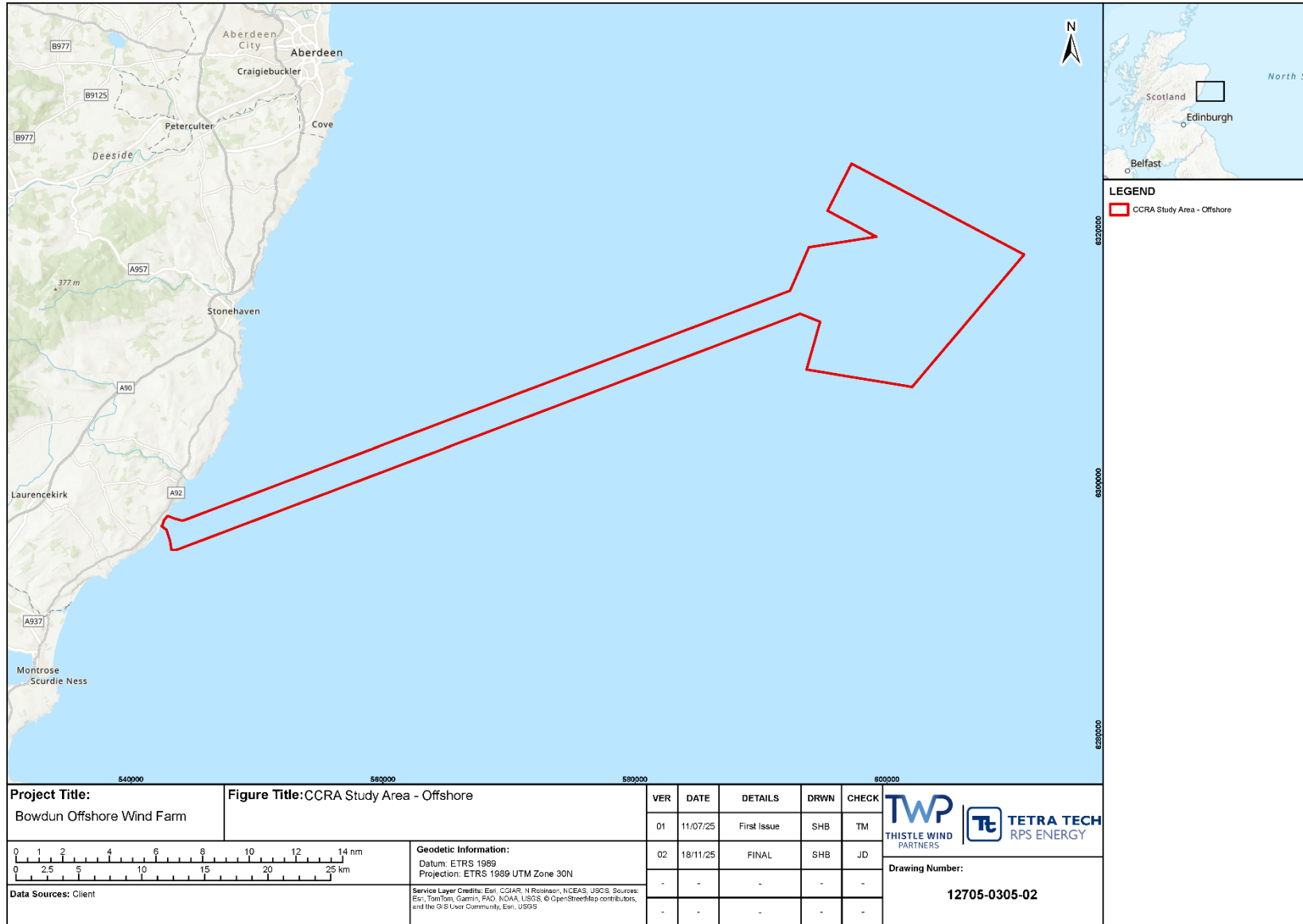


Figure 22.1: Climate Change Study Area

22.3 Legislative and Policy Context

22.3.1 The overarching policy and legislation applicable to the Proposed Development, including the contribution of the Project to United Kingdom (UK) and Scottish Climate Change policy is presented in Volume 1, Chapter 2: Policy and Legislation. Policy specific to climate change is contained in the Scottish National Marine Plan (NMP) (Scottish Government, 2015) and the UK Marine Policy Statement (MPS) (Department for Environment, Food and Rural Affairs (Defra), 2011). A summary of the legislative provisions relevant to climate change are provided in Table 22.1 below, with other relevant policy provisions set out in Table 22.2, Table 22.3 and Table 22.4.

Table 22.1: Summary of Legislation Relevant to Climate Change

Summary of Relevant Legislation	How and Where Considered in this Offshore EIA Report
<p>Climate Change Act 2008, as amended by the Climate Change Act 2008 (2050 Target Amendment) Order 2019 The Climate Change Act 2008, as amended, creates a framework for setting a series of interim national Carbon Budgets and plans for national adaptation to climate risks. The Act requires the UK Government to set Carbon Budgets (a Carbon Budget places a restriction on the total amount of GHG the UK can emit over a 5-year period if the budget for the period is to be met) for the whole of the UK.</p> <p>At present, the Third, Fourth, Fifth and Sixth Carbon Budgets, set through The Carbon Budget Orders 2009, 2011, 2016, and 2021 are 2.54 GtCO₂e (2018–2022), 1.95 GtCO₂e (2023–2027), 1.73 GtCO₂e (2028–2032), and 0.97 GtCO₂e (2033–2037). The Sixth Budget aligns with the UK's net zero target, requiring a 78% GHG reduction by 2035 from 1990 levels.</p>	<p>Section 22.10 provides an assessment of GHG emissions associated with the Proposed Development. The detailed assessment of GHG emissions is presented in Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report. The assessment considers whether the Proposed Development is in line with the UK's net zero target.</p> <p>The GHG emissions impact of the Proposed Development is contextualised against the UK Carbon Budgets in Section 22.10.</p> <p>Section 22.10 provides an assessment of climate risk and resilience for the relevant elements of the Proposed Development. A detailed assessment is provided with Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report.</p> <p>At the time of writing, the Seventh Carbon Budget has been proposed but no order created, therefore the assessment has only considered the approved budgets.</p>
<p>Climate Change (Scotland) Act 2009, as amended by Climate Change (Emissions Reduction Targets) (Scotland) Act 2024* The Climate Change (Scotland) Act 2009, as amended (2019, 2024) sets out Scotland's GHG emissions reduction targets in line with its net zero emissions target date of 2045. The Climate Change (Emissions Reduction Targets) (Scotland) Act 2024 replaces the original annual targets with a Carbon Budget system. The Act requires Scottish Ministers to set Carbon Budgets to cover a period of 5 years and set out</p>	<p>Section 22.10 provides an assessment of GHG emissions associated with the Proposed Development. The detailed assessment of GHG emissions is presented in Volume 3, Technical Appendix 22.2: Climatic Change Greenhouse Gas Technical Report.</p>

Summary of Relevant Legislation	How and Where Considered in this Offshore EIA Report
the amount of Greenhouse Gas emissions allowed during that period.	
<p>UK’s Nationally Determined Contribution (NDC) (Department for Business, Energy and Industrial Strategy (BEIS), 2022a; Department for Energy Security and Net Zero (DESNZ), 2025a) The UK’s NDC (BEIS, 2022a; DESNZ, 2025a) under the Paris Agreement to the United Nations Framework Convention on Climate Change (UNFCCC) (United Nations, 2015), submitted in September 2022 and amended in January 2025, commits the UK to reducing economy wide GHG emissions by at least 68% by 2030 and 81% by 2035, compared to 1990 levels.</p>	<p>The assessment of GHG effects (Section 22.10) considers whether the Proposed Development’s emissions are in line with relevant national policy and legislation, as discussed in Section 22.3.</p>

*It should be noted that the new Scotland Climate Change Plan 2026–2040 was published in draft in November 2025. Whilst it is still being consulted upon, the Proposed Development has not been assessed against this emerging legislation.

Table 22.2: Summary of Policy Relevant to Climate Change

Summary of Relevant Policy	How and Where Considered in this Offshore EIA Report
GEN5 Climate Change	
<p><i>“Marine planners and decision makers must act in the way best calculated to mitigate, and adapt to, climate change.”</i></p> <p>The NMP considers climate change in two distinct ways; in terms of how actions under this Plan might help mitigate the degree of anthropogenic induced climate change and facilitate a transition to a low carbon economy; and how actions under this Plan need to be adapted to take into account the effects of climate change, and where appropriate provide effective adaptation to its predicted effects. It is stated that developers should seek to address climate change through both of these aspects of climate change.</p>	<p>Section 22.10 provides an assessment of GHG emissions associated with the Proposed Development. A detailed assessment is presented in Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report.</p> <p>Section 22.10 provides an assessment of climate risk and resilience for the relevant elements the Proposed Development. A detailed assessment is provided with Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report.</p>
Chapter 11: Offshore Wind and Marine Renewable Energy Policies	
<p>The following key objectives and policies are included within chapter 11 and relevant to climate change:</p> <ul style="list-style-type: none"> • Objective 5: “Contribute to achieving the renewables target to generate electricity equivalent to 100% of Scotland’s gross annual electricity consumption from renewable sources by 2020.” • Objective 6: “Contribute to achieving the decarbonisation target of 50gCO₂/kWh by 2030 (to cut carbon emissions from electricity generation by more than four-fifths).” 	<p>Volume 1, Chapter 2: Policy and Legislation provides a summary of the policy and legislative background for the Proposed Development, including the need for new renewable energy capacity and offshore wind generation as identified in UK and Scottish policy.</p> <p>The assessment of significance of net GHG effects of the Proposed Development (Section 22.10) has considered emissions associated with the Proposed Development and associated generated electricity.</p>

Summary of Relevant Policy	How and Where Considered in this Offshore EIA Report
<p>• Renewables 7: “Marine planners and decision makers should ensure infrastructure is fit for purpose now and in future. Consideration should be given to the potential for climate change impacts on coasts vulnerable to erosion.”</p> <p>The following text is also relevant in providing context to the above objectives and policies:</p> <p><i>“Offshore wind and marine renewable energy is a key part of the mitigation measures and new technologies which will put Scotland at the forefront of building a sustainable low carbon economy. Offshore and marine renewables will contribute to Scotland’s climate change target for renewable sources to generate the equivalent of 100% of Scotland’s gross annual electricity consumption by 2020 and the decarbonisation target to achieve 50 gCO₂e/kWh of electricity generation in Scotland by 2030. Whilst the technologies themselves will involve the use of energy for construction, transportation and maintenance, they will contribute to the decarbonisation of electricity generation through their long term operation.”</i></p> <p><i>“A changing climate may result in changes in extreme weather events which could create difficult operating conditions for offshore installations. Offshore and onshore infrastructure supporting renewable energy developments should account for the potential impact of climate change.”</i></p>	<p>Section 22.10 provides an assessment of climate risk and resilience for the relevant elements of the Proposed Development. A detailed assessment is provided with Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report.</p>

Table 22.3: Summary of UK MPS Relevant to Climate Change (Defra, 2011)

Summary of Relevant Policy	How and Where Considered in this Offshore EIA Report
<p>Section 2.6.7 Climate Change Adaptation and Mitigation & Section 3.3 Energy Production and Infrastructure Development</p>	
<p>Understanding the impacts and effects of climate change is key to maintaining a healthy environment. This will influence how we use and value our coasts and seas both now and in the future. Adaptation, including in the marine environment, is necessary to deal with the potential impacts of these changes which are already in train. Sea level rises, increased flooding and coastal erosion will lead to increased vulnerability for development and significant change along parts of the UK coast (Paragraph 2.6.7.3).</p>	<p>Volume 1, Chapter 2: Policy and Legislation provides a summary of the policy and legislative background for the Proposed Development, including the need for new renewable energy capacity and offshore wind generation as identified in UK and Scottish policy.</p> <p>Section 22.10 provides an assessment of climate risk and resilience for the relevant elements the Proposed Development. A detailed assessment is provided with Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report.</p>

22.3.2 National climate change policy in relation to renewable energy infrastructure provides overarching guidance for the contribution of the Proposed Development towards government net zero targets. These policies are set out in Table 22.4.

Table 22.4: Summary of UK Climate Change Policy Relevant to Climate Change

Summary of Relevant Policy	How and Where Considered in this Offshore EIA Report
National Planning Framework 4 (Scottish Government, 2023a)	
<p>Policy 1: Tackling the climate and nature crises <i>“When considering all development proposals significant weight will be given to the global climate and nature crises”.</i></p> <p>Policy 2: Climate mitigation and adaptation This policy sets out that developments should consider climate change in the following ways: <i>“Development proposals will be sited and designed to minimise lifecycle greenhouse gas emissions as far as possible. Development proposals will be sited and designed to adapt to current and future risks from climate change”.</i></p>	<p>The assessment of significance of GHG effects of the Proposed Development (Section 22.10), has considered the Proposed Development’s contribution to national climate change policy, including renewable energy capacity targets. Section 22.10 provides an assessment of GHG emissions associated with the Proposed Development. A detailed assessment is presented in Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report.</p> <p>Section 22.10 provides an assessment of climate risk and resilience for the relevant elements the Proposed Development. A detailed assessment is provided with Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report.</p>
Net Zero Strategy: Build Back Greener (BEIS, 2021)	
<p>This strategy sets out the UK’s long term plans to meet net zero emissions by 2050 and gives the vision for a decarbonised economy in 2050.</p> <p>This strategy sets out the ambition to fully decarbonise the UK’s power system by 2035, with electricity sourced predominantly from offshore wind generation.</p> <p>It also highlights the role that electrification will play in decarbonisation of transport, heat and industry, with electricity demand anticipated to double by 2050.</p> <p>Further, the strategy outlines aims to support the decarbonisation of the construction and building sector. Reporting on embodied carbon in buildings and infrastructure is sought to be improved, alongside reductions in embodied carbon by way of material substitution, where appropriate, and resource efficiency.</p>	<p>Volume 1, Chapter 2: Policy and Legislation provides a summary of the policy and legislative background for the Proposed Development, including the need for new renewable energy capacity and offshore wind generation as identified in UK and Scottish policy.</p> <p>Section 22.10 provides an assessment of GHG emissions of the Proposed Development. A detailed assessment is provided with Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report.</p> <p>Section 22.10 provides an assessment of climate risk and resilience for the relevant elements of the Proposed Development. A detailed assessment is provided with Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report.</p> <p>The assessment of significance of GHG effects of the Proposed Development (Section 22.10), has considered the Proposed Development’s contribution to national climate change policy, including renewable energy capacity targets.</p>
Addressing Carbon Leakage Risk to Support Decarbonisation (His Majesty’s (HM) Treasury and DESNZ, 2023a)	
<p>This consultation response sets out the measures that the UK Government is exploring or committed to in order to address carbon leakage, whereby production of emissions-intensive</p>	<p>Section 22.10 provides an assessment of GHG emissions of the Proposed Development. A detailed assessment is provided with Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report.</p>

