Morven North Offshore Wind Array Project

Environmental Impact Assessment Report

Volume 2, Chapter 18: Climate Change

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18.1 Introduction

18.1.1.1 This chapter of the Morven North Offshore Wind Array Project (hereafter "Morven North") Environmental Impact Assessment (EIA) Report presents the assessment of the Likely Significant Effects (LSE[1]) (as per the "EIA Regulations") on and from climate change. Specifically, this chapter considers the potential impacts of Morven North on and from climate change during the construction, Operation and Maintenance (O&M), and decommissioning phases.

18.1.1.2 Climate change in the context of EIA can be considered broadly as two aspects:

- the effect of Greenhouse Gas (GHG) emissions caused directly or indirectly by Morven North which may have the potential to contribute to climate change;
- the potential effect of climate change on Morven North, which could affect Morven North directly or could modify its other potential environmental impacts. Consideration of In-Combination Climate Impacts (ICCI) is presented within Volume 3, Annex 18.3: In-Combination Climate Change Impact Assessment.

18.1.1.3 The assessment presented in this chapter has relied upon, or informed the following technical chapters and reports:

- Volume 3, Annex 18.1: Shared Climate Change Risk Assessment (CCRA);
- Volume 3, Annex 18.2: Climate Change Shared Greehouse Gases Technical Report;
- Volume 3, Annex 8.1: Benthic Subtidal Ecology Shared Technical Report.

18.1.1.4 Climate change was considered in the Scoping Report for the Morven Option Lease Agreement Site (hereafter, "the Morven Site Scoping Report"), (Morven Offshore Wind Limited (MvOWL), 2023). As described in Volume 1, Chapter 4: Site Selection and Consideration of Alternatives, the Morven Option Lease Agreement Site (hereafter, "Morven Site") has since been divided into two distinct projects, Morven North and The Morven South Offshore Wind Array Project (hereafter, "Morven South").

18.1.1.5 The potential impacts to and from climate change are considered to generally be the same for Morven North as the potential impacts identified in the Morven Site Scoping Report. Consequently, there has been no change in the methodology or impacts that were scoped in or out in the Morven Site Scoping Report for climate change. The advice provided by the Marine Directorate–Licensing and Operations Team (MD-LOT) in the Morven Site Scoping Opinion (MD-LOT, 2023) has therefore been considered for the development of this chapter.

18.1.1.6 This chapter presents and assesses refined parameters for Morven North and explains if and how any assessment aspects differ from the information set out in the Morven Site Scoping Report.

18.2 Study area

18.2.1.1 Figure 18.1 illustrates the Morven North Climate Change Study Area which encompasses the Morven North Boundary (i.e. the area in which project infrastructure will be located).

18.2.1.2 The Morven North Climate Change Study Area and associated assessment is considered in the context of the domestic and international scope as developed on the basis of established Institute of Environmental Management and Assessment (IEMA) guidance (IEMA, 2022) utilised throughout this chapter.

18.2.1.3 The domestic scope considers the local and national policy and targets concerning GHG and climate resilience. The international scope considers GHG emissions, which have a global (international) effect rather than directly affecting any specific local receptor. The impact of GHG emissions

occurring due to Morven North on the global atmospheric concentration of the relevant GHGs, expressed in carbon dioxide equivalents (CO_2e), is therefore considered within this assessment.

18.2.1.4 The Morven North Climate Change Study Area and Morven South Climate Change Study Area was presented and agreed during the scoping process for the Morven Site. The underlying principles used to define the Morven North Climate Change Study Area have not changed, other than the limits have been applied relative to the Morven North Boundary, rather than the Morven Site Boundary. The Morven North Climate Change Study Area was presented to and confirmed by the MD-LOT via a "Targeted Consultation Exercise" undertaken in March, 2025 and as detailed in Table 18.4.

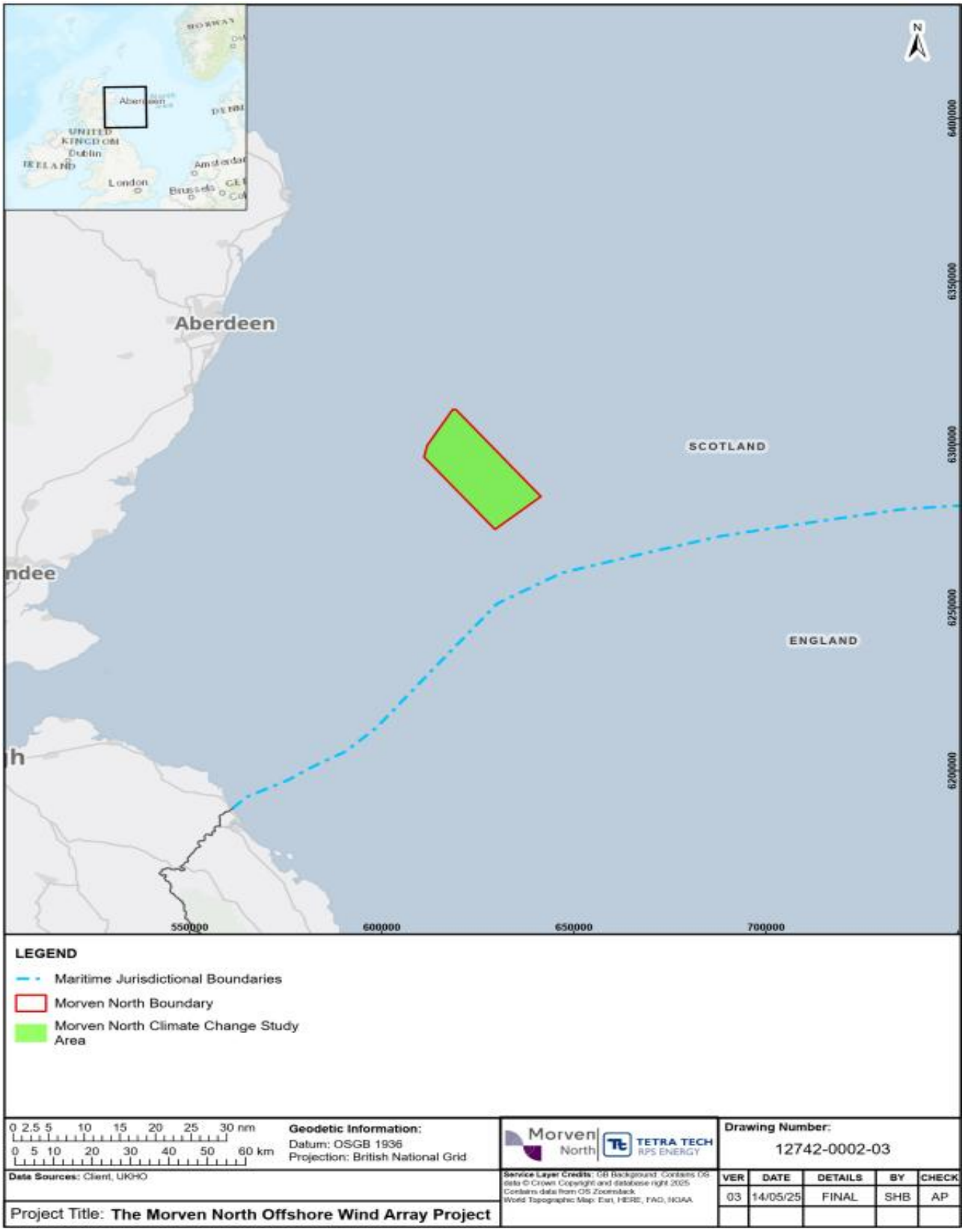

Figure 18.1: Climate Change Study Area for Morven North Offshore Wind Array Project

18.3 Policy and legislative context

18.3.1.1 Policy and legislation on renewable energy infrastructure is presented in Volume 1, Chapter 2: Policy and Legislation. Policy and legislation specific to climate change is contained in the Scottish National Marine Plan (NMP) (Scottish Government, 2015) and the United Kingdom (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 18.1 below, with other relevant policy provisions set out in Table 18.2, Table 18.3 and Table 18.4.

18.3.1.2 There are no relevant polices specific to climate change effects in the Sectoral Marine Plan (SMP) for Offshore Wind Energy (Scottish Government, 2020a, 2025 (update in draft)). As such, this Plan has not been considered further.

Table 18.1: Summary of climate change legislation relevant to Climate Change

Summary of relevant legislation	How and where considered in the Morven North EIA Report
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 five year period if the budget for the period is to be met) for the whole of the UK. At present, the Third, Fourth, Fifth and Sixth Carbon Budgets, set through The Carbon Budget Orders 2009, 2011, 2016 and 2021 are 2,544 mega tonnes carbon dioxide equivalent ($MtCO_2e$) for 2018 to 2022, 1,950 $MtCO_2e$ for 2023 to 2027, 1,725 $MtCO_2e$ for 2028 to 2032 and 965 $MtCO_2e$ for 2033 to 2037 respectively. The Sixth Carbon Budget is the first Carbon Budget that is consistent with the UK's net zero target, requiring a 78% reduction in GHG emissions by 2035 from 1990 levels.	Section 18.13 provides an assessment of GHG emissions of Morven North. A detailed assessment is provided within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. The assessment considers whether the emissions associated with Morven North are in line with the UK's net zero target. The net GHG emissions impact of Morven North is contextualised against the UK Carbon Budgets in Section 18.11.6. Section 18.11.7 provides an assessment of climate risk and resilience for the relevant elements of Morven North. A detailed assessment is provided within Volume 3, Annex 18.1: Shared Climate Change Risk Assessment.
Climate Change (Scotland) Act 2009, as amended by the Climate Change (Emissions Reduction Targets) (Scotland) Act 2024	
The Climate Change (Scotland) Act 2009, as amended (2024) sets out Scotland's net zero emissions target date of 2045. The Climate Change (Emissions Reduction Targets) (Scotland) Act 2024 legislates for five-year carbon budgets to set climate targets. This replaces annual emissions targets. At present, no carbon budgets have been set, but indicate budgets have been proposed. The carbon budgets are proposed to be set at 175 $MtCO_2e$ for 2026 to 2030, 126	Section 18.13 provides an assessment of GHG emissions arising from the construction, O&M and decommissioning of Morven North. A detailed assessment is provided with Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. As Scottish Carbon Budgets are not yet available, such emissions are contextualised within the UK Carbon Budgets.

Summary of relevant legislation	How and where considered in the Morven North EIA Report
$MtCO_2e$ for 2031 to 2035, 81 $MtCO_2e$ for 2036 to 2040, and 24 $MtCO_2e$ for 2041 to 2045 respectively.	
United Kingdom's Nationally Determined Contribution (Department for Business, Energy and Industrial Strategy (DESNZ), 2025a)	
The UK's nationally determined contribution (DESNZ, 2025a) under the Paris Agreement to the United Nations (UN) Framework Convention on Climate Change (UNFCCC) (UN, 2015), submitted in September 2022, commits the UK to reducing economy wide GHG emissions by at least 81% by 2035, compared to 1990 levels.	The assessment of net GHG effects (Section 18.11.6) considers whether Morven North's emissions are in line with relevant national policy and legislation, as discussed in Section 18.8.4.

Table 18.2: Summary of the Scottish National Marine Plan relevant to Climate Change (Scottish Government, 2015)

Summary of relevant policy	How and where considered in the Morven North EIA Report
GEN5 Climate Change	
"Marine planners and decision makers must act in the way best calculated to mitigate, and adapt to, climate change." 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.	Section 18.13 provides an assessment of GHG emissions associated with Morven North. A detailed assessment is provided within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. Section 18.11.7 provides an assessment of climate risk and resilience for the relevant elements of Morven North. A detailed assessment is provided within Volume 3, Annex 18.1: Shared Climate Change Risk Assessment.
Chapter 11: Offshore Wind and Marine Renewable Energy Policies	
The following key objectives and policies relevant to climate change are included within chapter 11: 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 $50gCO_2/kWh$ by 2030 (to cut carbon emissions from electricity generation by more than four-fifths)." 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."	Volume 1, Chapter 2: Policy and Legislation provides a summary of the policy and legislative background for Morven North, including the need for new renewable energy capacity and offshore wind generation as identified in UK and Scottish policy. The assessment of significance of net GHG effects of Morven North (Section 18.11.6), has considered emissions associated with Morven North and associated generated electricity. Section 18.11.7 provides an assessment of climate risk and resilience for the relevant elements of Morven North. A detailed assessment is provided with Volume 3, Annex 18.1: Shared Climate Change Risk Assessment. An assessment of the risks of major accidents and disasters to Morven North from climate change is

Summary of relevant policy	How and where considered in the Morven North EIA Report
The following text is also relevant in providing context to the above objectives and policies: "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 50gCO_2e/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." "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."	provided in Volume 2, Chapter 19: Major Accidents and Disasters.

Table 18.3: Summary of United Kingdom Marine Policy Statement relevant to Climate Change (Defra, 2011)

Summary of relevant policy	How and where considered in the Morven North EIA Report
Section 2.6.7 Climate Change Adaptation and Mitigation & Section 3.3 Energy Production and Infrastructure Development	
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). In marine planning and decision-making consideration will need to be given to how the marine environment can adapt to the impacts of climate change When developing Marine Plans, marine plan authorities should make an assessment of likely and potential impacts from climate change and their implications for the location or timing of development and activities over the plan period and beyond (paragraph 2.6.7.7). The assessment should be made in consultation with the relevant statutory agencies. If any adaptation measures give rise to consequential or additional impacts, such as on coastal change, as a result of protecting a	Volume 1, Chapter 2: Policy and Legislation provides a summary of the policy and legislative background for Morven North, including the need for new renewable energy capacity and offshore wind generation as identified in UK and Scottish policy. Section 18.11.7 provides an assessment of climate risk and resilience for the relevant elements of Morven North. A detailed assessment is provided with Volume 3, Annex 18.1: Shared Climate Change Risk Assessment.

Summary of relevant policy	How and where considered in the Morven North EIA Report
development against flood risk or coastal change for example, the marine plan authority should consider their impacts in relation to the Marine Plan as a whole (paragraph 2.6.7.9). Increasing the generation of energy from low carbon sources will mitigate against climate change, lessen the UK's dependence on fossil fuels and improve energy security by increasing the diversity of electricity supply (paragraph 3.3.16).	

18.3.1.3 National climate change policy in relation to renewable energy infrastructure provides overarching guidance for the contribution of Morven North towards government targets. These policies are set out in Table 18.4.

Table 18.4: Summary of national Climate Change policy and legislation relevant to Climate Change

Summary of relevant policy	How and where considered in the Morven North EIA Report
National Planning Framework 4 (NPF4) (Scottish Government, 2023)	
Policy 1: Tackling the climate and nature crises "When considering all development proposals significant weight will be given to the global climate and nature crises". Policy 2: Climate mitigation and adaptation This policy sets out that developments should consider climate change in the following ways: "Development proposals will be sited and designed to minimise lifecycle GHG emissions as far as possible. Development proposals will be sited and designed to adapt to current and future risks from climate change".	The assessment of significance of net GHG effects of Morven North (Section 18.11.6), has Morven North's contribution to national climate change policy, including renewable energy capacity targets. Section 18.13 provides an assessment of GHG emissions of Morven North, including an assessment of net whole lifetime GHG impacts of Morven North in Section 18.11.6. A detailed assessment is provided with Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. Section 18.11.7 provides an assessment of climate risk and resilience for the relevant elements of Morven North. A detailed assessment is provided with Volume 3, Annex 18.1: Shared Climate Change Risk Assessment. An assessment of the risks of major accidents and disasters to Morven North from climate change is provided in Volume 2, Chapter 19: Major Accidents and Disasters.
Net Zero Strategy: Build Back Greener (Department for Business, Energy and Industry Strategy (BEIS), 2021)	
This strategy (BEIS, 2021) 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. This strategy sets out the ambition to fully decarbonise the UK's power system by 2035, with electricity sourced predominantly from offshore wind generation.	Volume 1, Chapter 2: Policy and Legislation provides a summary of the policy and legislative background for Morven North, including the need for new renewable energy capacity and offshore wind generation as identified in UK and Scottish policy. Section 18.13 provides an assessment of GHG emissions of Morven North arising from the construction, O&M, and decommissioning phase activities. A detailed assessment is provided with

Summary of relevant policy	How and where considered in the Morven North EIA Report
It also highlights the role that electrification will play in decarbonisation of transport, heat and industry, with electricity demand anticipated to double by 2050. 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.	Volume 3, Annex 18.2: Climate Change Shared Greehouse Gases Technical Report. Within Section 18.11.3, the assessment includes emissions resulting from construction of Morven North, in particular emissions resulting from the manufacturing of materials required for Morven North. The assessment of significance of GHG effects of Morven North (Section 18.11.6), has considered Morven North's contribution to national climate change policy, including renewable energy capacity targets. Secondary mitigation has been outlined within paragraph **Error! Reference source not found.**, which would enable the reduction of embodied carbon associated with the construction phase.
This strategy (BEIS, 2021) 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. This strategy sets out the ambition to fully decarbonise the UK's power system by 2035, with electricity sourced predominantly from offshore wind generation. It also highlights the role that electrification will play in decarbonisation of transport, heat and industry, with electricity demand anticipated to double by 2050. 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.	Volume 1, Chapter 2: Policy and Legislation provides a summary of the policy and legislative background for Morven North, including the need for new renewable energy capacity and offshore wind generation as identified in UK and Scottish policy. Section 18.13 provides an assessment of GHG emissions of Morven North arising from the construction, O&M, and decommissioning phase activities. A detailed assessment is provided with Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. Within Section 18.11.3, the assessment includes emissions resulting from construction of Morven North, in particular emissions resulting from the manufacturing of materials required for Morven North. The assessment of significance of GHG effects of Morven North (Section 18.11.6), has considered Morven North's contribution to national climate change policy, including renewable energy capacity targets. Secondary mitigation has been outlined within paragraph **Error! Reference source not found.**, which would enable the reduction of embodied carbon associated with the construction phase.
Addressing Carbon Leakage Risk to Support Decarbonisation (HM Treasury and Department for Energy Security and Net Zero (DESNZ), 2023)	
This consultation response (HM Treasury and DESNZ, 2023) sets out the measures that the UK Government is exploring or committed to in order to address carbon leakage, whereby production of emissions-intensive products is transferred to another country, resulting in increased emissions abroad and reduced production in the UK.	Section 1.13 provides an assessment of GHG emissions of Morven North. A detailed assessment is provided with Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. Within Section 18.11.3, emissions associated with the construction phase have been presented within the assessment and quantification of GHG

Summary of relevant policy	How and where considered in the Morven North EIA Report
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.	emissions, as part of Morven North, whether these emissions occur within or outside the territorial boundaries of the UK.
Powering Up Britain: The Net Zero Growth Plan (DESNZ, 2023c)	
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" (DESNZ, 2023c). 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 (CCUS) abating emissions from these transition fuel sources.	Volume 1, Chapter 2: Policy and Legislation, provides a summary of the policy and legislative background for Morven North, including the need for new renewable energy capacity and offshore wind generation as identified in UK and Scottish policy. Section 18.13 provides an assessment of GHG emissions of Morven North. A detailed assessment is provided with Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. Within Section 18.11.4, the assessment includes emissions avoided as a result of the displacement of alternative generation sources by the renewable energy generated by Morven North. In recognition of the role that transition fuels may play, a range of alternative generation sources are presented for assessment.
Draft Energy and Just Transition Plan (Scottish Government, 2023)	
The draft Energy and Just Transition Plan (Scottish Government, 2023), an update to the Scottish Energy Strategy (Scottish Government, 2017) outlines how Scotland can transition towards cleaner energy. Key policies include: More than 20 GW of onshore and offshore renewable electricity by 2030. Accelerated decarbonisation of domestic industry, transport and heat. Generation of surplus electricity, enabling export of electricity to support decarbonisation UK- and Europe-wide.	Volume 1, Chapter 2: Policy and Legislation, provides a summary of the policy and legislative background for Morven North, including the need for new renewable energy capacity and offshore wind generation as identified in UK and Scottish policy. Section 18.13 provides an assessment of GHG emissions of Morven North. A detailed assessment is provided with Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. The assessment of significance of net GHG effects of Morven North (Section 18.11.6), has considered Morven North's contribution to national climate change policy.
Clean Power 2030 Action Plan (DESNZ 2025b)	
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,	Volume 1, Chapter 2: Policy and Legislation provides a summary of the policy and legislative background for Morven North, including the need for new renewable energy capacity and offshore wind generation as identified in UK and Scottish policy.

Summary of relevant policy	How and where considered in the Morven North EIA Report
thereby reducing carbon emissions and promoting a sustainable energy future.	Section 18.13 provides an assessment of GHG emissions of Morven North. A detailed assessment is provided with Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. Within Section 18.11.4, the assessment includes emissions avoided as a result of the displacement of alternative generation sources by the renewable energy generated by Morven North. In recognition of the role that transition fuels may play, a range of alternative generation sources are presented for assessment.