Summary of Relevant Policy	How and Where Considered in this Offshore EIA Report
<p>products is transferred to another country, resulting in increased emissions abroad and reduced production in the UK. A UK Carbon Border Adjustment Mechanism (CBAM) will be implemented by 2027. The CBAM will apply a tariff (or “carbon price”) on imported emission-intensive products, including the iron and steel, aluminium and cement industries. A CBAM sets out additional tariffs that would reflect both the carbon emitted in their production together with any gap between the carbon price applied in the country of origin and the carbon price that is incurred by UK-based production.</p>	<p>Within Section 22.10, emissions associated with the construction phase have been presented within the assessment and quantification of GHG emissions, as part of the Proposed Development, whether these emissions occur within or outside the territorial boundaries of the UK.</p>
<p>Powering Up Britain: The Net Zero Growth Plan (DESNZ, 2023b)</p>	
<p>Due to a successful legal challenge on the 2021 Net Zero Strategy (BEIS, 2021), the UK Government published an updated strategy in March 2023, titled “the Net Zero Growth Plan”. This plan largely restated existing policy contained within previous policy papers above. The plan confirmed the UK’s commitment to having a decarbonised power system by 2035, with the majority of power generated from renewable sources such as wind and solar. An increase to 50 GW of offshore wind capacity by 2030 is targeted. However, the policy also sets out how ‘transition fuels’ such as natural gas, will continue to play a role in the power sector, accompanied by carbon capture, usage and storage abating emissions from these transition fuel sources.</p>	<p>The Planning Statement (TWP-BOW-ERM-CON-RPT-00007) submitted alongside the Offshore EIA Report and Volume 1, Chapter 2: Policy and Legislation provides a summary of the policy and legislative background for the Proposed Development, including the need for new renewable energy capacity and offshore wind generation as identified in UK and Scottish policy. Section 22.10 provides an assessment of GHG emissions of the Proposed Development. A detailed assessment is provided with Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report. Within Section 22.10 the assessment includes emissions avoided as a result of the displacement of alternative generation sources by the renewable energy generated by the Proposed Development. In recognition of the role that transition fuels may play, a range of alternative generation sources are presented for assessment.</p>
<p>Clean Power 2030 Action Plan (DESNZ, 2024)</p>	
<p>Under the plan, the UK Government aims to achieve net zero electricity emissions intensity by 2030, focusing on significantly increasing the provision of renewable energy sources like wind and solar power. This plan includes investments in renewable infrastructure and technology to transition away from fossil fuels, thereby reducing carbon emissions and promoting a sustainable energy future.</p>	<p>The Planning Statement (TWP-BOW-ERM-CON-RPT-00007) submitted alongside the Offshore EIA Report and Volume 1, Chapter 2: Policy and Legislation provides a summary of the policy and legislative background for the Proposed Development, including the need for new renewable energy capacity and offshore wind generation as identified in UK and Scottish policy. Section 22.10 provides an assessment of GHG emissions of the Proposed Development. A detailed assessment is provided with Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report. Within Section 22.10 the assessment includes emissions avoided as a result of the displacement of alternative generation sources by the renewable energy generated by the Proposed Development. In recognition of the role that</p>

Summary of Relevant Policy	How and Where Considered in this Offshore EIA Report
	transition fuels may play, a range of alternative generation sources are presented for assessment.
Draft Energy and Just Transition Plan (Scottish Government, 2023b)	
<p>The draft Energy and Just Transition Plan outlines how Scotland can transition towards cleaner energy. Key policies include:</p> <ul style="list-style-type: none"> • More than 20 GW of onshore and offshore renewable electricity by 2030; • Accelerated decarbonisation of domestic industry, transport and heat; and • Generation of surplus electricity, enabling export of electricity to support decarbonisation UK- and Europe-wide. 	<p>Volume 1, Chapter 2: Policy and Legislation provides a summary of the policy and legislative background for the Proposed Development, including the need for new renewable energy capacity and offshore wind generation as identified in UK and Scottish policy. Section 22.10 provides an assessment of GHG emissions of the Proposed Development. A detailed assessment is provided with Volume 3, Technical Appendix 22.2 Greenhouse Gas Assessment Technical Report. The assessment of significance of GHG effects of the Proposed Development has considered the Proposed Development’s contribution to national climate change policy.</p>
Carbon Budget and Growth Delivery Plan (HM Government, 2025)	
<p>The Carbon Budget and Growth Delivery Plan sets out the UK Government’s proposals and timelines to ensure that Carbon Budgets 4, 5 and 6 are met. The plan reiterates the UK Government’s target to scale renewable energy generation, including to unlock an extra 13 GW of wind power by 2030.</p>	<p>Volume 1, Chapter 2: Policy and Legislation provides a summary of the policy and legislative background for the Proposed Development, including the need for new renewable energy capacity and offshore wind generation as identified in UK and Scottish policy. Section 22.10 provides an assessment of GHG emissions of the Proposed Development. A detailed assessment is provided with Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report. The assessment of significance of GHG effects of the Proposed Development has considered the Proposed Development’s contribution to national climate change policy.</p>

22.4 Consultation

22.4.1 The approach to consultation for the Proposed Development is set out in Volume 1, Chapter 5: Consultation and Engagement. A summary of the issues raised during consultation activities undertaken to date specific to climate change is presented in Table 22.5, together with how these issues have been considered in the production of this assessment. Further detail is presented within Volume 1, Chapter 5: Consultation and Engagement, Volume 3, Technical Appendix 5.1: Consultation Log and Volume 3, Technical Appendix 5.2: Pre-Application Consultation Report.

Table 22.5: Summary of Key Consultation Issues Raised During Consultation Activities Undertaken for the Proposed Development Relevant to Climate Change

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
01/11/2024	Marine Directorate-Licensing Operations Team (MD-LOT) 2024 Bowdun OWF Scoping Opinion	Content with approach to assessing climate change.	The Applicant notes your response.
		GHG assessment must use Life Cycle Assessment (LCA) approach, including pre-construction, construction, operation and decommissioning phases.	<p>The GHG assessment has used a LCA approach as suggested and includes consideration of carbon payback period from generated wind energy and avoided emissions from the displacement of fossil fuels.</p> <p>The assessment has considered the widest scope of emission sources as is feasible across the whole life cycle of the Proposed Development, where emissions sources are likely to be significant. The assessment of net GHG effects can be found in Section 22.10.</p> <p>The methodology is presented in Section 22.8 and the assessment is presented in Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report.</p>
		GHG assessment to consider Blue Carbon.	The impact of disturbance from the Proposed Development on Blue Carbon is considered in Section 22.10.
18/10/2024	NatureScot- Advice on the EIA Scoping Report	Content with format of Offshore Scoping Report.	The Applicant notes your response.
		GHG assessment must consider carbon cost (including supply chain) across the lifetime of the project, and to what extent this is offset through the production of green energy.	<p>The assessment has considered the widest scope of emission sources where relevant across the whole life cycle of the Proposed Development, where emissions sources are material and likely to be significant. The assessment of net GHG effects can be found in Section 22.10.</p> <p>The methodology is presented in Section 22.8 and the assessment is presented in Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report.</p>
		GHG assessment to consider Blue Carbon.	The impact of disturbance from the Proposed Development on Blue Carbon is considered in Section 22.10.

22.5 Data Sources

22.5.1 Information from desktop studies, including climatic data and GHG emissions data has been reviewed and analysed to inform this climate change baseline.

Desktop Study

22.5.2 Information on climate change within the Climate Change Study Area was collected through a detailed desktop review of existing studies and datasets which are summarised in Table 22.6.

22.5.3 Both the literature review of the reports and subsequent analysis using the datasets were used to determine the baseline and future baseline. The GHG Emissions Assessment and CCRA (Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report and Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report) include full details of the analysis undertaken to develop the climate change baseline.

Table 22.6: Summary of Key Data Sources

Title	Source	Extent	Year	Author
Digest of UK Energy Statistics (DUKES) 2024	DESNZ	2024	2025b	DESNZ
Inventory of Carbon and Energy (ICE) database V4.0	Jones and Hammond	2024	2024	Jones and Hammond
National Grid: Future Energy Scenarios	National Grid	2025	2025	National Grid
Climate Change Committee (CCC) – Progress Report to Parliament (2024)	CCC	2024	2024	CCC
Scottish Blue Carbon – a literature review of the current evidence for Scotland’s Blue Carbon habitats	NatureScot Research Report 1326	Unknown	2023	Cunningham and Hunt
Valuation of Energy Use and Greenhouse Gas: Supplementary guidance to the HM Treasury Green Book	DESNZ	2010 to 2100	2023c	DESNZ
UK Government GHG Conversion Factors for Company Reporting	DESNZ and Defra	2025	2025	DESNZ and Defra
Offshore Energy Strategic Environmental Assessment (SEA)	DESNZ, BEIS and Offshore Petroleum Regulator for Environment and Decommissioning (OPRED)	2022	2022	DESNZ, BEIS and OPRED

Title	Source	Extent	Year	Author
UK Offshore Energy Strategic Environmental Assessment: Appendix 1F: Climate and Meteorology	BEIS	1981 to 2020	2022b	BEIS
UK's third Climate Change Risk Assessment (CCRA3) (2021)	CCC	2021	2021	CCC
Climate Change 2021: The Physical Science Basis	Intergovernmental Panel on Climate Change (IPCC)	1850 to 2100	2021	IPCC
UK Climate Projections 2018 (UKCP18) Marine Report	UKCP18 Database	1981-2100	2018	Palmer <i>et al.</i>

Site-Specific Surveys

- 22.5.4 No site-specific surveys have been undertaken to inform the EIA for climate change. This is because the calculation of GHG emissions to inform the Greenhouse Gas assessment is solely a desk-based exercise, informed by the Maximum Design Scenario (MDS) as described in Table 22.7.
- 22.5.5 Additionally, the CCRA and the future climate baseline have been informed by climate projections, sourced from relevant Climate Change 2021: The Physical Science Basis and UKCP18 Marine Report. As such, no site-specific surveys specific to climate change are required. However, information gathered as part of Volume 3, Technical Appendix 8.1: Benthic Ecology Technical Report and Volume 3, Technical Appendix 7.1: Physical Processes Baseline Environment have been used to inform the climate change baseline, where appropriate.

22.6 Baseline Environment

Overview of Baseline Environment

- 22.6.1 The following sections provide a summary of the climate change baseline environment. Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report and Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report includes full details of the analysis undertaken to develop the climate change risk and GHG emissions baseline.

GHG Emissions Assessment Baseline Environment

- 22.6.2 To determine the GHG emissions assessment baseline environment, information has been sourced and cross referenced from Volume 3, Technical Appendix 8.1: Benthic Ecology Technical Report.
- 22.6.3 The baseline consists of various subtidal habitats which have been classed according to sediment type using the Folk (1954) classification, as set out in Volume 2, Chapter 8: Benthic Ecology. The predominant sediment types are slightly gravelly sand, slightly gravelly muddy sand and gravelly sand. These sediments are likely to contain stores of 'Blue Carbon', which is organic carbon that has been captured and stored through biological processes in the coastal and marine environment (Cunningham and Hunt, 2023). Though subtidal

sediments are a large carbon store within Scottish Exclusive Economic Zone (EEZ) waters, with an estimated 357 Mt of organic carbon stored within coastal and marine sediments (Smeaton *et al.*, 2020), such subtidal habitats are likely to present carbon stores of low relative importance, given their low organic carbon storage density compared to other habitats, including saltmarsh and seagrass habitats. Paragraph 22.10.5 presents the standing Blue Carbon stock in the subtidal sediments present within the Proposed Development.

22.6.4 The Proposed Development will contribute to the abatement of the amount of fossil fuel generation within the National Grid (i.e. National Grid carbon intensity). As such, the current baseline with regard to National Grid average emission factor for electricity generation, without the Proposed Development, is 222.9 kgCO₂e/MWh (including well-to-tank but as-generated, i.e. excluding transmission and distribution losses) (DESNZ and Defra, 2025).

22.6.5 Further information is presented in Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report.

CCRA Baseline Environment

22.6.6 Baseline offshore climatic conditions for the Climate Change Study Area have been sourced from observational data collated within the UK Offshore Energy Strategic Environmental Assessment (BEIS, 2022b), IPCC Sixth Assessment Reporting of the physical science (IPCC, 2021) and relevant information included in Volume 3, Technical Appendix 7.1: Physical Processes Baseline Environment.

22.6.7 The Proposed Development is located in Regional Sea 1 (BEIS, 2022b). Mean air temperatures range from lows of 1°C in January to 16°C in July (BEIS, 2022b). Annual precipitation across the North Sea varies between 340 mm and 500 mm, averaging 425 mm. Wind strengths in winter are typically in the range of Beaufort scale four to six (6 m/s to 11 m/s) with higher winds of force eight to 12 (17 m/s to 32 m/s) being much less frequent. Winds of force five (8 m/s) and greater are recorded 60% to 65% of the time in winter and 22% to 27% of the time in summer. Analysis shows that the largest significant wave height observed at Landfall was 6.93 m, while in the array, the largest significant wave height was 12.72 m. At the Export Cable Corridor, the largest significant wave height observed was 11.22 m (see Volume 3, Technical Appendix 7.1: Physical Processes Baseline Environment).

22.6.8 Global mean sea level rose by 0.2 m between 1901 and 2018, and continues to rise (IPCC, 2021). The average rate of sea level rise increased from 1.3 mm per year between 1901 and 1971, to 1.9 mm per year between 1971 and 2006, and further to 3.7 mm per year between 2006 and 2018 (IPCC, 2021).

Future Baseline Scenario

22.6.9 The EIA Regulations require that “*a description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the project as far as natural changes from the baseline scenario can be assessed with reasonable effort, on the basis of the availability of environmental information and scientific knowledge*” is included within this Offshore EIA Report.

- 22.6.10 An assessment of the ‘without development’ future baseline conditions has also been carried out and is described within this section.