18.4 Consultation

18.4.1.1 The approach to consultation for Morven North is set out in Volume 1, Chapter 5: Consultation. A summary of the issues raised during consultation activities undertaken to date specific to climate change is presented in Table 18.5, together with how these issues have been considered by Morven Offshore Wind Limited (MvOWL, hereafter referred to as "the Applicant") in the production of this Climate Change EIA Report Chapter. Further detail is presented within Volume 3, Annex 5.1: Consultation.

Table 18.5: Summary of key consultation issues raised during consultation activities undertaken for Morven North of relevance to Climate Change

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
30 November 2023	MD-LOT Scoping Opinion	"The Scottish Ministers are broadly content with the Developer's approach in assessing climate change and GHG in Section 9.8 of the Scoping Report, note that the IEMA EIA Guide "Assessing GHG Emissions and Evaluating their Significance" ("IEMA GHG Guidance") referenced by the Developer, provides further insight on this matter. The Scottish Ministers have considered this together with the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 and the requirement of the EIA Regulations to assess significant effects from the Proposed Development on climate. The Scottish Ministers therefore advise that the GHG Assessment should include the pre-construction, construction, operation and decommissioning phases, including consideration of the supply chain as well as benefits beyond the life cycle of the Proposed Development. The NatureScot and East Lothian Council representations regarding climatic factors and GHG assessment must be fully addressed by the Developer in the EIA Report."	Sections 18.11.2 to 18.11.5, and 18.11.6 provide an assessment of GHG emissions arising from the construction, operation and decommissioning phases of Morven North. The GHG assessment takes a whole-life approach to the assessment of GHG effects, including emissions from the supply chain and avoided emissions from the displacement of alternative generation sources by the renewable energy generated by Morven North. Pre-construction emissions are considered to comprise site clearance works (e.g. boulder clearance), which have been assessed within the scope of the construction phase. The NatureScot and East Lothian Council representations are responded to within this table (representations from Nature Scot dated 24 August 2023 and East Lothian dated 24 August 2023).
30 November 2023	MD-LOT Scoping Opinion	"Alongside the GHG assessment, the Scottish Ministers highlight the NatureScot representation in relation to blue carbon assessment. The Scottish	The impact of GHG emissions arising from seabed changes (i.e. assessment

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		Ministers advise that consideration should be given to impacts on blue carbon as a result of the Proposed Development, as well as an expanded assessment for benthic ecology focusing on potential impacts on marine sediments".	of impacts to blue carbon) is presented within Section 18.11.2. An assessment of impacts to benthic ecology is detailed within Volume 2, Chapter 8: Benthic Subtidal Ecology.
30 November 2023	NatureScot Scoping Opinion	"The impact of climate change effects should be considered, both in futureproofing the project design and how certain climate stressors may work in combination with potential effects from the proposed wind farm. The EIA Report should also consider the carbon cost of the wind farm (including supply chain) and to what extent this is offset through the production of green energy".	The impact of climate change on Morven North is considered in Volume 3, Annex 18.1: Shared Climate Change Risk Assessment, the conclusions of which are summarised within Section 18.11.7. Consideration of ICCI is presented within each technical chapter where relevant and appropriate and within Volume 3, Annex 18.3: In-combination Climate Change Impact (ICCI) Assessment. The GHG assessment takes a whole-life approach to the assessment of GHG effects to calculate the 'carbon cost' of Morven North, including emissions from the supply chain and avoided emissions from the displacement of fossil fuels. This is detailed within Sections 18.11.2 to 18.11.5, and 18.11.6.
30 November 2023	NatureScot Scoping Opinion	"We recommend that consideration is given to impacts on blue carbon and whether or not an assessment can be undertaken. This should expand on the information and assessment conducted for benthic ecology to focus on the	The impact of GHG emissions arising from seabed changes (i.e. assessment of impacts to blue carbon) is presented within Section 18.11.2.

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		potential impacts of the proposed development on marine sediments".	An assessment of impacts to benthic ecology is detailed within Volume 2, Chapter 8: Benthic Subtidal Ecology.
30 November 2023	East Lothian Council Scoping Opinion	"There will be emissions associated with the project, which are proposed to be assessed balanced against emissions in comparison to position without the project… A lifecycle calculation based on published Environmental Product Declarations (EPDs) is suggested, though the method for calculating emissions from sea bed change is not entirely clear. This would give an estimate of total emissions of the project as proposed. This would then be compared against the carbon intensity of the alternative grid average and the displaced marginal generation source (i.e. what would supply the grid in the absence of the project). This is a reasonable approach as undoubtedly demand for electricity will increase. The Scoping Report recognises (paragraph 9.8.5.4) that the carbon intensity of baseline generation is likely to reduce over time. The calculation is therefore likely to be different depending on when the scheme is built. This should be recognised in the information provided. The GHG emissions of the means of connection should be included in the	Sections 18.11.2 to 18.11.5, and 18.11.6 provide an assessment of GHG emissions arising from the construction, operation and decommissioning phases of Morven North. The GHG assessment takes a whole-life approach to the assessment of GHG effects, including emissions from the supply chain and avoided emissions from the displacement of alternative generation sources by the renewable energy generated by Morven North. The impact of GHG emissions arising from seabed changes (i.e. assessment of impacts to blue carbon) is presented within Section 18.11.2. Detailed methodology used to calculate whole-life emissions is provided with Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. The Cumulative Effects Assessment (CEA) detailed at Section 18.13 considers the net GHG impacts arising from Morven North alongside the Morven Hawthorn Pit Grid Connection Project (hereafter, "MHPGC Project") and the Morven Branxton Area Grid Connection Project (hereafter, "MBAGC

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		calculation, not considered as cumulative or separate. However, the potential for differences between methods of construction, design (for example more small wind turbines or fewer, larger wind turbines) or choice of wind turbine should also be included. This will allow the decision maker to understand not only the impact of the scheme overall but also the climate emissions impact of choices that are made on the details of design, location and construction method."	Project"). Given these are distinct projects, which together comprise the Morven Programme, it is not considered appropriate to account for them within the main assessment presented within Section 18.11. The assessment of whole-life GHG emissions considers a Maximum Design Scenario (MDS), detailed within Table 18.12, which assesses the design of Morven North which will result in the greatest potential for GHG emissions. Within Section 18.11, the assessment includes emissions avoided as a result of the displacement of alternative generation sources by the renewable energy generated by Morven North.
30 November 2023	East Lothian Council Scoping Opinion	"Table 9.28 shows the impacts Scoped in, which includes the vulnerability of Morven North to climate change during the operational phase. The baseline environment conditions will be based on United Kingdom Climate Projections (UKCP18) marine report, and the UK Climate Risk Independent Assessment. This should be augmented by up to date information. Table 9.29 scopes out the vulnerability of Morven North to climate change during construction and decommissioning. The construction phase is not considered lengthy enough for significant climate change risk to	The impacts of climate change on Morven North are considered in Volume 3, Annex 18.1: Shared Climate Change Risk Assessment, the conclusions of which are summarised within Section 18.11.7. Baseline and future baseline climate conditions are informed by up to date information at the time of writing. It is not considered that significant effects will arise from the impacts of climate change on Morven North during the decommissioning phase. This has been kept under review, and further detail is presented within Volume 3,

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		occur. However, the decommissioning phase is considered further away in time. Whether there could be significant effects in that time period should be kept under review during the preparation of the EIA (recent reporting suggests an unexpected heating of the North Atlantic, for example)…"	Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. An evaluation of the vulnerability of Morven North to existing major accidents and disasters, including climate-related events, is provided in Volume 2, Chapter 19: Major Accidents and Disasters.

18.5 Scope of the assessment

18.5.1 Impacts scoped into the assessment

18.5.1.1 The scope of this EIA Report has been developed in consultation with relevant statutory and non-statutory consultees as detailed in Table 18.5. Taking into account the scoping and consultation process, Table 18.6 summarises the potential impacts which have been scoped into this assessment. Where an impact is likely to occur within a specific development phase of Morven North, this is indicated within each relevant topic chapter (a '✓' is used to denote the phase the potential impact can occur, conversely a '✗' outlines there is no impact within this project phase), where relevant.

Table 18.6: Potential impacts scoped into the Climate Change assessment

C= Construction, O= O&M, D= Decommissioning phases

"✓" is used to denote the phase the potential impact can occur, "✗" outlines there is no impact within this project phase

Potential impact	Phase			Activity
	C	O	D	
The impact of GHG emissions arising from seabed change.	✓	×	×	Foundation installation (i.e. from wind turbines and Offshore Substation Platform (OSP)).
				Cable installation (i.e. inter-array and interconnector cables).
				Scour protection installation (i.e. for wind turbine and OSP foundations).
				Cable protection installation (i.e. for inter-array and interconnector cables).
		✓		Cable reburial events.
			✓	Removal of wind turbine and OSP foundations, inter-array and interconnector cables, and associated cable protection.
The impact of GHG emissions arising from the manufacturing and installation of Morven North including vessel movements.	✓	×	×	Wind turbine (including their foundations and scour protection) manufacture and installation.
				OSP (including their foundations and scour protection) manufacture and installation.
				Inter-array cable (including cable protection) manufacture and installation.
				Interconnector cable (including cable protection) manufacture and installation.
				Associated vessel and helicopter movements.
				This impact considers only the construction phase activities. Further impacts associated with O&M, and decommissioning activities are detailed below.
	×	✓	×	OSP major component replacement.

Potential impact	Phase			Activity
	C	O	D	
The impact of GHG emissions arising from the consumption of materials and activities required to facilitate the O&M phase and the impact of estimated abatement of UK Grid emissions during the O&M phase.				Inter-array cable repair and reburial.
				Interconnector cable repair and reburial.
				Associated vessel and helicopter movements.
				Renewable energy generated from Morven North enables the displacement of alternate generation sources.
				This impact considers only the O&M phase activities. Further impacts associated with construction and decommissioning activities are detailed above and below.
The impact of GHG emissions arising from decommissioning works (e.g. plant, fuel and vessel use) and the recovery (or disposal) of materials.	×	×	✓	Use of fuels associated with the recovery (or disposal) of materials associated with Morven North.
				This impact considers only the decommissioning phase activities. Further impacts associated with construction, and O&M activities are detailed above.
Net whole lifetime GHG impacts of Morven North.	✓	✓	✓	All activities considered above associated with the use of materials and fuels associated with the construction, O&M, and decommissioning of Morven North, in addition to renewable energy generated by Morven North enabling the displacement of alternative generation sources.
The vulnerability of Morven North to climate change during the O&M phase.	×	✓	×	Risks posed by climate change to Morven North (infrastructure and personnel) over the duration of its O&M phase.
				Construction and decommissioning phases are scoped out of the assessment, see Table 18.7 below for further detail.