GHG Emissions Assessment Future Baseline Scenario

- 22.6.11 The future baseline GHG emissions for existing land use (seabed) without the Proposed Development are expected to remain similar. Some areas of the North Sea experience almost no sediment accumulation and associated carbon sequestration through organic carbon deposits (Cunningham and Hunt, 2023). As such, no material change to the Blue Carbon stored within the Site Boundary is anticipated in the future baseline.
- 22.6.12 The future baseline for electricity generation that would be displaced by the Proposed Development depends broadly on future energy and climate policy in the UK, and more specifically (with regard to day-to-day emissions) on the demand for operation of the Proposed Development compared to other generation sources available, influenced by commercial factors and National Grid’s needs.
- 22.6.13 Several future baseline scenarios have therefore been considered, using DESNZ (formerly BEIS) projections of the carbon intensity of long run marginal electricity generation during the Proposed Development’s operating lifetime (DESNZ, 2023c) and assumptions about specific generation sources that could be displaced. These are detailed in Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report. It should be noted that the DESNZ long run marginal carbon intensity figures are dynamic and show year-on-year decarbonisation of the National Grid towards the UK’s target of being net zero by 2050. The long run marginal figures are projections and cannot be taken with absolute certainty.
- 22.6.14 The carbon intensity of baseline National Grid electricity generation is projected to reduce over time and so too would the intensity of the marginal generation source, displaced at a given time.

CCRA Future Baseline Scenario

- 22.6.15 In the near future (the next decade to two decades), variations in average temperature and precipitation will likely be the most visible year to year changes in climate. In subsequent decades, within the operating lifetime of the Proposed Development, anthropogenic climatic changes are expected to become more apparent.
- 22.6.16 It is expected that sea surface temperatures will continue to increase in the 21st century, with global mean sea surface temperatures predicted to increase by approximately 2.9°C by 2100 under Representative Concentration Pathway (RCP) 8.5. Sea temperatures in Northern Europe (including the North Sea) are predicted to rise at a greater rate than the global average, with temperatures predicted to increase by approximately 3.4°C under RCP 8.5 in the same time period. Ocean acidification is anticipated to increase, with a fall in surface pH by 0.4 units by 2100 under RCP 8.5 (IPCC, 2021).
- 22.6.17 Average sea level rise around the UK is expected to increase by 1 m by 2100, though a lesser rise is anticipated in the north of the UK. The north-east coast

of Scotland can expect to see an average sea level rise of approximately up to 0.7 m by 2100 under RCP 8.5 (Palmer *et al.*, 2018). The average wave height is predicted to decrease around much of the UK at a factor of about 10% to 20% over the 21st century, with average wave heights in the North Sea decreasing by approximately 0.1 m. However, owing to variation between different models, confidence in projected sea wave height changes is low (Jaroszweski *et al.*, 2021).

- 22.6.18 Further information has been presented within Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report.

Data Limitations and Assumptions

- 22.6.19 There is uncertainty about future climate and energy policy and market responses, which affect the likely future carbon intensity of energy supplies, and thereby the future carbon intensity of the electricity generation being displaced by the Proposed Development. Government projections consistent with national Carbon Budget commitments have been used in the assessment ('long run marginal' projections). It should be noted that latest UK Government projections include an increase in renewable energy generation, in particular from increased offshore wind capacity (DESNZ, 2025b), consistent with the UK Government's current policy of a low carbon electricity grid by 2030 (DESNZ, 2024). Thereby, for the Proposed Development's operational lifetime, the long run marginal projections presented are reliant on offshore wind projects, such as the Proposed Development being brought online. As such, the long run marginal does not represent a true 'without development' future baseline. Additionally, there is inherent uncertainty in such projections as the National Grid electricity factor changes from year to year as the fuel mix consumed in UK power stations changes, and as the proportion of net imported electricity also changes. Annual fluctuations can be large as they depend on the relative prices of energy imports, alongside fluctuations in peak demand and renewable provision (DESNZ, 2023c). Therefore, multiple scenarios have been considered to present a likely range of avoided emissions, including displacement of non-renewable fuels as an upper estimate for the likely avoided emissions, and comparison to the long run marginal projections as a lower estimate.
- 22.6.20 The majority of the construction stage GHG emissions associated with the manufacturing of components are likely to occur outside the territorial boundary of the UK and hence outside the scope of the UK's national Carbon Budget, policy and governance. However, in recognition of the climate change effect of GHG emissions (wherever occurring), and the need to avoid 'carbon leakage' overseas when reducing UK emissions, emissions associated with the construction stage have been presented within the assessment and quantification of GHG emissions, as part of the Proposed Development.
- 22.6.21 Furthermore, the specific materials and O&M vessels that would be used by the Proposed Development have not yet been specified. Thus, there is a degree of uncertainty regarding the construction and O&M stage GHG emissions of the Proposed Development. The assessment limits the impact of this by using MDS material quantities and vessel movements in the assessment of GHG impacts.

- 22.6.22 Additionally, due to the early stage in the development design, the specific Wind Turbine technology and design of Offshore Infrastructure that would be used for the Proposed Development have not yet been confirmed. Thus, there is a degree of uncertainty regarding the construction stage GHG emissions resulting from the manufacturing and construction of Wind Turbines and other Offshore Infrastructure. The assessment seeks to address this potential uncertainty by utilising peer reviewed published data, representing a range with regards to emission intensity to present a conservative position concerning magnitude of GHG impact.
- 22.6.23 An assumed operational lifetime of up to 30 years (2036 to 2065) has been applied to the assessment of avoided GHG emissions associated with the O&M phase of the Proposed Development and consideration of replacement and maintenance activities.
- 22.6.24 There is considerable uncertainty in the rate of Blue Carbon that is released as a result of marine habitat disturbance. There are many potential pathways for the organic carbon, including remineralisation (which could lead to aqueous CO₂ that is recycled during benthic respiration, laterally transported as particulate organic matter and redeposited, or it could potentially find its way to the surface and outgassed to the atmosphere, or a combination of all three). However, to ensure an appropriately conservative assessment, remineralisation of Blue Carbon stocks has been assumed to have the same impact as the release of an equivalent mass of CO₂ to the global atmosphere. Further details can be found in Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report.
- 22.6.25 When assessing climate risks, uncertainty arises from both modelling uncertainty and natural variability in the potential magnitude of future changes in climate. A high magnitude of change scenario and the high end of probabilistic projections have therefore been used, to provide a precautionary worst case approach. This is discussed further in Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report.
- 22.6.26 The above uncertainties are integral to the assessment of climate change effects, but a precautionary approach has been taken as far as practicable to provide a reasonable worst case assessment. On the basis of the above, it is considered that limitations to the assessment have been minimised and that the results provide a robust estimate of the effects of the Proposed Development.

22.7 Key Parameters for Assessment

Maximum Design Scenario

- 22.7.1 The MDS identified in Table 22.7 are those parameters expected to have the potential to result in the greatest effect on an identified receptor or receptor group. Any other development scenario within the Project Design Envelope (PDE), will result in the same, or less, level of environmental effect. The scenario has been selected from the details provided in Volume 1, Chapter 3: Project Description.

Table 22.7: MDS Considered for Each Potential Impact on Climate Change

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
<p>The impact of GHG emissions arising from the disturbance of Blue Carbon systems and seabed change, including benthic and subtidal/intertidal ecology, during the construction, O&M and decommissioning phases.</p>	✓	✓	✓	<p>Construction phase</p> <p><u>Temporary disturbance</u></p> <p>Up to 19,414,805 m² of loss and/or disturbance in total (for the 15 MW Wind Turbine Layout), due to the following:</p> <p>Trenchless solution (e.g. Horizontal Directional Drilling (HDD)) Exit Pit Excavation: Up to 17,130 m² of habitat disturbance associated with excavation of exit pits.</p> <p>Sandwave clearance: up to 835,872 m² compromising:</p> <ul style="list-style-type: none"> • Inter-Array Cables (IACs): up to 49,552 m²; • Wind Turbine foundation: up to 141,000 m²; • Offshore Substation Platform (OSP) foundations: up to 24,359 m²; • Interconnector Cables: 11,814 m²; and • Offshore Export Cables: up to 609,147 m². <p>Sandwave clearance material deposition: Up to 8,774,332 m² of habitat disturbance associated with the deposition of sandwave clearance material compromising:</p> <ul style="list-style-type: none"> • IAC: up to 395,910 m²; • Wind Turbine foundations: up to 1,188,770 m²; • OSP foundations: up to 272,824 m²; • Interconnector Cables: 94,382 m²; and • Offshore Export Cables: up to 6,822,446 m². <p>Cable installation (including boulder clearance): up to 9,638,945 m² of habitat disturbance associated with cable installation compromising the following.</p>	<p>The greatest footprint of the Proposed Development and greatest additional disturbance during construction and O&M phases will result in the greatest overall disturbance to the seabed, representing the greatest potential for GHG emissions from affecting Blue Carbon stores.</p> <p>Unexploded Ordnance (UXO) clearance has not been included in the disturbance area as it has been assumed that the area of clearance would be encompassed in the areas presented.</p> <p>The maximum area of disturbance to the seabed during decommissioning represents the greatest potential for GHG emissions from affecting Blue Carbon stores.</p>

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
				<ul style="list-style-type: none"> IACs: up to 3,753,860 m² disturbance from installation of up to 151 km of IACs; Interconnector Cables: up to 894,960 m² from installation of up to 36 km of Interconnector Cables; and Offshore Export Cables: up to 4,990,125 m² of disturbance from installation of up to 210 km of Offshore Export Cables. <p>Jack-up events: up to 148,400 m² of disturbance due to jack-up vessel use for the installation of up to three OSPs and up to 50 Wind Turbine foundations.</p> <ul style="list-style-type: none"> Up to 126 m² of disturbance due to jack-up vessel use for the installation of up to three trenchless solution (e.g. HDD) exit pits. <p><u>Permanent disturbance</u> Up to 2,251,000 m² of long term habitat loss due to Offshore Infrastructure installed in the construction phase. This comprises the following.</p> <ul style="list-style-type: none"> footprint area of 170,000 m² due to fixed 3-legged suction bucket Wind Turbine foundations (up to 50 Wind with a seabed footprint of 3,400 m² per foundation including Scour Protection)); cable protection for IACs: 755,000 m² due to (up to 75.5 km of cable requiring protection, with a cable protection width of 10 m); cable crossing protection: 40,500 m² for IACs for up to 9 crossings, with a length of 500 m and width of 9 m each; cable protection for Interconnector Cables: 180,000 m² due to (up to 18 km of cable requiring protection, with a cable protection width of 10 m); cable crossing protection for Interconnector Cables: 13,500 m² (up to 3 crossings, with a length of 500 m and width of 9 m each); 	

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
				<ul style="list-style-type: none"> • cable protection for Offshore Export Cables: 1,050,000 m² due to (up to 105 km of cable requiring protection, with a cable protection width of 10 m); • cable crossing protection for Offshore Export Cables: 27,000 m² (up to 6 crossings, with a length of 500 m and width of 9 m each); and • OSP foundations: 15,000 m² (maximum of 3 OSPs) and their Scour Protection. <p>O&M Phase <u>Temporary disturbance</u> A total of 11,688,813 m² of temporary subtidal habitat loss and/or disturbance due to disturbance caused by repair/reburial of the following:</p> <ul style="list-style-type: none"> • IACs up to 4,915 m per year; • Interconnector Cables: up to 2,040 m per year; • Offshore Export Cables: up to 6,390 m per year; and • the width of disturbance from the trenching tool during reburial is up to 25 m. <p>Decommissioning Phase At the end of the operational lifetime of the Proposed Development, Offshore Infrastructure such as cables and cable protection may be either left <i>in situ</i> or removed, in accordance with the Decommissioning Programme. For Blue Carbon emissions, total removal of Offshore Infrastructure including buried cables and cable protection is the MDS. As such, total disturbance area is conservatively assumed to be the same as for construction.</p>	
The impact of GHG emissions arising from the manufacturing and installation of the Proposed Development.	✓	×	×	<p>Construction:</p> <ul style="list-style-type: none"> • the greatest number of Wind Turbines (67) on 4-legged pile jacket foundations, and maximum Scour Protection of 174,586 m³; • OSPs (three) and maximum OSP Scour Protection (15,000 m³); 	The greatest number of Wind Turbines, OSPs, vessel movements, maximum length of the IACs, Offshore Export Cables and Interconnector Cables and maximum volume of cable and

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
				<ul style="list-style-type: none"> the maximum total length of IAC (151 km) with 1,370,000 m³ of cable protection; the maximum total length of Interconnector Cables (36 km) with 360,000 m³ of cable protection; the maximum total length of Offshore Export Cables (210 km) with 2,100,000 m³ of cable protection; total volume of crossing protection material across IAC crossings (101,250 m³); total volume of crossing protection material across Offshore Export Cable crossings (67,500 m³); total volume of crossing protection material across Interconnector Cable crossings (33,750 m³); maximum number of vessel movements (return trips) for site preparation and construction activities (2,260); and maximum number of helicopter movements (return trips) for construction activities (267). 	<p>Scour Protection represent the greatest potential for GHG emissions from the construction and installation of the Proposed Development. The MDS is therefore concerned with the design scenario which results in the greatest total embodied carbon and not the greatest number of Wind Turbines. Whilst other designs may include more turbines, these would result in a lower total embodied carbon due to differences in foundations.</p> <p>The design with 15MW Wind Turbines contains the greatest total embodied carbon. Whilst other designs include greater length of Inter-Array Cabling, the overall design would have lower total embodied carbon.</p> <p>Fixed foundations and three OSPs represent the greatest potential for GHG emissions from the construction and installation of the Proposed Development.</p>
<p>The impact of GHG emissions arising from the consumption of materials and activities required to facilitate the O&M phase of the Proposed Development and estimated</p>	x	✓	x	<p>30-year operating lifetime. Export Capacity of 1,005 MW (67 x 15 MW Wind Turbines).</p> <p>Maximum number of vessel movements (return trips) per year (973).</p> <p>Maximum number of helicopter movements (return trips) per year (30).</p>	<p>The greatest number of vessel movements, and maximum amount of maintenance activities will result in the greatest consumption of fuel and materials representing the greatest potential for GHG emissions.</p>

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
abatement of National Grid emissions.				<p>Maximum amount of material replacement:</p> <ul style="list-style-type: none"> • 4,915 m of repairs per year for IACs; • 6,390 m of repairs per year for Offshore Export Cables; and • 2,040 m of repairs per year for Interconnector Cables. 	The Proposed Development will have an export capacity of up to 1,005 MW, based on the greatest number of Wind Turbines (which represents the greatest potential for emissions).
GHG emissions arising from decommissioning works of the Proposed Development	x	x	✓	<p>At the end of the operational lifetime of the Proposed Development, it is anticipated that all structures above the seabed will be completely removed. Offshore Infrastructure, such as cables and Scour Protection may either be left <i>in situ</i> or removed, in accordance with a Decommissioning Programme. It may be decided, closer to the time of decommissioning, that removal will result in greater environmental impacts than leaving components <i>in situ</i>. The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels and equipment.</p>	The greatest number of vessel movements and the greatest number and size of structures will result in the greatest consumption of fuel and materials representing the greatest potential for GHG emissions from the decommissioning works.
Climate resilience of the Proposed Development	x	✓	✓	<p>O&M Phase Use of most adverse future climate change projections available for the Climate Change Study Area (RCP8.5), subject to data availability. Under this projection, consistently heightened temperatures, changes to rainfall patterns, increased wind speeds and increased frequency of extreme events such as storms could lead to efficiency losses due to overheating, the failure of electrical equipment or damage to Offshore Infrastructure which would result in an increase in O&M activities.</p> <p>Decommissioning Under RCP8.5, consistently heightened temperatures, changes to rainfall patterns, increased wind speeds and increased frequency of extreme events such as storms could lead to delays in decommissioning activities, overheating of equipment and possible ill health of workers due to overheating.</p>	The use of the most adverse future climate change projection (RCP8.5, a high emissions scenario) will result in the greatest magnitude and severity of climate change risks to the Array Area.