18.5.2 Impacts scoped out of the assessment

18.5.2.1 A summary of the impacts scoped out, together with justification for scoping them out and whether the approach has been agreed with key stakeholders through either scoping or consultation, is presented in Table 18.7.

Table 18.7: Impacts scoped out of the assessment for Climate Change

C= Construction, O= O&M, D= Decommissioning phases

"✓" is used to denote the phase the potential impact can occur, "✗" outlines there is no impact within this project phase

Potential impact	Phase			Justification
	C	O	D	
The vulnerability of the Offshore Wind Farm (OWF) Project to climate change during the construction and decommissioning phases.	✓	✗	✓	The construction phase (expected duration of approximately five years) will not be lengthy enough for significant climate change risks compared to the present-day baseline to occur. The Applicant will employ industry standard health and safety practices with respect to risks such as heatstroke or storm events offshore. As with the construction phase, it is considered unlikely that the decommissioning phase would be lengthy enough for significant climate change risks beyond those considered within the O&M phase assessment. In addition, the Applicant will employ industry standard health and safety practices with respect to risks such as heatstroke or storm events offshore.

18.6 Approach to baseline characterisation

18.6.1 Relevant guidance

18.6.1.1 The main guidance used for the assessment of GHG emissions in EIA is the IEMA guide to 'Assessing GHG Emissions and Evaluating their Significance' (IEMA, 2022).

18.6.1.2 The main guidance document with regard to climate risk and resilience assessment (including inter-related effects assessment) within the context of EIA is the EIA Guidance on: Climate Change Resilience and Adaptation (IEMA, 2020).

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

- the GHG Protocol suite of documents (World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD), 2004);
- PAS 2080: 2023 - Carbon Management in Infrastructure (British Standards Institution (BSI), 2023);
- UK Government GHG Conversion Factors for Company Reporting (DESNZ and Defra, 2025).

18.6.2 Desktop study

18.6.2.1 Information on climate change within the Morven North Climate Change Study Area was collected through a detailed desktop review of existing studies and datasets which are summarised in Table 18.8. Both a literature review of the reports and subsequent analysis using the datasets were undertaken to characterise the baseline.

18.6.2.2 The list provided in Table 18.8 is not exhaustive. Further datasets and reports accessed, as well as full details of the analysis undertaken to develop the climate change baseline for the CCRA and GHG emissions assessments are detailed in Volume 3, Annex 18.1: Shared Climate Change Risk Assessment and Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report, respectively.

Table 18.8: Summary of key desktop reports used to characterise the Climate Change baseline

Title	Source	Extent	Year	Author
UK Government GHG Conversion Factors for Company Reporting	DESNZ and Defra	2025	2025	DESNZ and Defra
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 GHG: Supplementary guidance to the HM Treasury Green Book	DESNZ	2010-2100	2023	DESNZ
UK Offshore Energy Strategic Environmental Assessment: Appendix 1F: Climate and Meteorology	Department for Business, Energy and Industrial Strategy (BEIS)	1981-2020	2022	BEIS
Climate Change 2021: The Physical Science Basis	Intergovernmental Panel on Climate Change (IPCC)	1850-2100	2021	IPCC
Inventory of Carbon and Energy (ICE) database	Jones and Hammond	2024	2024	Jones and Hammond
UKCP18 Marine Report	UKCP18 Database	1981-2100	2018	Palmer *et al*.

18.6.3 Site specific surveys

18.6.3.1 No site specific surveys have been undertaken to inform the EIA for climate change for Morven North. This is because the calculation of GHG emissions to inform the GHG assessment is solely a desk-based exercise, informed by the MDS as described in Table 18.12. Additionally, the CCRA and future climatic baseline have been informed by climate projections, sourced from relevant literature and guidance. As such, no site specific surveys specific to climate change are required. However, information gathered as part of the benthic subtidal survey (Volume 3, Annex 8.1: Benthic Subtidal Ecology Shared Technical Report) has been used to inform the climate change baseline, where appropriate.

18.7 Baseline environment

18.7.1 Overview of baseline environment

18.7.1.1 The following sections provide a summary of the climate change baseline environment. Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report and Volume 3, Annex 18.1: Shared Climate Change Risk Assessment includes full details of the analysis undertaken to develop the climate change risk and GHG emissions baseline.

18.7.2 Greenhouse Gas emissions assessment baseline environment

18.7.2.1 To determine the GHG emissions assessment baseline environment, information has been sourced and cross-referenced from Volume 3, Annex 8.1: Benthic Subtidal Ecology Shared Technical Report.

18.7.2.2 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 3, Annex 8.1: Benthic Subtidal Ecology Shared Technical Report. The predominant sediment types include sand, slightly gravelly sand and

muddy 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 the Scottish Exclusive Economic Zone (EEZ) waters, with an estimated 357 mega tonnes (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. Section 18.11.2 presents the standing blue carbon stock in the subtidal sediments present within Morven North Climate Change Study Area.

18.7.2.3 Morven North will likely contribute to the abatement of fossil fuel generation within the UK Grid (i.e. UK Grid carbon intensity). As such, the current baseline with regard to the UK Grid-average emission factor for electricity generation, without Morven North, is 222.9kg CO_2e/MWh (including well-to-tank but as generated, (i.e. excluding export cable and distribution losses)) (DESNZ and Defra, 2025).

18.7.2.4 Further information is presented in Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report.

18.7.3 Shared Climate Change risk assessment baseline environment

18.7.3.1 Baseline offshore climatic conditions have been sourced from observational data collated within the UK Offshore Energy Strategic Environmental Assessment (BEIS, 2022b) and IPCC Sixth Assessment Reporting of the physical science (IPCC, 2021).

18.7.3.2 Air temperatures in the central North Sea do not tend to vary beyond the range of 0°C to 19°C, with the exception of extended periods of easterly winds which can lead to extreme cold in winter and warm conditions in summer. Mean air temperatures range from lows of 1°C in January to 13°C in July (BEIS, 2022b).

18.7.3.3 Precipitation rates across the central North Sea follows a seasonal trend with April to June tending to be the driest months, and October to January being wetter. Thunderstorms are infrequent, and snow showers vary from approximately 10 to 12 days in the central North Sea (BEIS, 2022b).

18.7.3.4 As detailed within Volume 3, Annex 7.1: Physical Processes Shared Technical Report, annual mean significant wave height across the Morven North Boundary and Morven South Boundary ranges from approximately 1.75m to 1.91m, and 1.81m to 1.95m, respectively. Maximum wave heights recorded within the Morven North Boundary and Morven South Boundary were 10.09m and 9.95m, respectively. Waves predominantly come from the north, northeast and north.

18.7.3.5 The prevailing winds in the central North Sea are from the southwest and the north northeast; wind strengths in winter are typically in the range of Beaufort scale 4 to 6 (6m/s to 11m/s) with higher winds of force 8 to 12 (17m/s to 32m/s) being much less frequent.

18.7.3.6 Mean sea level (MSL) is a crucial element of climate change related risks for wind farms, as increased MSL has the potential to both increase water damage and corrosion of components above the water line at the time of construction. Increased MSL also has the potential to cause increased damage from storm surge. Global MSL rose by 0.2 m between 1901 and 2018, and continues to rise (IPCC, 2021).

18.7.4 Future baseline scenario

18.7.4.1 The EIA Regulations (The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 and The Marine Works (Environmental Impact Assessment) Regulations 2007 require the following to be included within the EIA Report: "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 development 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."

18.7.4.2 In the event that Morven North does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

Future baseline- Greenhouse Gas emissions

18.7.4.3 The future baseline GHG emissions for existing land use (seabed) without Morven North are expected to remain similar to that listed in paragraph 18.7.2.2. 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 Morven North Climate Change Study Area is anticipated in the future baseline.

18.7.4.4 The future baseline for electricity generation that would be displaced by Morven North 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 Morven North compared to other generation sources available, influenced by commercial factors and National Grid's needs.

18.7.4.5 Several future baseline scenarios have therefore been considered using DESNZ projections of the carbon intensity of long-run marginal electricity generation during Morven North's operating lifetime (DESNZ, 2023a) and assumptions about specific generation sources that could be displaced. These are detailed in Volume 3, Annex 18.1: Climate Change Shared Greenhouse Gases Technical Report.

18.7.4.6 The carbon intensity of baseline UK Grid electricity generation (see paragraph 18.7.2.3) is projected to reduce over time and so too would the intensity of the marginal generation source, displaced at a given time.

Future baseline- Climate Change

18.7.4.7 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 Morven North, anthropogenic climatic changes are expected to become more apparent.

18.7.4.8 It is virtually certain 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 RCP8.5 in the same time period. Ocean acidification is anticipated to increase, with a fall in surface pH by 0.4 units by 2100 under RCP8.5 (IPCC, 2021).

18.7.4.9 Average wave height is predicted to decrease around much of the UK, with average wave heights in the North Sea decreasing by approximately 0.1m. Given the close relationship between wave heights and wind speeds, average changes in wind speed are predicted to follow similar patterns to those predicted for average wave height, with a slight increase to the north of the British Isles. However, there is little consensus between models regarding the extent and pattern of such winds and wave heights in relation to climate change (Palmer *et al*., 2018). As such, conservatively an increase in maximum wind speed and wave height should be anticipated.

18.7.4.10 Average sea level rise around the UK is expected to increase by 1m by 2100, though a lesser rise is anticipated in the north of the UK. The east coast of Scotland can expect to see a MSL rise of between approximately 0.5m and 0.6m by 2100 (Palmer *et al*., 2018).

18.7.4.11 Further information is presented in Volume 3, Annex 18.1: Shared Climate Change Risk Assessment.

18.7.5 Data limitations and assumptions

18.7.5.1 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 Morven North. UK 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, 2023a), consistent with the UK Government's current policy of a clean power by 2030, with backup fossil fuel reserves (DESNZ 2025b). As such, for Morven North's operational lifetime, the long-run marginal projections presented are reliant on offshore wind projects such as Morven North being brought online. As such, the long-run marginal does not represent a true 'without development' future baseline. 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.