* Proposed Development Phase refers to construction (C), O&M (O) and decommissioning (D).

Impacts Scoped Out of the Assessment

- 22.7.2 On the basis of the baseline environment and the Project Description outlined in Volume 1, Chapter 3: Project Description, a number of impacts are scoped out of the assessment for climate change. The impacts were proposed to be scoped out in the Bowdun Offshore Scoping Report (Bowdun Offshore Wind Farm Limited (BOWFL), 2024) and were confirmed in the Scoping Opinion received (MD-LOT, 2024).
- 22.7.3 This impact is outlined, together with a justification for scoping it out, in Table 22.8.

Table 22.8: Impact Scoped Out of the Assessment for Climate Change

Potential Impact	Phase*			Justification
	C	O	D	
Climate resilience of the Proposed Development - construction	✓	×	×	The Proposed Development is unlikely to experience significant changes in climate during construction compared to the current baseline due to the short duration (indicative 5 years construction period). Additionally, as construction is anticipated to begin soon (2031), climate conditions during construction will be similar to the current baseline. The Applicant’s contractors will employ good construction and health and safety practices with respect to risks such as heatstroke or storm events offshore.
ICCI	✓	✓	✓	ICCI has been addressed individually within relevant topic chapters of this Offshore EIA Report. Each relevant topic will consider how potential climatic changes may affect topic-specific future baselines, including the sensitivity or resilience of receptors. This includes the input from all topics in Volume 2, Chapters 7 to 21.

* Proposed Development Phase refers to construction (C), O&M (O) and decommissioning (D).

22.8 Methodology for Assessment of Effects

Overview

- 22.8.1 The climate change assessment of effects has followed the methodology set out in Volume 1, Chapter 4: Environmental Impact Assessment Methodology. Specific to the climate change assessment, the following guidance documents have also been considered:
- IEMA Guidance on Climate Change Adaption and Resilience (IEMA, 2020); and
 - IEMA Guidance on ‘Assessing Greenhouse Gas Emissions and Evaluating their Significance’ (IEMA, 2022).

GHG Emissions Assessment Methodology

- 22.8.2 GHG emissions have been estimated by applying published emissions factors to activities in the baseline and to those required for the Proposed Development. The emissions factors relate to a given level of activity, or amount of fuel, energy or materials used, to the mass of GHGs released as a consequence. The GHGs considered in this assessment are those in the ‘Kyoto

basket' of global warming gases expressed as their CO₂e Global Warming Potential (GWP). This is denoted by CO₂e units in emissions factors and calculation results. GWPs used are typically the 100-year factors in the IPCC Fifth Assessment Report (IPCC, 2013) or as otherwise defined for national reporting under the UNFCCC.

22.8.3 Additional guidance used for the quantification of GHG emissions includes:

- Jones and Hammond (2024). ICE Database;
- DESNZ (2023c) Valuation of Energy Use and Greenhouse Gas: Supplementary Guidance to the HM Treasury Green Book;
- UK Government GHG Conversion Factors for Company Reporting (DESNZ and Defra, 2025); and
- the Greenhouse Gas Protocol suite of documents (World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD), 2004)).

22.8.4 GHG emissions caused by an activity are often categorised into 'scope 1', 'scope 2' or 'scope 3' emissions, following the guidance of the WRI and the WBCSD GHG Protocol suite of guidance documents (WRI and WBCSD, 2004).

- Scope 1 emissions: direct GHG emissions from sources owned or controlled by the company (e.g. from combustion of fuel at an installation).
- Scope 2 emissions: caused indirectly by consumption of purchased energy (e.g. from generating electricity supplied through the National Grid to an installation).
- Scope 3 emissions: all other indirect emissions occurring as a consequence of the activities of the company (e.g. in the upstream extraction, processing and transport of materials consumed or the use of sold products or services). Downstream use of products and services sold to customers would also be captured under scope 3 emissions.

22.8.5 Consideration of indirect effects has accounted for the emissions associated with upstream (material manufacturing and transportation) and downstream (end use of renewable energy generation and the abatement of fossil fuel in the grid). Additional information regarding scope and methodology for these emissions can be found in Section 3.1.2 of Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report.

22.8.6 This assessment has sought to include emissions from all three scopes, where this is material and reasonably practicable from the information and emissions factors available, to capture the impacts attributable most completely to the Proposed Development. These emissions shall not be separated out by defined scopes (scopes 1, 2 or 3) in the assessment.

22.8.7 The assessment has considered:

- the GHG emissions arising from the Proposed Development (during construction, O&M, and decommissioning phases);

- any GHG emissions that are avoided, compared to the current or future baseline; and
- the net impact on climate change due to these changes in GHG emissions overall.

22.8.8 As previously discussed in Section 22.6, to avoid ‘carbon leakage’ overseas when reducing UK emissions, the full life cycle GHG emissions of the Proposed Development, including emissions associated with the construction phase have been evaluated where practicable when determining the significance of effects.

22.8.9 Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report provides further details of the GHG emissions assessment methodology including the methodology used for calculation of Blue Carbon emissions, and should be read alongside this chapter.

CCRA Methodology

22.8.10 Baseline offshore climatic conditions have been sourced from data detailed in Section 22.6.

22.8.11 Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report should be read alongside this chapter, which provides further detail of the approach and data input.

22.8.12 A high level screening risk assessment has been undertaken, considering the hazard, exposure and vulnerability of the Proposed Development and workers. The assessment of effects has considered the Embedded Mitigation as part of the Proposed Development.

22.8.13 Where potentially significant impacts have been identified at the screening stage prior to any Additional Mitigation, further assessment has been undertaken with consideration of appropriate Additional Mitigation to determine whether significant residual risks are likely.

Criteria for Assessment

22.8.14 When determining the significance of effects, a two stage process is used which involves defining the magnitude of the potential impacts and the sensitivity of the receptors. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on those which are described in further detail in Volume 1, Chapter 4: Environmental Impact Assessment Methodology. The criteria for determining the significance of effects have been divided into two categories:

- assessment of the significance of the effect of Proposed Development on climate change (GHG assessment); and
- assessment of the significance of the effect from climatic changes on Proposed Development (CCRA).

22.8.15 The impact assessment criteria for each of these categories is set out below.

Impact Assessment Criteria: GHG Emissions

Magnitude of Impact

- 22.8.16 In accordance with the IEMA Guidance (2022), where GHG emissions can be quantified directly and expressed based on their GWP as tonnes of CO₂e emitted, the magnitude of impact is reported numerically. Where a quantifiable figure is not possible, for example due to a lack of available data at early design stage, this is expressed qualitatively, based on professional judgement.

Sensitivity of Receptor

- 22.8.17 GHG emissions have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The global atmospheric mass of the relevant GHGs and consequent warming potential, expressed in CO₂e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor).

Significance of Effect

- 22.8.18 Assessment guidance for GHG emissions (IEMA, 2022) describes five levels of significance for emissions resulting from a development, each based on whether the GHG emission impact of the development will support or undermine a science-based 1.5°C compatible trajectory towards net zero, in line with the goals of the Paris Agreement (United Nations (UN), 2015). To aid in considering whether climatic effects are significant, IEMA (2022) recommends that GHG emissions should be contextualised against pre-determined Carbon Budgets, or applicable existing and emerging policy and performance standards where a budget is not available. It is a matter of professional judgement to integrate these sources of evidence and evaluate them in the context of significance.
- 22.8.19 Taking the guidance into account, the following have been considered in contextualising Proposed Development GHG emissions:
- the magnitude of net GHG emissions as a percentage of UK Carbon Budgets (where feasible and where Carbon Budgets are available); and
 - whether the Proposed Development contributes to, and is in line with, the UK's policy for GHG emissions reductions, where these are consistent with science-based commitments to limit global climate change to an internationally agreed level (as determined by the UK's NDC to reduce emissions by 81% by 2035 (DESNZ, 2025a)).
- 22.8.20 Effects from GHG emissions are described in this chapter as adverse (major, moderate or minor), negligible or beneficial based on the following definitions in Table 22.9, which closely follow the examples in Box 3 of the IEMA Guidance (IEMA, 2022).

Table 22.9: Guidance Definitions of Significance in Relation to GHG Emissions (IEMA, 2022)

Significance	Definition
Major adverse	The Proposed Development’s GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type.
Moderate adverse	The Proposed Development’s GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type.
Minor adverse	The Proposed Development’s GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type.
Negligible	The Proposed Development’s GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050.
Beneficial	The Proposed Development’s net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline.

22.8.21 Major and moderate adverse and beneficial effects are considered to be significant in EIA terms. Minor adverse and negligible effects are not considered to be significant in EIA terms.

22.8.22 GHG emissions associated with a project are often reported as a whole life figure (net emissions) that takes account of all life stages. The net whole life figure is the key element for determining the Proposed Development’s whole life impact on climate change. In addition, it is key to determining its impact within the context of the Project during its O&M phase, allowing the consideration of avoided emissions that the Proposed Development enables (avoided emissions refer to those emissions that have been ‘avoided’ by using a specific product or service, compared to a scenario where the product or service had not been used).

22.8.23 It is noted in the IEMA Guidance (2022) that due to the nature of GHG emissions, it is good practice to include a section that reports on the whole life GHG emissions associated with a project, alongside the sections that assess construction, O&M, and decommissioning effects in isolation. As such, this chapter details the assessment of effects from the construction, O&M, and decommissioning phases individually, before assessing the net whole life GHG emissions from the Proposed Development alone and for the Project as a whole (including the Offshore Generation Assets, the Offshore Transmission Assets and the Onshore Transmission Assets).

Impact Assessment Criteria: CCRA

22.8.24 IEMA Guidance (IEMA, 2020) defines climate change resilience as the “*ability to respond to changes in climate. If a receptor or project has good climate change resilience, it is able to respond to the changes in climate in a way that ensures it retains much of its original function and form. A receptor or project that has*

poor climate change resilience will lose much of its original function or form as the climate changes”.

- 22.8.25 The methodology to assess impacts presented in the CCRA differs from many other EIA topics in that it considers how the resilience of a development is affected by an external factor (climate change) and not specifically how potential environmental receptors are affected by a development’s impacts. Consequentially, the CCRA cannot be assigned significance with respect to the severity of impacts in the same way as for the other topics. Instead, a risk-analysis based approach has been used for the assessment.
- 22.8.26 As is detailed in Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report, a risk assessment has been undertaken, considering the hazard, exposure and vulnerability of the Proposed Development and its users. Hazard, exposure and vulnerability are defined in Table 22.10 below, alongside their scoring criteria.
- 22.8.27 Table 22.11 presents the matrix for determining the significance of effect, and considers the hazard and exposure and vulnerability of the receptor(s) affected. The assessment of effects has considered the Embedded Mitigation adopted as part of Volume 3, Technical Appendix 4.6: Schedule of Mitigation and Commitments.

Table 22.10: Hazard, Exposure and Vulnerability Factor Definitions

Factor	Score Definition
<p>Hazard: refers to the possible, future occurrence of natural or human physical events that may have adverse effects on vulnerable and exposed elements. The presence of a hazard is identified and weighted based on the location’s exposure to that hazard. For example, a hazard may occur within a particular scenario, however the relative exposure to that hazard is how it will be measured.</p>	
<p>Exposure: considers the nature of the impacts and the degree of certainty based on the obtained climate projections. Exposure is necessary, but not determinant of risk. A site can be exposed but not vulnerable.</p>	<p>Major: large change to climate condition and large increase in the frequency of the event.</p> <p>Moderate: a large, measurable change in climate conditions at a regular frequency.</p> <p>Minor: change in climate conditions that may have measurable effect on a receptor, but which are low likelihood of occurring or infrequent.</p> <p>Negligible: no change in climate conditions.</p>
<p>Vulnerability: the degree of vulnerability of each receptor to the hazard. Vulnerability can be seen as situation specific.</p>	<p>High: short term, acute impact to functionality or a large, measurable decrease in receptor lifespan following the occurrence of a climate impact. Major increase in the need for maintenance and repairs.</p> <p>Medium: measurable decrease in receptor performance or lifespan or increase in necessary maintenance and repairs following the occurrence of a climate impact.</p> <p>Low: small measurable impact to a receptor’s performance following climate impact, or deterioration of a receptors’ lifespan due to a chronic effect.</p> <p>Negligible: no measurable impact to a receptor’s performance following climate impact, or deterioration of a receptors’ lifespan due to a chronic effect.</p>

Table 22.11: Scoring Matrix for Climate Risk

		Exposure		
Vulnerability		Major	Moderate	Minor
	High	Significant	Significant	Significant
	Medium	Significant	Significant	Not Significant
	Low	Significant	Not Significant	Not Significant
	Negligible	Not Significant	Not Significant	Not Significant

22.9 Embedded Mitigation

22.9.1 As part of the Proposed Development design process, a number of Embedded Mitigation measures have been proposed to reduce the potential for impacts on climate change (see Table 22.12). They are considered at every stage of the Proposed Development through design and best practice and, as there is a commitment to implementing these measures, these have been considered in the assessment presented in Section 22.10 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These Embedded Mitigation are considered standard industry practice for this type of development.

Table 22.12: Embedded Mitigation Adopted as Part of the Proposed Development

ID*	Embedded Mitigation Adopted as Part of the Proposed Development	Justification
2	Anti-corrosion protective coatings and Scour Protection will be used where there is potential for scour to develop around the Offshore Infrastructure, and it is appropriate to do so.	The potential increased temperatures and ocean acidification may lead to accelerated corrosion of submerged structures, including Offshore Export Cables and as such appropriate measures are required to reduce the potential effect.
5	Development of, and adherence to, an Environmental Management Plan (EMP), including a Marine Pollution Contingency Plan (MPCP) and a Biosecurity Plan with commitments to environmental monitoring and actions to minimise Invasive Non-Native Species (INNS).	Secure measures to limit adverse impact on marine environment, as a result of the Project. Reduce pollution and therefore emissions by virtue of these measures.
7	Development of, and adherence to a Construction Method Statement (CMS) along with a Code of Construction Practice (CoCP).	Reduce on site construction stage emissions associated with plant activity and construction practices.
18	All vessels working on the Proposed Development will meet the required certification standards and carriage requirements, along with following international marine regulations.	Reduce transport emissions associated with vessel movements.
23	Development of, and adherence to, an Operation and Maintenance Programme (OMP) in conjunction with approved post-consent construction plans.	Potential for increased wear and tear resulting in erosion and degradation of blade surfaces, increased drag and thereby decreasing energy production.

ID*	Embedded Mitigation Adopted as Part of the Proposed Development	Justification
32	The Applicant will consider, as far as reasonably possible, to procuring materials fabricated within the UK for the installation as part of the Offshore Infrastructure.	Reduce potential GHG emissions associated with the transportation of materials compared to if procured overseas.
33	Offshore Infrastructure will be designed to be resilient to climate risks such as storms and waves with factors of safety incorporated into the design.	Reduce the requirement for replacement materials throughout the phases of development thereby reducing GHG emissions.
40	Creation of a Waste Management Plan (WMP), which will describe the processes for handling and managing any waste materials.	The WMP will set out procedures to ensure all waste processing and handling activities with the potential to affect the environment are appropriately managed.
51	Safety margin within the Wind Turbine design to be fitted with automatic shutdowns/lockdowns with regards to spinning too fast.	Overheating and higher winds/extreme weather pose a risk of increased degradation and need for replacement in addition to inhibition and potential export capacity.
52	Electrical plant within the OSPs will be cooled by means of natural ventilation or by forced High Voltage Alternating Current. Both cooling and heating will be applied when necessary to avoid overheating of equipment.	Consistently heightened temperatures could lead to efficiency losses due to overheating, or the failure of electrical equipment.

*See Volume 3, Technical Appendix 4.6: Schedule of Mitigation and Commitments.

22.10 Assessment of Significance

22.10.1 Table 22.7 summarises the potential impacts arising from the construction, O&M and decommissioning phases of the Proposed Development, as well as the MDS against which each impact has been assessed. An assessment of the likely significance of the effects of the Proposed Development on and from climate change caused by each identified impact is given below.

IMPACT 1 - THE IMPACT OF GHG EMISSIONS ARISING FROM THE DISTURBANCE OF BLUE CARBON SYSTEMS AND SEABED CHANGE, INCLUDING BENTHIC AND SUBTIDAL/INTERTIDAL ECOLOGY, DURING THE CONSTRUCTION, O&M AND DECOMMISSIONING PHASES

22.10.2 Throughout the lifetime of the Proposed Development, during the construction, O&M and decommissioning phases, it is anticipated that there will be disturbance to seabed habitats. For the construction phase this will arise from the installation of the Wind Turbine foundations, OSP foundations, Interconnector Cables, IACs and Offshore Export Cables, cable protection and Scour Protection.

22.10.3 Where seabed habitats are disturbed, this affects the habitat's ability to store and sequester Blue Carbon. For example, when organic sediments are disturbed and enter the water column, stored Blue Carbon within these organic sediments can be converted to CO₂ through a process called remineralisation (Cunningham and Hunt, 2023). The emissions associated with the disturbance from the

Proposed Development are detailed below. This impact entails an assessment of the largest total Proposed Development footprint over all phases, representing the greatest potential for GHG emissions from disturbance to Blue Carbon stores.

- 22.10.4 However, there are a range of potential pathways for disturbed organic carbon, not all of which would result in release of CO₂ to the atmosphere (Smeaton and Austin, 2022). As such, a range of emissions are presented, reflecting sediment remineralisation potential and resulting potential for CO₂ production/emission (Smeaton and Austin, 2022; Cunningham and Hunt, 2023).

Construction Phase

Magnitude of Impact

- 22.10.5 Based on the MDS presented in Table 22.7, the total area disturbed during the construction phase is 1,941 ha (19.41 km²). As set out in Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report, site-specific benthic surveys undertaken for the Proposed Development (Volume 3, Technical Appendix 8.1: Benthic Ecology Technical Report) and published literature values (Smeaton *et al.*, 2020) have been used to calculate the average Blue Carbon per hectare contained in habitats within the Site Boundary. This figure has been calculated to be 3.9 tonnes of carbon per hectare, which corresponds to 14.2 tCO₂ per hectare when converted from carbon to CO₂. Literature values for remineralisation potential in offshore sediments (Smeaton and Austin, 2022) were then used to calculate total emissions. Refer to Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report, for more details.
- 22.10.6 The impact is predicted to be of international spatial extent, short term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude of impact is calculated to be between 5,526 tCO₂ and 27,629 tCO₂.

Sensitivity of the Receptor

- 22.10.7 In accordance with Paragraph 22.8.17, the receptor is deemed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the Effect

- 22.10.8 Overall, the magnitude of the impact is deemed to be between 5,526 tCO₂ and 27,629 tCO₂ and the sensitivity of the receptor is considered to be high. The magnitude of emissions comprises between 0.0002% and 0.002% of the Fifth and Sixth UK Carbon Budgets (set out in Table 22.1). Further, the magnitude of emissions arising from disturbance to Blue Carbon stocks during the construction phase comprises between 0.002% and 0.0004% of Scotland's estimated Blue Carbon stocks (Smeaton *et al.*, 2020; Cunningham and Hunt, 2023), with loss arising from habitats of low relative importance to carbon storage as outlined in Paragraph 22.8.18. The effect will therefore be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

22.10.9 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

O&M Phase and Decommissioning Phase

22.10.10 For the O&M phase emissions may arise from OSP foundations, cables and associated Scour Protection. Any disturbance during O&M of the Proposed Development is likely to fall within areas that were previously disturbed during the construction of the Proposed Development. Given the negligible sequestration rates of sediments in the North Sea (Cunningham and Hunt, 2023), it is considered that there will be **Negligible** additional Blue Carbon emissions during O&M, as emissions will have been accounted for during the construction phase.

22.10.11 Given the negligible rates of sediment accumulation and associated carbon sequestration in the Site Boundary, there is not anticipated to be any material change to the Blue Carbon stocks over the Proposed Development's operational lifetime. As such, any disturbance to the seabed and Blue Carbon habitats at the decommissioning phase is not likely to result in the release of additional emissions not already presented in the assessment of construction effects. Therefore, this impact is not assessed further as the effect would be negligible.

IMPACT 2 - THE IMPACT OF GHG EMISSIONS ARISING FROM THE MANUFACTURING AND INSTALLATION OF THE PROPOSED DEVELOPMENT

22.10.12 The below considers the embodied carbon emissions associated with materials and associated transportation emissions detailed within the MDS in Volume 1, Chapter 3: Project Description.

Construction Phase

22.10.13 This section considers the GHG emissions arising from the consumption of materials and activities required to construct the Proposed Development. Calculations to reach such emissions consider the maximum amount of materials required to construct the Wind Turbines and OSPs, maximum lengths of all cables, with associated Scour Protection and cable protection, representing the greatest potential for GHG emissions from the construction and installation of the Proposed Development as a conservative estimate of impact.

22.10.14 The following items are considered within this assessment:

- Wind Turbines (blades and tower);
- Wind Turbines (foundations) - including Scour Protection;
- OSP (platforms);
- OSP (foundations) - including Scour Protection;
- OSP plant;
- IACs;
- Interconnector Cables;

- Offshore Export Cables; and
- vessel and helicopter movements.

- 22.10.15 Detailed and current LCAs are not available for all items specific to the Offshore Infrastructure due to the early stage of the Proposed Development design. As such, a combined approach has been taken to calculate embodied carbon, informed largely by conservative estimates of construction materials or fuels scaled by relevant emissions factors, and also in part by LCA data.
- 22.10.16 The potential impact of the Wind Turbines and foundations, OSP topsides and foundations, cabling (including IACs, Interconnector Cables and Offshore Export Cables), cable protection and Scour Protection has been estimated by using the appropriate material emission intensities ICE database (Jones and Hammond, 2024), scaled by material estimates for each element. Material types and the emissions factors by which they have been scaled are listed within Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report.
- 22.10.17 Construction phase emissions associated with the proposed electrical plant included on the OSPs have been calculated using an intensity for the manufacturing GWP of 2,190 kgCO₂e per MW (ABB, 2003). This was scaled by the Proposed Development output capacity of 1,005 MW to give an estimated embodied emission value of 2,201 tCO₂e.
- 22.10.18 Emissions associated with fuel combustion from vessel and helicopter movements have been calculated based on the maximum number of movements proposed during the construction phase, likely base port and fuel consumption rates per vessel type where available, in order to reach a conservative estimate. Anticipated fuel consumption for each movement was scaled by an appropriate emissions factor to give total estimated emissions of 109,611 tCO₂e during the construction phase.
- 22.10.19 Table 22.13 summarises the calculated construction phase emissions based on conservative estimates and the MDS (Section 22.7) associated with the Proposed Development, which totals 1,533,145 tCO₂e. It is anticipated that the actual construction phase emissions would be lower than those detailed in Table 22.13 as this is a conservative MDS which will be further refined to inform final detailed design for the Proposed Development.

Table 22.13: Construction Phase GHG Emissions

Item	Value (tCO ₂ e)
Wind Turbines (blades and tower)	411,962
Wind Turbines (foundations) - including Scour Protection	712,422
OSP (platforms)	21,060
OSP (foundations) - including Scour Protection	63,477
OSP plant	2,201
IACs	79,564
Interconnector Cables	19,794
Offshore Export Cables	113,055

Item	Value (tCO ₂ e)
Vessel and helicopter movements	109,611
Total	1,533,145

Magnitude of Impact

22.10.20 The impact is predicted to be of international spatial extent, short term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be 1,533,145 tCO₂e for the construction phase.

Sensitivity of the Receptor

22.10.21 In accordance with Paragraph 22.8.17, the receptor is deemed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the Effect

22.10.22 Overall, the magnitude of the impact is deemed to be 1,533,145 tCO₂e and the sensitivity of the receptor is considered to be high. Consistent with Paragraph 22.8.18 the magnitude of emissions comprises 0.09% of the Fifth and 0.16% of the Sixth UK Carbon Budgets (set out in Table 22.1), respectively. Note that construction phase emissions have been calculated based on precautionary calculations of material quantities as set out in Paragraph 22.6.21, which will be refined throughout the design stage.

22.10.23 In the absence of GHG-related Additional Mitigation measures to reduce emissions at this application stage, it cannot be concluded that the GHG impacts at the construction phase are in keeping with current and emerging local and national climate policy regarding the transition towards net zero. However, the Applicant is committed to exploring measures to reduce construction related GHG emissions at the detailed design stage, as set out in Paragraph 22.10.27.

22.10.24 Based on the definitions as set out in Table 22.9, the effect will be of **Moderate** adverse significance, which is significant in EIA terms.

22.10.25 It is important to note that this assessment is based on a precautionary MDS, and the magnitude of impact is likely to be lower after final design of the Proposed Development. In addition, the purpose of the Proposed Development is to provide a source of renewable energy, and as such, the effects due to GHG emissions from the manufacture and installation of the Proposed Development must be considered together with the effect of avoided GHG emissions arising from the operation of the Proposed Development (see Paragraphs 22.10.30 to 22.10.46), so as to determine the net effects of GHG emissions resulting from the Proposed Development (see Paragraphs 22.10.66 to 22.10.78), in line with IEMA (2022) Guidance.

Additional Mitigation and Residual Effect

- 22.10.26 A **Moderate** adverse effect is predicted for GHG emissions produced as a result of construction activity associated with the Proposed Development. This is significant in EIA terms.
- 22.10.27 In order to seek to mitigate this effect, the Applicant is committed to exploring options to reduce construction related emissions during detailed design, in line with the carbon management hierarchy (IEMA, 2022) and the principles of PAS 2080: Carbon Management in Infrastructure and Built Environment (British Standards Institution, 2023). This will include:
- Measures to switch GHG emissions ('build less'): within the parameters of the PDE, as set out in Volume 1, Chapter 3: Project Description, the Applicant will evaluate alternative technologies for the design of the Proposed Development (e.g. cables, cable crossing technologies, Wind Turbines, and OSPs), with consideration of whole life carbon emissions (where it would not adversely impact other environmental receptors).
 - Measures to support sustainability ('sustainable by design'): the Applicant will explore the use of low carbon products, materials and production facilities, and will work with the supply chain to drive the uptake of low carbon solutions in the construction of the Proposed Development. Focus areas for supply chain engagement during the construction phase will be on carbon hotspots, such as Wind Turbine towers and foundations. Sustainability criteria will be implemented within supplier selection processes.
 - Optimise construction processes ('construct efficiently'): the Applicant will work with the Principal Contractor(s) to encourage optimisation of construction activity to reduce emissions, where practicable. This could include vessel scheduling, co-ordination of shipping/delivery of materials and the identification energy efficiency mechanisms.
- 22.10.28 Measures will be explored further during detailed design. Measures to avoid GHG emissions (do not build) are not considered, due to the need for the Proposed Development as noted in the assessment of alternatives set out in Volume 1, Chapter 6: Site Selection and Consideration of Reasonable Alternatives.
- 22.10.29 With these Additional Mitigation measures, it is considered that the impact of GHG emissions during construction would be reduced as far as feasibly practicable in line with the GHG reduction hierarchy. The Proposed Development would be in line with national policy for low carbon design. In accordance with the criteria in Table 22.9, the residual effect is therefore assessed to be **Minor** adverse, which is not significant in EIA terms.

IMPACT 3 - THE IMPACT OF GHG EMISSIONS ARISING FROM THE CONSUMPTION OF MATERIALS AND ACTIVITIES REQUIRED TO FACILITATE THE O&M PHASE OF THE PROPOSED DEVELOPMENT AND ESTIMATED ABATEMENT OF NATIONAL GRID EMISSIONS

O&M Phase

- 22.10.30 The primary purpose of the operational phase of a wind farm is to generate electricity which avoids the need for fossil fuel generated electricity and reduces the National Grid carbon intensity. The avoided emissions associated with the displacement of projected marginal generation of the National Grid should be considered in-combination with the impact of GHG emissions arising from the consumption of materials and activities required to facilitate the O&M of the Proposed Development.
- 22.10.31 The GHG emissions arising from the consumption of materials and activities required to facilitate the O&M of the Proposed Development are presented in Table 22.14, and further details are presented in Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report. The majority of emissions result from the vessel and helicopter movements required to undertake maintenance activities over the Proposed Development’s lifetime. Remaining emissions are associated with the replacement of cables and cable protection informed by conservative assumptions for material replacement rates. Emissions from the vessel and helicopter movements and cable equipment replacement have been calculated with values outlined in Table 22.7, representing the greatest potential for GHG emissions from the O&M of the Proposed Development as a conservative estimate of impact.