18.7.5.2 Construction phase GHG emissions associated with the manufacturing of infrastructure associated with Morven North may 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 (globally occurring), and to avoid 'carbon leakage' overseas when reducing UK emissions, emissions associated with the construction phase have been presented within the assessment and quantification of GHG emissions, as part of a life cycle GHG emission assessment of Morven North (see Section 18.11).

18.7.5.3 The specific design for the components of Morven North (wind turbine quantity, foundations, number of OSPs, length of inter-array and interconnector cabling), alongside the specifications of vehicles and vessels that would be used by Morven North have not yet been specified. The final design of Morven North will be confirmed through the detailed design phase, post-consent submission. Thus, there is a degree of uncertainty regarding GHG emissions resulting from the manufacturing and construction of wind turbines and infrastructure, vessel movements and O&M activities associated with Morven North. This assessment seeks to limit the impact this might have by using MDS, which includes material quantities and material types (i.e. those with the greatest carbon impact), in the calculation of construction phase emissions and emissions resulting from O&M activities. This assessment has also used MDS vessel movements, as stated in Table 18.12. It is unlikely that the full extent of these MDS material quantities will be used in the final design of Morven North, owing to improvements in wind turbine and associated infrastructure design and refinements to design assumptions. As such, calculated emissions represent a conservative (reasonable adverse case) scenario.

18.7.5.4 When calculating emissions for cable crossing protection, rock bags have been used as the likely material of choice, but a mixture of cable protection approaches may be required (such as grout, cement, concrete or sand bags). In the absence of detailed information regarding the breakdown of each approach, calculations are therefore high level. This approach to the calculations however does not alter the conclusions reached in this chapter.

18.7.5.5 Detailed information is not yet available for the decommissioning phase. However, it is anticipated that this phase will involve similar types and numbers of vessels and equipment to that of the construction phase. As such, emissions from the decommissioning phase have been estimated based on MDS vessel movements for the construction phase.

18.7.5.6 The calculation of emissions associated with material and fuel consumption throughout the construction, O&M, and decommissioning phases use currently available emissions factors which no not account for the future decarbonisation the construction and transportation sectors in line with policy and legislation as the UK moves towards its net zero target. Therefore, the values presented regarding such emissions present a conservative scenario.

18.7.5.7 Blue carbon that is released as a result of marine habitat disturbance dissolves into coastal and marine ecosystems, such as the ocean. As such, this impact does not directly contribute to the global atmospheric mass of CO_2 (the receptor). However, it is likely to indirectly impact atmospheric CO_2 concentrations, as an increased concentration of dissolved CO_2 alters ocean and calcium carbonate ($CaCO_3$) chemistry. Though interactions between different states of carbon in the oceans are complex, it is likely that increased concentrations of ocean CO_2 will overall reduce the capacity of oceans to absorb CO_2 and cause a greater potential for the ocean to release CO_2 to the atmosphere under certain conditions (IPCC, 2021). As such, for the purposes of this assessment remineralisation of blue carbon stocks has been assumed to have the same impact as the release of an equivalent mass of CO_2 to the global atmosphere.

18.7.5.8 Morven North will have an operational lifetime of 35 years, however, the final operational dates are currently unknown. Therefore, for the purposes of the assessment of avoided GHG emissions associated with the O&M phase and consideration of maintenance activities, it has been assumed that Morven North will be operational between 2038 and 2072, informed by the indicative commissioning year of 2038 (as per the high-level indicative construction programme described in Volume 1, Chapter 3: Project Description), subject to the necessary grid connection agreements.

18.7.5.9 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 reasonable adverse approach. This is further discussed in Volume 3, Annex 18.1: Shared Climate Change Risk Assessment.

18.7.5.10 The above uncertainties are integral to the assessment of climate change but a precautionary approach has been taken as far as practicable to provide a reasonable MDS assessment. On the basis of the above, it is considered that limitations to the assessment have been reduced and that the results provide a robust estimate of the effects of Morven North.

18.7.5.11 It is important to note that Morven North would not operate in isolation, as offshore export cable corridor(s) and onshore export cable corridor(s) are required to connect Morven North to the grid in order to realise the potential avoided emissions associated with the production of wind energy. However, the offshore export cable corridor(s) and onshore export cable corridor(s) are subject to separate applications (MHPGC Project and MBAGC Project). As such, it is necessary to consider the embodied emissions associated with the export cable corridor within the cumulative assessment for Morven North, so as to understand the whole-life time effects of Morven North with the MHPGC Project, and MBAGC Project.

18.7.5.12 The design parameters of the MHPGC Project and MBAGC Project required to connect Morven North to the grid are not yet completely defined. As such, calculations for the assessment of cumulative effects, in order to quantify whole-life GHG emissions for Morven North and associated export cable infrastructure, have been based on high-level indicative parameters. These parameters will be refined in subsequent applications for the export cable infrastructure, alongside the associated calculations as more information becomes available. The cumulative assessment presented in Section 18.12 is therefore carried out using a precautionary approach and is a MDS assessment.

18.8 Methodology for assessment of effects

18.8.1 Overview

18.8.1.1 The climate change assessment of effects has followed the methodology set out in Volume 1, Chapter 6: EIA Methodology. Specific to the climate change assessment of effects, the following guidance documents have also been considered:

- IEMA guidance on Climate Change Adaption and Resilience (IEMA, 2020);
- IEMA guidance on 'Assessing GHG Emissions and Evaluating their Significance' (IEMA, 2022).

18.8.1.2 In addition to the overarching policy and legislation as described in Volume 1, Chapter 2: Policy and Legislation, national climate change policy and legislation relevant to the climate change impact assessment is set out in Section 18.2.1.1. In order to undertake a climate change impact assessment, the information gathered in Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report and Volume 3, Annex 18.1: Shared Climate Change Risk Assessment has been utilised. This information is sourced from primary calculations and secondary sources to calculate the effect of Morven North on and from climate change.

18.8.1.3 The approach for determining the significance of effects is a two-stage process that 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 6: EIA Methodology.

18.8.2 Greenhouse Gas emissions assessment methodology

18.8.2.1 GHG emissions have been estimated by applying published emissions factors to activities in the baseline and to those required for Morven North. 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[1] expressed as their CO_2-equivalent (CO_2e) Global Warming Potential (GWP). This is denoted by CO_2e 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.

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

- DESNZ (2023a) Valuation of Energy Use and GHG: Supplementary guidance to the HM Treasury Green Book;
- UK Government GHG Conversion Factors for Company Reporting (DESNZ and Defra, 2025);
- the GHG Protocol suite of documents WRI and (WBCSD, 2004).

18.8.2.3 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 WBSCD, 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.

18.8.2.4 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 Morven North. These emissions shall not be separated out by defined scopes (scopes 1, 2 or 3) in the assessment.

[1] The Kyoto Basket of global warming gases are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). The latter four are together termed "F-Gases". IPCC (2013). Climate Change 2013: The Physical Science Basis. Available at: https://www.ipcc.ch/report/ar5/wg1/

18.8.2.5 The assessment has considered:

- the GHG emissions arising as a result of Morven North (during construction, O&M, and decommissioning phases);
- any GHG emissions that are avoided, compared to the current or future baseline;
- the net impact on climate change due to these changes in GHG emissions overall.

18.8.2.6 As previously discussed in paragraph 18.7.5.2, construction phase GHG emissions associated with the manufacturing of components may occur outside the territorial boundary of the UK and hence outside the scope of the UK's national carbon budget. However, in recognition of the climate change effect of GHG emissions (wherever occurring) and to avoid 'carbon leakage' overseas when reducing UK emissions, the full life cycle GHG emissions of Morven North, including emissions associated with the construction phase (wherever they derive, globally, where it is reasonably practicable to make assumptions for those emissions), have been evaluated where possible when determining the significance of effects.

18.8.2.7 Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report, which provides further details of the GHG emissions assessment methodology, should be read alongside this chapter.

18.8.3 Climate Change risk assessment methodology

18.8.3.1 Baseline offshore climatic conditions 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 Volume 3, Annex 7.1: Physical Processes Shared Technical Report. Information from the UKCP18 RCP8.5 has been drawn upon in addition to the UK CCRA3 to establish UK marine climate projections for the 21st century through to 2100.

18.8.3.2 Volume 3, Annex 18.1: Shared Climate Change Risk Assessment, should be read alongside this chapter, which provides further detail of the approach and data input.

18.8.3.3 A high-level screening risk assessment has been undertaken, considering the climate change hazards and potential impacts to Morven North (accounting for its exposure and vulnerability). The assessment of effects has considered the designed-in measures adopted as part of Morven North (primary and tertiary mitigation) in determining the combined risk score. Should an effect be significant after designed in mitigation is applied, further mitigation is presented where relevant to reduce the residual effect to negligible and not significant in EIA terms.

18.8.4 Assessment criteria

18.8.4.1 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 criteria for determining the significance of effects have been divided into two categories:

- assessment of the significance of the effect of Morven North on climate change (GHG assessment);
- assessment of the significance of the effect from climatic changes on Morven North (CCRA).

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

Impact assessment criteria: Greenhouse Gas emissions

Magnitude of impact

18.8.4.3 In accordance with the IEMA Guidance (2022) where GHG emissions can be quantified directly and expressed based on their GWP as tonnes of CO_2e 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

18.8.4.4 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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor).

Significance of effect

18.8.4.5 The significance of the effect upon climate change is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed for this assessment is presented in Table 18.9.

18.8.4.6 In cases where a range is suggested for the significance of effect, there remains the possibility that this may span the significance threshold (i.e. the range is given as minor to moderate). In such cases the final significance is based upon the expert's professional judgement as to which outcome delineates the most likely effect, with an explanation as to why this is the case.

18.8.4.7 For the purposes of this assessment:

- a level of effect of moderate adverse or more will be considered a 'significant' effect in terms of the EIA Regulations;
- a level of effect of minor adverse or less will be considered 'not significant' in terms of the EIA Regulations.

18.8.4.8 Effects of moderate adverse significance or above are therefore considered important in the decision-making process, whilst effects of minor significance or less warrant little, if any, weight in the decision-making process.

18.8.4.9 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 (UN, 2015). To aid in considering whether climate change impacts 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.

18.8.4.10 Taking the guidance into account, the following have been considered in contextualising Morven North GHG emissions:

- the magnitude of net GHG emissions as a percentage of UK national carbon budgets (where feasible and where carbon budgets are available);
- whether Morven North 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 nationally determined contribution (NDC) to the Paris Agreement (DESNZ, 2025).