Table 22.14: O&M Phase GHG Emissions

Item	Value (tCO ₂ e)
Transport	316,403
Materials	291,948
Total	608,351

- 22.10.32 When considering the Proposed Development’s impact on climate change, the emissions as a result of O&M phase activities must be considered alongside the displacement of marginal alternative sources of electricity generation. This element is further considered in the assessment below.
- 22.10.33 Table 22.15 sets out the parameters for the Proposed Development and associated annual energy output.

Table 22.15: Energy Flows for the Proposed Development

Parameter	Value	Unit	Source
Input parameter – anticipated rated power	1,005	MW	Volume 1, Chapter 3: Project Description.
Input parameter – capacity factor	39.55	%	DESNZ (2025b), calculated based on a rolling 10-year average for offshore wind.

Parameter	Value	Unit	Source
Input parameter – degradation factor	1.60	%	Staffel and Green (2014)
Input parameter – total annual operating hours	8,760	hrs	Total number of hours in year.
Output parameter – annual energy output (year 1)	3,481,903	MWh	Calculated based on the input parameters.
Output parameter – lifetime energy output (30 years)	83,481,611	MWh	Calculated based on the input parameters, accounting for the degradation factor.
Output parameter – O&M phase emissions intensity	7.3	gCO ₂ e/kWh	Calculated based on lifetime energy output and total O&M phase emissions.

22.10.34 The input and output figures for the O&M phase of the Proposed Development have been scaled against the assumptions stated within the DESNZ long run marginal projections (DESNZ, 2025b). This allows for a direct presentation of the cumulative GHG emissions throughout the O&M phase of the Proposed Development and therefore how the Proposed Development contributes towards reaching net zero targets.

22.10.35 The resulting estimated emissions associated with the O&M phase of the Proposed Development would be 270,929 to -36,791,410 tCO₂e emissions associated with the abatement of the National Grid.

Sensitivity Analysis

22.10.36 It should be noted that as Scotland and the UK move towards the 2045 and 2050 net zero carbon targets respectively, the marginal source of electricity generation will likely become a combination of renewables (predominately solar and wind) and energy storage. By the time the Proposed Development is anticipated to be fully operational, the UK and Scotland are expected to have made significant progress towards a low carbon electricity grid, with the current UK Government policy target year of 2030 (DESNZ, 2025a). It is important to note therefore that from circa 2030 onwards, long run marginal projections assume that there is no unabated fossil fuel generation, in line with UK Government policy.

22.10.37 However, the UK Government has highlighted that some ‘transition’ fossil fuels will continue to play a part in the UK’s energy supply, including an expected 35 GW of unabated gas reserve capacity post 2030 (DESNZ, 2025a). Further, the use of the long run marginal projections may not present a true ‘without development’ future baseline and does not account for uncertainty in the National Grid carbon intensity as a result of annual fluctuation due to changes in the energy market (as detailed in Paragraph 22.6.19). Therefore, it is likely that the true value of the avoided emissions displaced as a result of the Proposed Development’s contribution to the National Grid would be higher than that of avoided emissions detailed above.

22.10.38 As such, a sensitivity analysis has been carried out using the current National Grid carbon intensity and current estimated intensity from electricity supplied

for ‘all non-renewable fuels’, as detailed in Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report. This is shown in Table 22.16.

Table 22.16: Total Avoided Emissions Sensitivity Test

Operating years	Output (MWh)	DESNZ Long run Marginal Avoided Emissions (tCO ₂ e)	Current UK National Grid Average Avoided Emissions (tCO ₂ e)	DESNZ ‘Non-renewable Fuels’ Avoided Emissions (tCO ₂ e)
30	83,481,611	-337,422	-18,608,051	-37,399,762

22.10.39 Although the use of the current National Grid average and DESNZ ‘non-renewable fuels’ carbon intensities would conclude greater avoided emissions and an ultimate reduction in carbon payback period, these are static baselines and do not account for future National Grid decarbonisation. Further, as the Proposed Development’s generation output would be dictated by day-to-day demand alongside commercial factors and the National Grid’s needs, the benefit of provision of additional low carbon electricity capacity cannot be used to quantify avoided emissions. As such, the long run marginal provides a conservative quantification of avoided emissions for the purpose of this assessment. The true emissions value for the Proposed Development is likely to lie between the upper and lower limits shown in Table 22.16 (i.e. between -337,422 tCO₂e and -37,399,762 tCO₂e avoided) and has been used to provide additional context to the assessment of significance.

Magnitude of Impact

22.10.40 The impact is predicted to be of international spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude for the Proposed Development is considered to be an emissions impact of between 270,929 tCO₂e (long run marginal) and -36,791,410 tCO₂e (DESNZ ‘non-renewable fuels mix’), when considering the emissions associated with O&M (Table 22.14) alongside the avoided emissions of the Proposed Development (Table 22.16). This range reflects displacement of alternative energy generation sources from a range of future baseline scenarios (note that negative values in final magnitude totals represent avoided emissions (i.e. emissions that would have occurred without the Proposed Development)), in order to provide additional context to the assessment.

Sensitivity of Receptor

22.10.41 In accordance with Paragraph 22.8.17, the receptor is deemed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the Effect

22.10.42 Overall, the magnitude of the impact for the Proposed Development is deemed to be between 270,929 tCO₂e (long run marginal) and -36,791,410 tCO₂e (DESNZ ‘non-renewable fuels mix’) and the sensitivity of the receptor is considered to be high. As discussed in Paragraph 22.10.36, it is likely that the use of the long run marginal projections represents an underestimate of the true value of avoided emissions from the Proposed Development. Additionally, emissions

associated with the O&M phase have been calculated based on precautionary calculations of material quantities and do not account for the continued decarbonisation of UK industry, as set out in Paragraph 22.6.21. The magnitude of emissions comprises between -0.02% (long run marginal) and -0.8% (DESNZ 'non-renewable fuels mix') of the UK Carbon Budget within the period of 2033 - 2037.

- 22.10.43 The Proposed Development will produce electricity at an emissions intensity of 7.3 gCO₂e/kWh (see Table 22.15). This is lower than the current grid average (223 gCO₂e/kWh), fossil fuel generation (448 gCO₂e/kWh) and the CCC's electricity emissions intensity target for 2035 (10 gCO₂e/kWh) (CCC, 2020), but is higher than 2050 target (2 gCO₂e/kWh).
- 22.10.44 Given that the reported O&M emissions for the Proposed Development do not account for the decarbonisation of associated activities (i.e. vessel movements and material replacement) in line with the UK's planned decarbonisation of the manufacturing and transport sectors, it can be expected that the true carbon intensities will be lower compared to those reported above. As such, it is likely that the carbon intensity for the Proposed Development would align with the CCC's electricity emissions target of 2 gCO₂e/kWh by 2050, thereby demonstrating that the electricity generated by the Offshore Generation Assets enables and aids National Grid decarbonisation.
- 22.10.45 Within the context of national legislation and policy (in particular the UK Net Zero Strategy, and Scotland's and the UK's net zero targets), the purpose of the Proposed Development is to provide a source of renewable energy, thereby contributing towards UK and Scottish climate change policy goals and associated renewable energy targets. Based on the definitions set out in Table 22.9, there will be a **Beneficial** effect, which is significant in EIA terms.

Additional Mitigation and Residual Effect

- 22.10.46 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is beneficial.

IMPACT 4 - GHG EMISSIONS ARISING FROM DECOMMISSIONING WORKS OF THE PROPOSED DEVELOPMENT

Decommissioning Phase

- 22.10.47 The majority of emissions during decommissioning of the Proposed Development relate to vessel movements for decommissioning, disassembly and recovery of Offshore Infrastructure, and ultimate disposal and/or recycling of the Wind Turbines, OSPs and other Offshore Infrastructure.
- 22.10.48 At this stage, the approach to decommissioning the Proposed Development is still to be determined. However, it is anticipated that all structures above the seabed will be completely removed. Offshore Infrastructure, such as cables and Scour Protection below the seabed may either be left *in situ* or removed, in accordance with a Decommissioning Programme. It may be decided, closer to the time of decommissioning, that removal will result in greater environmental impacts than leaving components *in situ*.

- 22.10.49 The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels and equipment.
- 22.10.50 The components of the Wind Turbines are considered to be highly recyclable. When disposing of Wind Turbines, recycling is the preferred solution. This not only prevents the materials from being sent to landfills, but also reduces the need for the extraction of primary materials. Material which cannot be recycled might be used for incineration or energy from waste. It is considered the same approach can be applied to all OSP topsides, foundations and cables retrieved during decommissioning.
- 22.10.51 Cables and other Offshore Infrastructure may be left *in situ* during decommissioning or removed. If removed, this Offshore Infrastructure would be recycled or reused where practicable, or used for incineration or energy from waste. If left *in situ*, this will not result in additional emissions during this phase. As such, emissions associated with the disposal of materials at the end of their lifetime is considered to be immaterial and may even result in future avoided emissions through reuse or recycling of material. This impact is not assessed further.
- 22.10.52 In the absence of detailed information regarding offshore transport movements during the decommissioning phase, it has been assumed that such emissions equal those associated with the construction phase (Table 22.13), totalling 109,611 tCO₂e. It is worth noting that this value is precautionary and likely to be reduced after final design of the Proposed Development. Given carbon emissions associated with vessel movements is expected to have achieved good levels of decarbonisation at the decommissioning phase of the Proposed Development which, based on up to a 30-year operational lifetime, is likely to be 2065, this is likely to present a conservative MDS.

Magnitude of Impact

- 22.10.53 The impact is predicted to be of international spatial extent, short term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude of impact is determined to be 109,611 tCO₂e.

Sensitivity of the Receptor

- 22.10.54 In accordance with Paragraph 22.8.17, the receptor is deemed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the Effect

- 22.10.55 Overall, the magnitude of the impact is deemed to be 109,611 tCO₂e and the sensitivity of the receptor is considered to be high. The magnitude of emissions is unable to be contextualised within the UK Carbon Budgets, as required by Paragraph 22.8.18, given the decommissioning phase falls outside of such budgets when the UK will have achieved net zero. It is expected that the decommissioning activities will have achieved good levels of decarbonisation in line with applicable policy requirements at that time. The effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

22.10.56 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

IMPACT 5 - CLIMATE RESILIENCE OF THE PROPOSED DEVELOPMENT

O&M Phase

22.10.57 Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report identifies the following risks:

- increases in average and extreme air temperatures, both in winter and summer;
- increases in sea surface temperatures and ocean acidification;
- changes to rainfall patterns, leading to increased annual precipitation;
- increased frequency and intensity of extreme weather (i.e. storms);
- increased wind speeds and changes to wind patterns;
- increase in mean sea level;
- increased wave height; and
- changes in the tidal range.

22.10.58 These risks could lead to:

- efficiency losses and more frequent Wind Turbine shutdowns, reducing output of the Proposed Development;
- the failure of electrical equipment, increasing O&M activities;
- damage to Offshore Infrastructure, increasing O&M activities; and
- reduced accessibility for maintenance and inspection.

22.10.59 The receptor is considered to be of high sensitivity.

22.10.60 The impact is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report summarises the potential climatic changes in the coming decades and considers the potential consequences for the Proposed Development in a risk assessment format.

22.10.61 The risk assessment presented in Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report considers the hazard, exposure and vulnerability of the Proposed Development. The assessment of effects has considered the measures adopted as part of the Proposed Development (Table 22.12) in determining the significance of risk. Should an effect be significant, Additional Mitigation is presented where relevant to reduce the residual effect to negligible and not significant in EIA terms.

22.10.62 No risks to the Proposed Development due to climate change have been identified as significant (see Volume 3, Technical Appendix 22.1: Climatic Change Risk Assessment Technical Report). As such, the effect on the Proposed

Development has been determined to be of **Negligible adverse** which is not significant in EIA terms.

Decommissioning

22.10.63 Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report identifies the following risks:

- increases in average and extreme air temperatures, both in winter and summer; and
- increased frequency and intensity of extreme weather (i.e. storms).

22.10.64 These risks could lead to:

- the failure of equipment, increasing the duration of decommissioning activities;
- worker ill health due to overheating; and
- reduced accessibility for decommissioning activities due to worse weather conditions.

22.10.65 No risks to the Proposed Development due to climate change have been identified as significant (see Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report). As such, the effect on the Proposed Development has been determined to be of **Negligible adverse** which is not significant in EIA terms.

NET GHG IMPACTS OF THE PROPOSED DEVELOPMENT

22.10.66 As detailed in Section 22.8, the Proposed Development's whole life impact is an important consideration when assessing the Proposed Development's impacts and subsequent effects on climate change. As such, considering the Proposed Development's net emissions in the context of existing and emerging policy commitments and UK and Scottish Carbon Budgets is necessary.

22.10.67 Over its lifetime, the net impact of the Proposed Development would be between 1,941,314 tCO₂e and -35,121,026 tCO₂e, based upon a precautionary range derived from the calculations in Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report. This net impact considers the GHG emissions associated with disturbance to Blue Carbon habitats, materials and vessel movements during the construction, O&M and decommissioning phases, alongside the avoided emissions from the operation of the Proposed Development. Negative emissions represent net avoided emissions. The Proposed Development would have a carbon payback period¹ of two years (at the earliest, from the point of full commissioning of the Proposed Development) when accounting for construction, O&M and decommissioning phase emissions

¹ The carbon payback period is the time it takes for a renewable energy project to offset the GHGs emitted during its construction and begin displacing grid-based electricity generated from non-renewable sources. It should be noted that there is inherent uncertainty in such projections as the National Grid electricity factor changes from year to year as the fuel mix consumed in UK power stations changes, and as the proportion of net imported electricity also changes. As such, the true payback period would fall within the range presented.

(see Table 22.17 below). Given the operation of the Proposed Development would avoid the need for fossil fuel generators through the provision of renewable electricity, the associated avoided emissions would likely be greater than those presented in the conservative case (i.e. when using the long run marginal projections) resulting in a reduction to the conservative net effect scenario presented above.

Table 22.17: Summary of Proposed Development Net GHG Emissions

	DESNZ long run marginal	Current National Grid average	DESNZ 'non-renewable fuels'
Construction Emissions (tCO₂e)*	1,560,774		
O&M Emissions (tCO₂e)	270,929	-17,999,700	-36,791,410
Decommissioning Emissions (tCO₂e)	109,611		
Net Emissions (tCO₂e)	1,941,314	-16,329,315	-35,121,026
Payback Period (Years)	No Payback	3	2

*Including emissions associated with Blue Carbon. The greatest magnitude of potential Blue Carbon emissions have been reported within this table, to provide a conservative estimate of net GHG emissions from the Proposed Development.