18.8.4.11 Effects from GHG emissions are described in this chapter as adverse (major, moderate or minor), negligible or beneficial based on the following definitions, which closely follow the examples in Box 3 of the IEMA guidance (IEMA, 2022) as detailed in Table 18.9.

Table 18.9: Guidance definitions of significance of effect in relation to Greenhouse Gas emissions (IEMA, 2022)

Significance	Definition
Major adverse	Morven North'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	Morven North'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	Morven North'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	Morven North'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	Morven North'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.

18.8.4.12 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.

18.8.4.13 GHG emissions associated with a proposed project are often reported as a whole life figure (net emissions) that takes account of all Morven North's phases. The net whole life figure is the key element for determining Morven North's whole life impact on climate change. However, 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 Morven North, alongside the sections that assess construction, O&M and decommissioning effects in isolation.

Impact assessment criteria: Climate Change risk assessment

18.8.4.14 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".

18.8.4.15 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.

18.8.4.16 As is detailed in Volume 3, Annex 18.1: Shared Climate Change Risk Assessment, a risk assessment has been undertaken, considering the hazard, exposure and vulnerability of Morven North and its users. The criteria for defining the exposure and vulnerability are presented in Table 18.10 below. The assessment of significance is subsequently undertaken in line with the significance matrix presented in Table 18.11. The assessment of effects has taken into account design considerations in determining the risk score. Should an effect be significant, further measures are presented where relevant to reduce the residual effect to negligible and not significant in EIA terms.

Table 18.10: Hazard, exposure and vulnerability definitions (aligning with IEMA 2020 guidance)

Factor	Score definition
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.	
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.	**Major:** large change to climate condition and large increase in the frequency of the event.
	Moderate: a large, measurable change in climate conditions at a regular frequency.
	Minor: change in climate conditions that may have measurable effect on a receptor, but which are low likelihood of occurring or infrequent.
	Negligible: no change in climate conditions.
Vulnerability: the degree of vulnerability of each receptor to the hazard. Vulnerability can be seen as situation specific.	**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.
	Medium: measurable decrease in receptor performance or lifespan or increase in necessary maintenance and repairs following the occurrence of a climate impact.
	Low: small measurable impact to a receptor's performance following climate impact, or deterioration of a receptors' lifespan due to a chronic effect.
	Negligible: no measurable impact to a receptor's performance following climate impact, or deterioration of a receptors' lifespan due to a chronic effect.

Table 18.11: Climate risk significance matrix

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

18.9 Parameters for assessment

18.9.1 Maximum Design Scenario

18.9.1.1 The MDSs identified in Table 18.12 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the details provided in Volume 1, Chapter 3: Project Description. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Morven North Project Design Envelope (PDE) (e.g. different infrastructure layout), to that assessed here, be taken forward in the final design scheme.

Table 18.12: Maximum Design Scenario considered for each potential impact as part of the assessment of Likely Significant Effects on and from Climate Change

C= Construction, O= O&M, D= Decommissioning phases

"✓" is used to denote the phase the potential impact can occur, "✗" outlines there is no impact within this project phase

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
The impact of GHG emissions arising from seabed change.	✓	✓	✓	**Construction, O&M and decommissioning phases** • The greatest seabed footprint of the wind turbine footprint and scour protection (Suction Bucket Jacket (SBJ) 3L) – 804,914m^2 • The greatest seabed footprint from OSP foundations (gravity base) and scour protection – 311,333m^2 • The greatest seabed footprint from inter-array cable - 8,475,000m^2 • The greatest seabed footprint from inter-array cable protection – 423,750m^2 • The greatest seabed footprint from interconnector cable - 9,680,000m^2 • The greatest seabed footprint from interconnector cable protection – 484,000m^2	The greatest footprint of Morven North and greatest additional disturbance during construction and O&M phases will result in the greatest overall disturbance to the seabed, representing the greatest potential to disturb the maximum amount of carbon stored in benthic sediments (if these present significant carbon stores).
The impact of GHG emissions arising from the manufacturing and installation of Morven North, including vessel movements.	✓	✗	✗	• 58 wind turbines, 320m maximum rotor diameter, 8.2m maximum blade width, 8.2m maximum chord width, 203m maximum hub height (above LAT), 1,600 tonnes nacelle weight (including hub), 8m tower diameter at top, 10.5m tower diameter at bottom. • SBJ (3 legged) wind turbines foundations, one per wind turbine, 5m jacket leg diameter, 20m suction bucket diameter. • Scour protection volume of 1,739,332m^3. • 5 no. OSPs, 4 no. with 15,000 tonne topside weight, the fifth with two 30,000 tonnes topsides and an 800-tonne link bridge. • SBJ (6 legged) OSP foundations, 6 no. in total (two foundations for the fifth OSP). • Scour protection volume of 142,737m^3 and 247,068m^3 associated with the 15,000 tonne and 30,000 tonne OSPs respectively.	The greatest quantity of materials and fuel consumption represents the greatest potential for GHG emissions. 58 no. wind turbines and 5 no. OSPs and associated foundations, interconnector and inter-array cables represent the greatest potential for GHG emissions from the construction and installation of Morven North.

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Total inter-array cable length of 281km, maximum external cable diameter of 230mm, 75 no. cables, copper core cable. • 10% of the inter-array cables require cable protection, localised protection across 0.5% of the total inter-array cable length. Total length of crossings of 400m. • Total interconnector cable length of 484km, maximum external cable diameter of 322mm, 10 x no. cables, copper core cable. • 10% of the interconnector cables require cable protection, localised protection across 0.01% of the total interconnector cable length. Total length of crossings of 400m. • The greatest number of transport vehicles and vessels for the installation of Morven North, measured in return trips (488 main installation and support vessels, 416 tug/anchor handlers, 162 cable lay installation and support vessels, 172 guard vessels, 156 survey vessels, 50 seabed preparation vessels, 1,460 crew transfer vessels, 156 scour protection installation vessels, 1,826 helicopters) over the greatest distance (245km to construction port).	
The impact of GHG emissions arising from the consumption of materials and activities required to facilitate the O&M phase and the impact of estimated abatement of UK Grid emissions during the O&M phase.	×	✓	×	• Maximum anticipated export capacity of 1,500MW. • The greatest number of maintenance vehicles and vessels, measured in annual return trips (219 crew transfer vessels, 13 jack-up vessels, 3 cable repair vessels, 59 other vessels, 1,660 helicopters, 60 unmanned surface vehicles) over the greatest distance (245km to O&M port). • OSP major component replacement up to once every three years per OSP. • Inter-array cable repair: 2 no. events every 5 years on average. • Inter-array cable reburial events: 1 no. every 5 years on average covering 4% of cable length. • Interconnector cable repair: 1 no. repair per interconnector in 25 years, typically 2km of cable per repair event.	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. Greatest quantity of materials and fuel consumption represents the greatest potential for GHG emissions.

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
				• Interconnector cable reburial events: 1 no. every 5 years maximum covering 4% of cable length.	
The impact of GHG emissions arising from decommissioning works (e.g. plant, fuel and vessel use) and the recovery (or disposal) of materials).	×	×	✓	At the end of Morven North's operational lifetime, it is anticipated that all wind turbines and OSPs (including foundations), inter-array cable and interconnector cables will be removed where possible/practicable. It is assumed that cable protection will be removed. The decommissioning sequence will generally be the reverse of the construction sequence and involve similar types and numbers of vessels and equipment.	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.
Net whole lifetime GHG impacts of Morven North.	✓	✓	✓	**Construction phase** MDS as per impacts above. • GHG emissions arising from disturbance to blue carbon stocks during the construction of Morven North. • GHG emissions arising from the manufacturing and installation of Morven North. **O&M phase** MDS as per impacts above. • GHG emissions arising from disturbance to blue carbon stocks during the O&M of Morven North. • GHG emissions arising from the consumption of materials and activities required to facilitate the O&M of Morven North and estimated abatement of UK Grid emissions. **Decommissioning phase** MDS as per impacts above. • GHG emissions arising from disturbance to blue carbon stocks during the decommissioning of Morven North. • GHG emissions arising from decommissioning works of Morven North.	The greatest footprint of Morven North will result in the greatest overall disturbance to the seabed, representing the greatest potential to disturb the maximum amount of carbon stored in benthic sediments (if these present significant carbon stores). The greatest quantity of materials and fuel consumed will result in the greatest potential for GHG emissions.
The vulnerability of Morven North to climate	×	✓	×	Use of most adverse future climate change projections available for the Morven North Climate Change Study Area (RCP8.5, see paragraph 18.7.4.7), subject to data availability.	The use of the most adverse future climate change

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
change during the O&M phase.				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 infrastructure which would result in an increase in O&M activities.	projection (RCP8.5, a high emissions scenario) will result in the greatest magnitude and severity of climate change risks to Morven North.

18.10 Designed-in measures and mitigation

18.10.1.1 As part of the Morven North design process, a number of measures (primary and tertiary) have been adopted to reduce the potential for impacts on and from climate change (see Table 18.13). For the purposes of the EIA process, the term 'designed-in measure' is used to include the following measures (adapted from IEMA, 2016 and IEMA, 2024):

- Measures included as part of the design of Morven North. These include modifications to the location or design of Morven North, which are integrated into the application for consent. These measures are considered standard industry practice for this type of development and are referred to as primary mitigation in IEMA, 2016 and IEMA, 2024.
- Measures required to meet legislative requirements, or actions that are generally standard practice used to manage commonly occurring environmental effects. These measures are secured through the conditions of the marine licences and referred to as tertiary mitigation in IEMA, 2016 and IEMA, 2024.

18.10.1.2 As there is a commitment to implementing these measures, they are considered inherently part of the design of Morven North and have therefore been considered in the assessment presented in Section 18.11 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

18.10.1.3 The requirement for any additional mitigation measures is dependent on the significance of the effects on and from climate change. Where LSE[1] have been identified, further mitigation measures (referred to as secondary mitigation in IEMA, 2016 and IEMA, 2024) have been identified to reduce the significance of effect to acceptable levels following the initial assessment. These are measures that could further prevent, reduce and, where possible, offset any adverse effects on the environment. These measures are set out, where relevant, in Section 18.11.

18.10.1.4 All designed-in measures and mitigation are detailed in Volume 3, Annex 6.3: Morven North EIA Commitments Register.