22.10.68 Consideration of the Proposed Development's net emissions performance can be considered with the following contextualisation:

- it provides additional low carbon electricity generation capacity, contributing to the achievement of national net zero goals; and
- it is in keeping with Scottish and UK energy and climate policy.

22.10.69 The Proposed Development's net emissions accounting for activities up to the end of the UK Sixth Carbon Budget are detailed in Table 22.18 below. As the Proposed Development is anticipated to become fully operational by 2036, the avoided emissions resulting from the first two years of the O&M phase of the Proposed Development and all construction emissions lie within the scope of the currently quantified UK Carbon Budgets, which end in 2037. The Proposed Development's construction phase GHG emissions and the O&M phase emissions to the end of the Sixth Carbon Budget (2037), correspond to approximately 0.09% (long run marginal) to -0.09% (DESNZ 'non-renewable fuels') of the UK Carbon Budget for the same period.

Table 22.18: GHG Impacts in the Context of the UK's Carbon Budgets

	2028-2032*	2033-2037	Total
UK Carbon Budget (tCO₂e)	690,000,000	965,000,000	1,655,000,000
Proposed Development GHG Impacts (tCO₂e)	624,309	870,882 to -2,117,806	1,495,191 to -1,493,496
Proposed Development emissions as percentage of UK Carbon Budget (%)	0.09%	0.09% to -0.22%	0.09% to -0.09%

* This accounts for only two years of construction emissions and associated carbon budget, owing to the commencement of construction in 2031.

- 22.10.70 The Proposed Development's net emission intensity, when accounting for construction, O&M and decommissioning emissions alongside total generation output, is 27.3 gCO₂e/kWh. There are no established net emission intensity benchmarks available for the industry that the Proposed Development's net emission intensity can be compared against.
- 22.10.71 The Proposed Development is in line with the Scottish NMP's principle of supporting new offshore wind and marine renewable energy, in addition to their Offshore Infrastructure, in order to contribute to reductions in GHG emissions. In addition, the up to 1,005 MW capacity from the Proposed Development, based on current understanding, would contribute towards the UK Government's ambitions to increase low carbon electricity generation, with an anticipated doubling in electricity demand by 2050 (National Grid Energy System Operator (ESO), 2025).
- 22.10.72 Further, the Proposed Development is supported by national energy and climate change policy (including the Net Zero Strategy, Energy and Just Transition Plan and Scotland's Climate Change Plan) which highlight the need for an end to the use of unabated fossil fuel generation, whilst also significantly ramping up electricity generation capacity to meet the demands of increased electrification of transport, heat and industry. As such, UK and Scottish Government policy dictates that large-scale deployment of renewable energy generators such as the Proposed Development are necessary in order to meet GHG reduction targets.
- 22.10.73 In addition, National Grid modelling anticipates an increase in annual electricity demand across the UK to between 559 TWh and 797 TWh per year by 2050, compared to 290 TWh per year in 2023 (National Grid ESO, 2025). By facilitating the expansion of renewable energy supply, the Proposed Development would assist the UK Government target of achieving a fully decarbonised power system by 2035, and the UK and Scottish Government's aim to become net zero by 2050 and 2045 respectively.

Magnitude of Impact

- 22.10.74 The impact is predicted to be of international spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude of impact is calculated to be between 1,941,314 tCO₂e and -35,121,026 tCO₂e. This range reflects displacement of alternative energy generation sources from a range of future baseline scenarios, in order to provide additional context to the assessment.

Sensitivity of the Receptor

- 22.10.75 In accordance with Paragraph 22.8.17, the receptor is deemed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.

Significance of the Effect

- 22.10.76 Overall, the magnitude of the impact is deemed to be between 1,941,314 tCO₂e and -35,121,026 tCO₂e and the sensitivity of the receptor is considered to be high. As discussed in Paragraph 22.10.36 and 22.10.37, it is likely that the use of the long run marginal projections is likely to represent an underestimate of the

true value of avoided emissions from the Proposed Development. Further, construction phase emissions have been calculated based on precautionary calculations of material quantities as set out in Paragraph 22.6.21, which will be refined throughout the design stage.

22.10.77 Consistent with Paragraph 22.8.18, the magnitude of emissions comprise between 0.09% and -0.09% of the Fifth and Sixth UK Carbon Budgets (set out in Table 22.1). Within the context of national policy, the purpose of the Proposed Development is to provide a source of renewable energy, thereby contributing towards UK and Scottish climate change policy goals and associated renewable energy targets (in particular the respective net zero targets). In accordance with the definitions set out in Table 22.9 the effect will be of **Beneficial** effect, which is significant in EIA terms.

Additional Mitigation and Residual Effect

22.10.78 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is beneficial.

22.11 Inter-Related Effects

22.11.1 A description of the likely Inter-Related Effects arising from the Proposed Development on climate change is provided in Volume 2, Chapter 23: Inter-Related Effects.

22.11.2 Inter-relationships are considered to be the impacts and associated effects of different aspects of Bowdun OWF on the same receptor. Inter-related effects are considered to be either:

- Lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of Bowdun OWF (construction, O&M and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three project stages (e.g. underwater sound effects from piling, operational Wind Turbines, vessels and decommissioning);
- Receptor-led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on Infrastructure and Other Users, such as displacement of recreational activities and impacts to cables or pipelines or restrictions on access to these assets, may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects may be short-term, temporary or transient effects, or incorporate longer-term effects

22.11.3 As noted above, effects on climate change also have the potential to have secondary effects on other receptors and these effects are fully considered in the topic-specific chapters. These receptors and effects are:

- Volume 2, Chapter 7: Physical Processes:
 - potential changes in the tidal, storm or wind regimes due to the effects of climate change.

- Volume 2, Chapter 8: Benthic Ecology; Chapter 9: Fish and Shellfish Ecology; Chapter 10: Marine Mammals; Chapter 11: Ornithology; and Chapter 13: Commercial Fisheries:
 - potential changes in the sensitivity of habitats or species to development impacts in the future due to the effects of climate change (e.g. due to changes to species distribution patterns and/or local, national or international rarity).

22.12 Cumulative Effects Assessment

Methodology

- 22.12.1 In undertaking the CEA for the Proposed Development, it is important to bear in mind that other projects under consideration will have differing potential for proceeding to an operational stage and hence a differing potential to ultimately contribute to a cumulative impact alongside the Proposed Development. Therefore, a tiered approach has been adopted. This provides a framework for placing relative weight upon the potential for each project to be included in the CEA to ultimately be realised, based upon the project's current stage of maturity and certainty in the projects' parameters. The tiered approach utilised within the Proposed Development CEA employs the following tiers:
- Tier 1 – The onshore elements of the Project;
 - Tier 2 – Projects that have an application submitted, are consented, under construction or operational to the extent not already captured with the baseline;
 - Tier 3 – Projects which have submitted a scoping report and/or have received a scoping opinion; and
 - Tier 4 – Reasonably foreseeable projects including those with Crown Estate Scotland option or lease agreements.
- 22.12.2 All developments that emit, avoid or sequester GHGs have the potential to impact the atmospheric mass of GHGs as a receptor, and so may have a cumulative impact on climate change. Consequently, cumulative effects due to other specific local development projects are not individually considered but are taken into account when considering the impact of the Proposed Development by defining the atmospheric mass of GHGs as a high sensitivity receptor. Therefore Tier 2, Tier 3 and Tier 4 are not assessed in the CEA.
- 22.12.3 However, it is important to note that the Proposed Development cannot deliver the avoided emissions without the Onshore Transmission Assets (Tier 1) to enable connection to the National Grid. Therefore, the associated emissions from the construction, O&M and decommissioning phases of the Onshore Transmission Assets (Tier 1) must be considered within the cumulative assessment for this assessment alongside the Proposed Development emissions.
- 22.12.4 GHG emissions from the Onshore Transmission Assets have been calculated using MDS information available at the time of submission of the Onshore Transmission Assets. Detailed MDS information is provided in Volume 3,

Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report, which includes Greenhouse Gas assessment information for both onshore and offshore elements of the Project. Additionally, Volume 1, Chapter 16: Climate Change of the Onshore EIA Report for the Project (BOWFL, 2025) details the assessment and MDS which is also presented below in Table 22.19.

22.12.5 This cumulative assessment builds on the precautionary assessment set out in Volume 1, Chapter 16: Climate Change of the Onshore EIA Report for the Project (BOWFL, 2025), with net GHG emissions at the Project level provided in more detail.

Maximum Design Scenario

22.12.6 The MDS identified in Table 22.19 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. The cumulative effects presented and assessed in this section have been selected from the details provided in Volume 1, Chapter 3: Project Description to inform an MDS. Any other development scenario within the PDE, will result in in the same, or less, level of environmental effect.

Table 22.19: MDS Considered for Each Impact on Climate Change

Potential Cumulative Effect	Phase*			Tier	MDS
	C	O	D		
Emissions resultant from the Proposed Development together with (enabled by) the Onshore Transmission Assets, resulting in lifetime emissions for the Project	✓	✓	✓	1	<p>Construction Phase <u>Offshore Transmission and Generation Assets:</u></p> <ul style="list-style-type: none"> MDS for construction of the Proposed Development as described in Table 22.7. <p><u>Onshore Transmission Assets:</u></p> <ul style="list-style-type: none"> The greatest number of transport vehicles for the installation of the Onshore Transmission Assets (41,300 no. Heavy Goods Vehicles (HGVs)). The greatest area of Substation buildings: 5,146 m². Largest building up to 95 m in width, 25 m in length and 15 m in height. The maximum dimensions of cables: 22 km x 0.13 m (diameter) onshore export cables (9 no.), 1.2 km x 0.13 m (diameter) 400 kV cable (9 no.)). The maximum volume of cable protection (1,279 m³). The maximum dimensions of cable ducting for Onshore Export Cables and 400 kV Cables (119,040 m based on 22 km Onshore Export Cable with six ducts total, 2,400 m based on 1.2 km 400 kV Cable with two ducts total, 0.25 m maximum diameter, 7 mm wall thickness, construction from Unplasticized Polyvinyl Chloride (UPVC)). The maximum dimensions of ducting for Landfall and Onshore Cable Crossings (total length of onshore crossings equal 19,440 m, based on 18 crossings for nine ducts, each measuring 120 m in length, 0.35 m maximum diameter and 29 mm wall thickness; total length of landfall crossings equal 2,280 m, based on three crossings across 760 m length, 2.2 m maximum tunnel diameter, 800 mm maximum duct diameter, and 29 mm wall thickness). The maximum area of joint bays (58 m² per joint bay) and link boxes (4 m² per link box). The maximum number of joint bays (63 no.) and link boxes (63 no.). The maximum number of Transition Joint Bays (TJBs) at Landfall (3 no.) with maximum dimensions: 20 m (length) x 4 m (width) x 4 m (depth), 0.3 m wall and base thickness. The maximum number of HDD crossings for the Onshore Export Cable (18), with 9 associated ducts, each with a length of 120 m. There will be no HDD crossings for the grid connection cable. <p>O&M Phase <u>Offshore Transmission and Generation Assets:</u></p> <ul style="list-style-type: none"> MDS for O&M phase of the Proposed Development as described in Table 22.7. <p><u>Onshore Transmission Assets:</u></p>

Potential Cumulative Effect	Phase*			Tier	MDS
	C	O	D		
					<ul style="list-style-type: none"> The greatest number of maintenance vehicles across the lifetime of the Onshore Transmission Assets assuming one round trip per month over the 30-year O&M phase (360 no. total round trips). <p>Decommissioning Phase <u>Offshore Transmission and Generation Assets:</u></p> <ul style="list-style-type: none"> MDS for decommissioning phase of the Proposed Development as described in Table 22.7. <p><u>Onshore Transmission Assets:</u></p> <ul style="list-style-type: none"> As per the parameters listed for the Onshore Transmission Assets construction phase – manufacturing and installation.

* Proposed Development Phase refers to construction (C), O&M (O) and decommissioning (D).

Cumulative Effects Assessment

22.12.7 An assessment of the likely significance of the cumulative effects of the Proposed Development on climate change arising from each identified impact is given below.

EMISSIONS RESULTANT FROM THE PROPOSED DEVELOPMENT TOGETHER WITH (ENABLED BY) THE ONSHORE TRANSMISSION ASSETS, RESULTING IN LIFETIME EMISSIONS FOR THE PROJECT

Tier 1

22.12.8 This section presents an assessment of the GHG impacts during the construction, O&M and decommissioning phases from the Proposed Development, together with (enabled by) the Onshore Transmission Assets.

22.12.9 Calculation methodology for both the Offshore Transmission and Generation Assets (the Proposed Development) and the Onshore Transmission Assets are presented in Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report.

22.12.10 Table 22.20 sets out a summary of the cumulative GHG impacts, which are assessed in the sections below. This range reflects displacement of alternative energy generation sources from a range of future baseline scenarios, in order to provide additional context to the assessment. As mentioned in Paragraph 22.10.67, although a range of net GHG effects is provided for the Proposed Development, the operation of the Project would avoid the need for fossil fuel generators through the provision of renewable electricity. As such the associated avoided emissions would likely be greater than those presented in the conservative case (i.e. when using the long run marginal projections) resulting in a reduction to the conservative net effect scenario presented below.

Table 22.20: Net Whole Life GHG Emissions

Stage	Resulting emissions (tCO ₂ e)
Construction	Onshore: 129,640 Offshore: 1,560,774 TOTAL: 1,690,414
Operation and Maintenance	Onshore: 35 Offshore: 270,929 to -36,791,410 TOTAL: 270,965 to -36,791,375
Decommissioning	Onshore: 13,952 Offshore: 109,611 TOTAL: 123,563
Total	2,084,941 to - 34,977,399

Construction Phase

- 22.12.11 The below considers the embodied carbon emissions associated with materials, associated transportation emissions and disturbance of land/seabed use for the cumulative assessment.
- 22.12.12 Construction GHG emissions from the Proposed Development are set out in Table 22.13.
- 22.12.13 Key emissions sources from the Onshore Transmission Assets included in this assessment are:
- land use change (peat and woodland disturbance);
 - embodied carbon emissions in materials for the Onshore Transmission Assets required (the Substation, Onshore Export Cables and 400 kV cables, onshore cable crossings, cable protection, joint bays, TJBs and link boxes); and
 - onshore transport emissions during construction.
- 22.12.14 Table 22.20 presents the total construction phase emissions for the cumulative assessment. More details on the calculation methodology can be found in Volume 3, Technical Appendix 22.1: Climate Change Risk Assessment Technical Report.

Magnitude of Impact

- 22.12.15 The cumulative impact is predicted to be of international spatial extent, short term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude has been considered to be 1,690,414 tCO₂e for the construction phase.