Table 18.13: Designed-in (primary and tertiary) measures adopted as part of Morven North

Reference number	Designed-in measures adopted as part of Morven North	Justification	Primary or tertiary
MM-1	Development of and adherence to a Scour Protection Management Plan.	There is the potential for scouring of seabed sediments to occur due to interactions between metocean regime (wave and currents) and foundations or other seabed structures. This scouring can develop into depressions around the structure. The use of scour protection around offshore structures and foundations will be employed, as described in Volume 1, Chapter 3: Project Description. The SPMP will set out the approach to scour protection installation and monitoring. This will maximise protection of offshore infrastructure as far as possible during the project lifecycle.	Primary

Reference number	Designed-in measures adopted as part of Morven North	Justification	Primary or tertiary
		It will enable Morven North to be resilient to future climate change, in particular from the risk of changes in tidal range.	
MM-4	Development of and adherence to a Construction Method Statement which will require the use of durable materials within the offshore substation platform structures, in line with appropriate design standards for offshore wind in the North Sea.	The CMS will ensure that all works are carried out efficiently, safely, and in compliance with environmental and regulatory requirements. The Construction Method Statement will outline the planned approach, procedures, and safety measures for the offshore construction activities. Ensures resilience to future climate change, in particular from the risk of increased wear from sea level rise, extreme weather events and increased precipitation and changes to wind patterns.	Tertiary
MM-17	The wind turbine design will be fitted with automatic shutdowns/lockdowns safety margins to prevent spinning too fast in high winds.	Enables Morven North to be resilient to future climate change, in particular from the risk of increased frequency and intensity of extreme weather.	Primary
MM-28	The Offshore Substation Platform main high voltage electrical equipment will be located within an internal structure. Appropriate cooling plant will be designed to account for a range of temperature conditions.	Enables Morven North to be resilient to future climate change, in particular from the risk of overheating from temperature changes.	Primary
MM-29	Application of anti-corrosion protective coatings, where appropriate and accounting for sea level rise.	Enables Morven North to be resilient to future climate change, in particular from the risk of increased sea temperatures, ocean acidification and sea level rise.	Primary
MM-35	Regular inspections to be carried out to assess wind turbine and offshore substation platform conditions.	Ensures resilience to future climate change, in particular from the risk of increased wear from sea level rise, extreme weather events and increased precipitation.	Primary
MM-44	Design standards for structural safety in line with international	Ensure resilience to future climate change, in particular	Primary

Reference number	Designed-in measures adopted as part of Morven North	Justification	Primary or tertiary
	requirements, with allowance for increased heights of extreme waves and sea level rise.	from the risk of increased wear from extreme weather events, sea level rise and wave heights.	
MM-47	The Applicant is committed to reducing construction related emissions through the provision of a GHG Reduction Strategy (aligned with PAS 2080: Carbon Management in Infrastructure) detailing the processes and measures to be implemented to manage carbon throughout the construction phase.	Throughout the Morven North design process, this approach to carbon management (aligned with PAS 2080) enforces decision-making regarding emissions reductions. Such actions will be detailed within a GHG Reduction Strategy. The commitment to progress such a strategy is listed within the Applicant's Morven Sustainability Strategy, with guiding principles to be developed in Q2 2026.The consideration of low carbon design options, sustainable and low carbon procurement practices, working with the supply chain to incorporate low carbon solutions, and reviewing efficiency mechanisms, each enable emissions reductions associated with the manufacture and installation of Morven North.	Primary
MM-51	When disposing of wind turbines during the decommissioning phase, 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 thereby reducing associated emissions.	Primary

18.10.1.5 Further to measure MM-47, detailed within Table 18.13, the following provides additional context regarding areas to be explored by the Applicant within the GHG Reduction Strategy to reduce the magnitude of construction emissions. The commitment to progress such a strategy is listed within the Applicant's Morven Sustainability Strategy, with guiding principles (in line with those listed below) to be developed in Q2 2026.

- the investigation of low carbon criteria within procurement activities, in partnership with the supply chain, in particular through the use of renewable energy in the manufacturing process, use of local materials where feasible, and the specification of materials with high recycled content. Greatest focus will be given to carbon hotspots, i.e. the greatest emissions sources;
- working with the supply chain and its partners to enable greater transparency into the GHG impacts of products and materials used by requesting environmental product declarations (EPDs) from key components, in order to identify and reduce emissions during construction and operation;

- the inclusion of sustainability criteria within the supplier selection process (i.e. including tender questions regarding carbon management, and clauses regarding sustainability performance during construction);
- the consideration of design options' embedded emissions when informing decision decisions for Morven North, and the selection of design options with lower embodied emissions than alternatives where feasible;
- the review of construction and operational activity to reduce emissions where feasible (e.g. vessel scheduling, co-ordination of shipping/delivery of materials and the identification of energy efficiency mechanisms).

18.11 Assessment of significant effects

18.11.1.1 The potential impacts arising from the construction, O&M and decommissioning phases of Morven North are listed in Table 18.12, along with the MDS against which each impact has been assessed.

18.11.1.2 An assessment of the likely significance of the effects of Morven North on receptors, and climate change on Morven North, caused by each identified impact is given below. These are in relation to both GHG emissions and risk associated with climate change.

18.11.2 Greenhouse Gas emissions arising from seabed change

18.11.2.1 Throughout the lifetime of Morven North, 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 wind turbine foundations, OSP foundations, interconnector and inter-array cables, cable protection and scour protection. For the O&M phase this will arise from cable reburial. For decommissioning, disturbance is likely to be similar to construction.

18.11.2.2 Where seabed habitats are disturbed, this has the potential to affect 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 CO_2 through a process called remineralisation (Cunningham and Hunt, 2023). The potential emissions associated with the disturbance from Morven North are detailed below. This impact entails an assessment of the largest total footprint of Morven North, over all phases, representing the greatest potential for GHG emissions from disturbance to blue carbon stores.

18.11.2.3 However, not all blue carbon stocks that are disturbed will be remineralised to CO_2 (Smeaton and Austin, 2022). As such, a range of emissions are presented, reflecting the likely range of remineralisation potential and resulting potential emissions (Smeaton and Austin, 2022; Cunningham and Hunt, 2023).

Construction phase

Magnitude of impact

18.11.2.4 Based on the MDS presented in Table 18.12, the total area disturbed during the construction phase is 2,018ha. As set out in Volume 3, Annex 8.1: Benthic Subtidal Ecology Shared Technical Report, site specific benthic surveys undertaken for Morven North and published literature values (Smeaton *et al.*, 2020) have been used to calculate the average blue carbon per hectare contained in habitats within the Morven North Climate Change Study Area. This figure has been calculated to be 3.99 tonnes of carbon per hectare. Literature values for remineralisation potential in offshore sediments (Smeaton and Austin, 2022) were then used to calculate total potential emissions. Refer to Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report, for more details.

18.11.2.5 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 5,908tCO_2e and 29,540tCO_2e

Sensitivity of the receptor

18.11.2.6 In accordance with paragraph 18.8.4.4, 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

18.11.2.7 Overall, the magnitude of impact is deemed to be between 5,908tCO_2 and 29,540tCO_2, and the sensitivity of the receptor is considered to be high. Consistent with paragraph 18.8.4.10, the magnitude of emissions comprise less than 0.01% of the Sixth UK Carbon Budget (set out in Table 18.1), and 0.01% of the proposed Scottish Carbon Budgets for the 2031-2035 and 2036-2050 periods. Further, the magnitude of emissions arising from disturbance to blue carbon stocks during the construction phase comprises less than 0.01% of Scotland's estimated blue carbon stocks (Smeaton *et al*., 2020; Cunningham *et al*., 2023), with loss arising from habitats of low relative importance to carbon storage as outlined in paragraph 18.7.2.2. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

18.11.2.8 No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.

Operation and Maintenance phase

Magnitude of impact

18.11.2.9 As set out in paragraph 18.7.4.3 and Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report, blue carbon sequestration rates in offshore sediments in the North Sea are deemed to be negligible. Furthermore, O&M activities are unlikely to result in further disturbance of sediment beyond that already disturbed during the construction phase. Therefore, it is considered that any impact of emissions arising from disturbance to blue carbon stocks will be negligible over Morven North's 35 year lifetime. The magnitude is therefore negligible and no further quantitative assessment has been undertaken.

Sensitivity of the receptor

18.11.2.10 In accordance with paragraph 18.8.4.4, 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

18.11.2.11 Overall, the magnitude of impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect, therefore, will be of **negligible** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

18.11.2.12 No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.

Decommissioning phase

Magnitude of impact

18.11.2.13 As stated in Volume 1, Chapter 3: Project Description, the sequence of activities in the decommissioning phase will generally be the reverse of the construction sequence and will involve similar equipment. It is anticipated all wind turbines (including foundations) and OSPs (including

foundations) will be removed; inter-array and interconnector cables will be removed where possible and appropriate to do so, cable and scour protection will be removed.

18.11.2.14 Given the negligible rates of sediment accumulation and associated carbon sequestration in the Morven North Climate Change Study Area, there is not anticipated to be any material change to the blue carbon stocks over Morven North's operational lifetime. As such, any disturbance to the seabed and blue carbon habitats that may result from infrastructure removal at the decommissioning phase is not likely to result in the release of additional emissions not captured by the range of likely emissions presented in the assessment of construction effects.

18.11.2.15 As such, there will not be substantial additional disturbance of the seabed, beyond that disturbed during the construction phase, meaning that further blue carbon stores will not be disturbed and released. The magnitude of impact is therefore negligible.

18.11.2.16 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 deemed to be negligible.

Sensitivity of the receptor

18.11.2.17 In accordance with paragraph 18.8.4.4, 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

18.11.2.18 Overall, the magnitude of impact is deemed to be negligible, and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **negligible** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

18.11.2.19 No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.

18.11.3 Greenhouse Gas emissions arising from the manufacturing and installation of Morven North including vessel movements

18.11.3.1 The below considers the embodied carbon emissions associated with materials and transportation emissions. This impact entails an assessment of the highest emitting scenario, outlined within the MDS in Table 18.12, representing the greatest potential for GHG emissions from the manufacture and installation of Morven North as a conservative estimate of impact.

Construction phase

18.11.3.2 This section considers the GHG emissions arising from the consumption of materials and activities required to construct Morven North. Calculations to reach such emissions consider the maximum amount of materials required to construct the wind turbines and OSPs, total lengths of all cables for the chosen option, with associated scour protection and cable protection, representing the greatest potential for GHG emissions from the construction and installation of Morven North as a conservative estimate of impact. Further, the designed-in measures adopted as part of Morven North (detailed in Table 18.13) have not been quantitatively assessed given the early stage in Morven North's design. As such, it can be expected that their implementation will result in a reduced magnitude of emissions than presented within this assessment. Their impact on the significance of effect assessed has been considered qualitatively.