Sensitivity of Receptor

- 22.12.16 In accordance with Paragraph 22.8.17, the receptor is deemed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.

Significance of Effect

- 22.12.17 Overall, the magnitude of the cumulative effect is deemed to be 1,690,414 tCO₂e and the sensitivity of the receptor is considered to be high. The magnitude of emissions comprise 0.10% and 0.18% of the Fifth and Sixth UK Carbon Budgets, respectively (as set out in Table 22.1). As construction spans the final two years of the Fifth budget and the first three years of the Sixth budget, impacts are apportioned accordingly. It should be noted however that construction phase emissions have been calculated based on precautionary calculations for material quantities. Therefore, representing a conservative scenario.
- 22.12.18 With the Additional Mitigation measures noted in Paragraph 22.10.27 above and in the Onshore EIA Report (BOWFL, 2025), it is considered that the impact of GHG emissions during construction would be reduced as far as feasibly practicable in line with the GHG reduction hierarchy. The Proposed Development would be in line with local and national policy for low carbon

design. In accordance with the criteria in Table 22.9 the residual effect is therefore assessed to be **Minor** adverse, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

- 22.12.19 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms. As set out in Paragraph 22.12.18 above, the cumulative assessment takes account of the Additional Mitigation set out in Paragraph 22.10.27.

O&M Phase

- 22.12.20 O&M GHG emissions from the Proposed Development are set out in Table 22.14 and Table 22.16. The range reflects displacement of alternative energy generation sources from a range of future baseline scenarios, in order to provide additional context to the assessment.
- 22.12.21 O&M GHG emissions from the Onshore Transmission Assets will arise from the consumption of materials and activities required to facilitate O&M, along with emissions from land use change. These emissions are presented in Table 22.20 and further details are included in Volume 3, Technical Appendix 22.2: Greenhouse Gas Assessment Technical Report.

Magnitude of Impact

- 22.12.22 The impact is predicted to be of international spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is considered to be an emissions impact of between 270,965 tCO₂e to -36,791,375 tCO₂e.

Sensitivity of Receptor

- 22.12.23 In accordance with Paragraph 22.8.17, the receptor is deemed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.

Significance of Effect

- 22.12.24 Overall, the magnitude of the cumulative effect is deemed to be 270,965 tCO₂e to -36,791,375 tCO₂e and the sensitivity of the receptor is considered to be high. As discussed in Paragraph 22.10.37, it is likely that the use of the long run marginal projections represents an underestimate of the true value of avoided emissions from the Proposed Development (and hence the Project). Additionally, emissions associated with O&M have been calculated based on precautionary calculations of material quantities and do not account for continued decarbonisation of UK industry, as set out in Paragraph 22.10.36. The magnitude of emissions comprise -0.01% to -0.32% of the Sixth UK Carbon Budget (set out in Table 22.1).
- 22.12.25 The Proposed Development, in-combination with the Onshore Transmission Assets, will produce electricity at an emissions intensity of 7.3 gCO₂e/kWh, based on the lifetime generation output presented in Table 22.15 and the cumulative O&M emissions set out in Table 22.20. This is lower than the current grid average (223 gCO₂e/kWh), fossil fuel generation (448 gCO₂e/kWh) and the CCC's electricity emissions intensity target for 2035 (10 gCO₂e/kWh) (CCC, 2020).

22.12.26 Within the context of national policy, the purpose of the Project is to provide a source of renewable energy, thereby contributing towards UK and Scottish climate change policy goals and associated renewable energy targets. Based on the definitions set out in Table 22.9 the cumulative effect will, therefore be of Beneficial effect, which is significant in EIA terms.

Additional Mitigation and Residual Effect

22.12.27 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Decommissioning Phase

22.12.28 At this stage, the approach to decommissioning the Proposed Development is still to be determined. However, it is anticipated that all structures above the seabed will be completely removed. Offshore Infrastructure, such as cables and Scour Protection below the seabed may either be left *in situ* or removed, in accordance with a Decommissioning Programme. It may be decided, closer to the time of decommissioning, that removal will result in greater environmental impacts than leaving components *in situ*.

22.12.29 As discussed in Paragraph 22.10.51, emissions associated with the disposal of materials at the end of their lifetime is considered to be immaterial and may even result in future avoided emissions through reuse or recycling of material. This impact is not assessed further. As such emissions associated with either leaving components *in situ* or removal and disposal are likely to be limited to the vessel and vehicle movements during decommissioning activities.

22.12.30 In alignment with the approach to decommissioning phase transport emissions for the Proposed Development (set out in Paragraph 22.10.52), it has been assumed that cumulative transport emissions equal those associated with the construction phase. These emissions are presented in Table 22.20.

Magnitude of Impact

22.12.31 The impact is predicted to be of international spatial extent, short term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude of impact is determined to be 123,563 tCO_{2e}. As mentioned in Paragraph 22.10.52, this value is precautionary and likely to be reduced after final design of the Proposed Development.

Sensitivity of Receptor

22.12.32 In accordance with Paragraph 22.8.17, the receptor is deemed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.

Significance of Effect

22.12.33 Overall, the magnitude of the cumulative impact is deemed to be 123,563 tCO_{2e} and the sensitivity of the receptor is considered to be high. The magnitude of emissions is unable to be contextualised within the UK Carbon Budgets, given the decommissioning phase falls outside of such budgets when the UK will have achieved net zero. It is expected that the decommissioning activities will have achieved good levels of decarbonisation in line with applicable policy requirements at that time. Based on the definitions set out in Table 22.9, the

cumulative effect will, therefore be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

22.12.34 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Net Cumulative GHG Impacts of the Project

Magnitude of Impact

22.12.35 The assessment considers the lifetime cumulative net GHG emissions, including the net emissions from the Proposed Development and the Onshore Transmission Assets. This has been summarised within Table 22.20 above.

22.12.36 Although the whole lifecycle and combined emission totals likely overstate the predicted GHG impact due to conservative assumptions, as set out in Paragraph 22.6.21, avoided emissions during the O&M of the Proposed Development through the displacement of alternative electricity generation sources result in a beneficial contribution to the UK and Scotland meeting its emission reduction targets.

22.12.37 The Project would likely have a carbon payback period of two years (at the earliest) when accounting for construction, O&M and decommissioning phase emissions from both the Proposed Development and Onshore Transmission Assets.

22.12.38 The cumulative impact is predicted to be of international spatial extent, long term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be between 2,084,941 tCO₂e and -34,977,399 tCO₂e.

22.12.39 In accordance with IEMA (2022) Guidance, the magnitude of impact has also been contextualised against the UK Carbon Budgets. Note that these Carbon Budgets do not cover the whole lifetime of the Project, as discussed in Paragraph 22.10.69. Cumulative net emissions have been contextualised within the UK Fifth and Sixth Carbon Budgets (Table 22.21).

Table 22.21: Cumulative GHG Impacts in the Context of the UK’s Fifth and Sixth Carbon Budgets

	2028-2032*	2033-2037	Total
UK Carbon Budget (tCO₂e)	690,000,000	965,000,000	1,655,000,000
Cumulative GHG Impacts (tCO₂e)	676,165	948,668 to -2,040,019	1,624,834 to -1,363,854
Cumulative emissions as percentage of UK Carbon Budget (%)	0.10%	0.10% to -0.21%	0.10% to -0.08%

* This accounts for only two years of construction emissions and associated carbon budget, owing to the commencement of construction in 2031.

22.12.40 The Project’s cumulative net emission intensity, when accounting for cumulative construction, O&M and decommissioning emissions alongside total generation output is 29 gCO₂e/kWh. There are no established net emission intensity benchmarks available for the industry that the net emission intensity can be compared against.

Sensitivity of Receptor

- 22.12.41 In accordance with Paragraph 22.8.17, the receptor is deemed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.

Significance of Effect

- 22.12.42 Overall, the magnitude of the cumulative effect is deemed to be between 2,084,941 tCO₂e and -34,977,399 tCO₂e. As discussed in Paragraph 22.10.36, it is likely that the use of the long run marginal projections represents an underestimate of the true value of avoided emissions from the Project.

- 22.12.43 The sensitivity of the receptor is considered to be high.

- 22.12.44 In addition, within the context of national policy, the purpose of the Proposed Development is to provide a source of renewable energy, thereby contributing towards UK and Scottish climate change policy goals and associated renewable energy targets (in particular the respective net zero targets). Based on the definitions set out in Table 22.9, the cumulative effect will, therefore, be Beneficial, which is significant in EIA terms.

Additional Mitigation and Residual Effect

- 22.12.45 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is beneficial.

22.13 Proposed Monitoring

- 22.13.1 No project specific monitoring measures are proposed given that no significant impacts are predicted from the Proposed Development alone or cumulatively with other plans and projects.

22.14 Transboundary Effects

- 22.14.1 All developments which emit GHGs have the potential to impact the atmospheric mass of GHGs as a receptor (this includes manufacturing of materials in other territories) and so may have a transboundary impact on climate change. Consequently, transboundary effects due to other specific international development projects are not individually identified but would be taken into account when considering the impact of the Proposed Development by defining the atmospheric mass of GHGs as a high sensitivity receptor. Other countries have their own policies and targets concerning carbon and climate change which are intended to limit GHG emissions to acceptable levels within that country's defined budget and international commitments.

22.15 Summary of Impacts, Mitigation, Likely Significant Environmental Effects and Monitoring

- 22.15.1 Information on climate change within the Climate Change Study Area was collected through a detailed desktop review of existing studies and datasets. This information is summarised in Table 22.6.
- 22.15.2 Table 22.22 presents a summary of the potential impacts, Embedded Mitigation and the conclusion of likely significant environmental effects in EIA terms in respect to climate change. The impacts assessed include:

- GHG emissions arising from the disturbance of Blue Carbon systems and seabed change, including benthic and subtidal/intertidal ecology, during the construction, O&M and decommissioning phases;
- GHG emissions arising from the manufacturing and installation of the Proposed Development;
- GHG emissions arising from the consumption of materials and activities required to facilitate the O&M of the Proposed Development and estimated abatement of National Grid emissions;
- GHG emissions arising from decommissioning works of the Proposed Development;
- climate change resilience of the Proposed Development; and
- net GHG impacts of the Proposed Development.

22.15.3 Overall, considering the Embedded and Additional Mitigation set out within this chapter, it is concluded that there will be no likely significant residual adverse environmental effects arising from the Proposed Development during the construction, O&M and decommissioning phases.

22.15.4 Table 22.23 presents a summary of the potential cumulative impacts, Embedded Mitigation and the conclusion of likely significant environmental effects on climate change in EIA terms.

22.15.5 The cumulative effects assessed include:

- emissions resultant from the Proposed Development together with (enabled by) the Onshore Transmission Assets, resulting in lifetime emissions for the Project; and
- net cumulative GHG impacts of the Project.

22.15.6 Overall, it is concluded that there will be likely significant beneficial cumulative effects from the Proposed Development alongside the Onshore Transmission Assets due to the avoided emissions resultant from the Project. By providing approximately 1,005 MW of renewable electricity generation capacity, the Proposed Development will contribute to the achievement of local and national net zero goals, and is in keeping with Scottish and UK energy and climate policy. In particular, the UK's Net Zero Strategy and Scotland's Energy and Just Transition Plan highlight the need for phase-out of unabated fossil fuel generation whilst also substantially ramping up electricity generation capacity to meet the demands of increased electrification of transport, heat and industry. As such, UK and Scottish Government policy dictates that large-scale deployment of renewable energy generation capacity, such as the Proposed Development, is necessary in order to meet net zero goals.

22.15.7 No likely significant transboundary effects have been identified in regard to effects of the Proposed Development.

Table 22.22: Summary of Assessment of Significance

Description of Impact	Embedded Mitigation ID	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Additional Mitigation	Significance of Residual Effect	Proposed Monitoring
Construction Phase							
GHG emissions arising from the disturbance of Blue Carbon systems and seabed change, including benthic and subtidal/intertidal ecology, during the construction, O&M and decommissioning phases	N/A	5,526 tCO ₂ – 27,629 tCO ₂	High	Minor adverse	None	Minor Adverse	None proposed.
GHG emissions arising from the manufacturing and installation of the Proposed Development	5, 7, 18, 32	1,533,145 tCO ₂ e	High	Moderate adverse	The Applicant commits to exploring options to minimise construction related emissions during detailed design by: <ul style="list-style-type: none"> • implementing measures to switch GHG emissions ('build less'); • implementing measures to substitute materials ('design clever'); and • optimising construction processes ('construct efficiently'). 	Minor Adverse	None proposed.
Net GHG impacts of the Proposed Development	5, 7, 18, 32, 33, 40	1,941,314 tCO ₂ e - 35,121,026 tCO ₂ e	High	Beneficial	None	Beneficial	None proposed.
O&M Phase							
GHG emissions arising from the consumption of materials and activities required to facilitate the O&M of the Proposed Development and estimated abatement of National Grid emissions	5, 18, 33	270,929 tCO ₂ e - 36,791,410 tCO ₂ e	High	Beneficial	None	Beneficial	None proposed.
Climate Resilience of the Proposed Development	2, 23, 33, 51, 52	N/A	High	Negligible adverse	None	Negligible Adverse	None proposed.
Net GHG impacts of the Proposed Development	5, 7, 18, 32, 33, 40	1,941,314 tCO ₂ e - 35,121,026 tCO ₂ e	High	Beneficial	None	Beneficial	None proposed.
Decommissioning Phase							
GHG emissions arising from decommissioning works of the Proposed Development	5, 18, 40	109,611 tCO ₂ e	High	Minor adverse	None	Minor Adverse	None proposed.
Net GHG impacts of the Proposed Development	5, 7, 18, 32, 33, 40	1,941,314 tCO ₂ e - 35,121,026 tCO ₂ e	High	Beneficial	None	Beneficial	None proposed.

Table 22.23: Summary of Cumulative Effects Assessment

Description of Impact	Phase	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Additional Mitigation	Significance of Residual Effect	Proposed Monitoring
Emissions resultant from the Proposed Development together with (enabled by) the Onshore Transmission Assets, resulting in lifetime emissions for the Project	Construction	C: 1,690,414 tCO ₂ e	All Phases: High	Minor adverse	None	Minor Adverse	None proposed.
	O&M	O&M: 270,965 tCO ₂ e - 36,791,375 tCO ₂ e		Beneficial		Beneficial	
	Decommissioning	D: 123,563 tCO ₂ e		Minor adverse		Minor Adverse	
Net cumulative GHG impacts of the Project	Construction	2,084,941 tCO ₂ e - 34,977,399 tCO ₂ e	High	Beneficial	None	Beneficial	None proposed.
	O&M						
	Decommissioning						

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