18.11.3.3 The following items are considered within this assessment:

- wind turbines (blades, towers, nacelles, and including foundations);
- OSP topside structures and foundations;

- interconnector and inter-array cables;
- inter-array and interconnector cable protection;
- scour protection;
- vessel and helicopter movements.

18.11.3.4 Detailed and current Life Cycle Assessments (LCA) are not available for all items specific to Morven North infrastructure due to the early stage of the Morven North 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.

18.11.3.5 The potential impact of the wind turbines and foundations, OSP topsides and foundations, cabling (including inter-array and interconnector), cable protection and scour protection has been estimated using appropriate material emission intensities from the 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, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report.

18.11.3.6 Construction phase emissions associated with the proposed electrical plant included on the OSPs has been captured using an intensity for the manufacturing GWP of 2,190kgCO_2e per MW (ABB, 2003). This was scaled by Morven North's anticipated output capacity of 1.5GW to give an estimated embodied emission value.

18.11.3.7 Emissions associated with fuel combustion from vessel and helicopter movements from a likely base port to the Morven Site have been calculated based on the maximum number of movements proposed during the construction phase, assumed distance of travel from a 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.

18.11.3.8 Additional emissions associated with the transport of materials and products to the construction port have been approximated, informed by the total tonnage of materials associated with the construction of Morven North, high level transport scenario assumptions regarding travel distances, and appropriate emissions factors.

18.11.3.9 Table 18.14 summarises the calculated construction phase emissions based on conservative estimates and a MDS (Section 18.9.1) associated with Morven North, which totals 3,512,986CO_2e. It is anticipated that the actual construction phase emissions would be lower than those detailed in Table 18.14 as this is a conservative MDS.

Table 18.14: Construction phase Greenhouse Gas emissions

Item	Value (tCO_2e)
Wind turbines (blades, towers and nacelles)	691,874
Wind turbines (foundation including scour protection)	1,424,503
OSP (topside)	285,504
OSP (foundations)	435,003
Inter-array cables	67,766
Inter-array cable protection	19,779
Inter-array cable crossings	1,140
Interconnector cables	170,205
Interconnector cable protection	32,599

Item	Value (tCO_2e)
Interconnector cable crossings	1,140
Transport	255,377
Transport (materials transport to the construction port)	128,095
Total	3,512,986

Magnitude of impact

18.11.3.10 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 3,512,986tCO_2e for the construction phase.

18.11.3.11 As detailed within paragraph 18.11.3.2, the magnitude of emissions presented above does not account for designed in measures set out in Table 18.13, which are not able to be quantified at this stage in the design. It is likely that the magnitude of such emissions will be reduced when accounting for the impact of these measures.

Sensitivity of the receptor

18.11.3.12 In accordance with paragraph 18.8.4.4, 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

18.11.3.13 Overall, the magnitude of the impact is deemed to be 3,512,986tCO_2e and the sensitivity of the receptor is considered to be high. Consistent with paragraph 18.8.4.10, the magnitude of emissions comprise 0.36% of the Sixth UK Carbon Budget (set out in Table 18.1), and 1.7% of the proposed Scottish Carbon Budgets over the 2031 to 2035 and 2036 to 2040 periods. Further, as detailed within paragraphs 18.11.3.2 and 18.11.3.11, the magnitude of such emissions do not account for designed in measures adopted to reduce emissions associated with the construction phase. As such, calculated emissions represent a conservative (reasonable adverse case) scenario.

18.11.3.14 Owing to the designed in measures set out in Table 18.13 (comprising the commitment to reducing construction related emissions through the provision of a GHG Reduction Strategy aligned with PAS 2080, investigating emissions reduction mechanisms within design choices, procurement and supply chain collaboration, and efficiency improvements), it can be concluded that Morven North's impacts are consistent with existing and emerging policy and good practice design aligned with a 1.5°C compatible trajectory towards net zero. Based on the definitions as set out in Table 18.9, the effect will, therefore, be of **minor adverse** effect**,** which is not significant in EIA terms.

18.11.3.15 It is important to note that, in line with the Scottish NMP objectives (Scottish Government, 2015) and wider UK decarbonisation strategy, one of the purposes of Morven North is to provide a source of renewable energy. A key objective of Morven North is to help advance the transition to an innovative low carbon energy system, in line with the UK's target of net zero by 2050. As such, the effects due to GHG emissions from the manufacture and installation of Morven North must be considered together with the effect of avoided GHG emissions arising from the operation of Morven North (see paragraphs 18.11.4.1 to 18.11.4.14 below), so as to determine the net effects of GHG emissions resulting from Morven North (see Section 18.11.6 below), in line with IEMA (2022) guidance.

Secondary mitigation and residual effect

18.11.3.16 No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is beneficial.

18.11.4 Greenhouse Gas emissions arising from the consumption of materials and activities required to facilitate the Operation and Maintenance phase and estimated abatement of United Kingdom grid emissions

Operation and Maintenance phase

18.11.4.1 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 UK Grid carbon intensity. The avoided emissions associated with the displacement of projected marginal generation of the UK 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 Morven North.

18.11.4.2 The GHG emissions arising from the consumption of materials and activities required to facilitate the O&M of Morven North are presented in Table 18.15, and further details are presented in Volume 3, Annex 18.2: Climate Change Shared GHG Technical. The majority of emissions result from vessel and helicopter movements required to undertake maintenance activities over Morven North's lifetime. Remaining emissions are associated with the replacement of cables, electrical equipment and cable protection.

18.11.4.3 Emissions from the vessel and helicopter movements, product transport and cable, scour protection and electrical equipment replacement have been calculated following the methodology outlined in paragraphs 18.11.3.5 to 18.11.3.8 above. In summary, emissions associated with fuel consumption from vessel movements have been calculated based on the maximum number of movements proposed, assumed distance of travel from a likely base port, and fuel consumption rates per vessel type. Additional emissions associated with the transport of materials and products to the construction port have been approximated, informed by the total tonnage of materials associated with the O&M phase, high level assumptions regarding travel distances, and appropriate emissions factors. Emissions associated with the replacement of cables and cable protection have been calculated using appropriate material emission intensities from the ICE database (Jones and Hammond, 2024), scaled by material estimates for each element. Finally, emissions associated with electrical equipment replacement have been scaled by those calculated for the construction phase, informed by the maximum frequency of equipment replacement.

Table 18.15: Operation and Maintenance phase Greenhouse Gas emissions

Item	Value (tCO2e)
Transport	877,056
Materials	218,629
Total	1,095,686

18.11.4.4 It should be noted that when considering Morven North's impact on climate change, the emissions as a result of O&M activities must be considered alongside the displacement of marginal alternative sources of electricity generation. This element is further considered in the assessment below.

18.11.4.5 Table 18.16 sets out the parameters for Morven North and associated annual energy output.

Table 18.16: Energy flows for Morven North

Parameter	Value	Unit	Source	
Input parameter – anticipated output capacity	1,500	MW	Volume 1, Chapter 3: Project Description	

Parameter	Value	Unit	Source
Input parameter – capacity factor	39.7	%	DESNZ (2023b)
Input parameter – degradation factor	1.6	%	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)	5,222,544	MWh	Calculated based on the input parameters above (i.e. anticipated output capacity, capacity factor, and total annual operating hours)
Output parameter – lifetime energy output (35 years)	140,803,609	MWh	Calculated based on the input parameters above (i.e. anticipated output capacity, capacity factor, and total annual operating hours), accounting for the degradation factor and scaled over Morven North's lifetime.

18.11.4.6 The input and output figures for the O&M phase of Morven North have been scaled against the assumptions stated within the DESNZ long-run marginal (DESNZ, 2023a). This allows for a direct presentation of the cumulative GHG emissions avoided throughout the O&M lifetime of Morven North and therefore, how Morven North contributes towards reaching net zero targets.

18.11.4.7 The resulting estimated avoided emissions associated with the O&M phase of Morven North would be -382,069tCO_2e avoided emissions associated with the abatement of the UK Grid (note that negative values represent avoided emissions, (i.e. emissions that would have occurred without Morven North)).

Sensitivity analysis

18.11.4.8 It should be noted that as the UK and Scotland move towards the 2050 and 2045 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 Morven North 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 2035 (DESNZ, 2025b). It is important to note therefore that from circa 2035 onwards, long-run marginal projections assume that there is no unabated fossil fuel generation, in line with UK Government policy.

18.11.4.9 However, the UK Government has highlighted that some 'transition' fossil fuels will continue to play a part in the UK's energy supply (DESNZ, 2023c). Therefore, it is likely that the true value of the avoided emissions displaced as a result of Morven North's contribution to the UK electricity grid would be higher than that of avoided emissions detailed above.

18.11.4.10 As such, a sensitivity analysis has been carried out using the current UK electricity grid carbon intensity and current estimated intensity from electricity supplied for 'all non-renewable fuels', as detailed in Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. This is shown in Table 18.17.

Table 18.17: Morven North avoided emissions sensitivity test

Operating years	Output (MWh)	DESNZ Long-run Marginal Avoided Emissions (tCO_2e)	Current UK Grid Average Avoided Emissions (tCO_2e)	DESNZ 'Non-renewable Fuels' Avoided Emissions (tCO_2e)
35	140,803,609	-382,069	-31,385,124	-61,531,177

18.11.4.11 Although the use of the current UK electricity 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 UK electricity grid decarbonisation. Further, as Morven North'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 avoided emissions value for Morven North is likely to lie between the upper and lower limits shown in Table 18.17 (i.e. between -382,069tCO2e and -61,531,177tCO2e).

Magnitude of impact

18.11.4.12 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 713,617tCO_2e (long-run marginal) and -60,435,491tCO_2e (DESNZ 'non-renewable fuels mix'), when considering the emissions associated with O&M (Table 18.15) alongside the avoided emissions of Morven North (Table 18.17). This range reflects displacement of alternative energy generation sources from a range of future baseline scenarios (note that negative values represent avoided emissions, (i.e. emissions that would have occurred without Morven North)).

Sensitivity of receptor

18.11.4.13 In accordance with paragraph 18.8.4.4, 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

18.11.4.14 Overall, the magnitude of the impact is deemed to be between 713,617tCO_2e and -60,435,491tCO_2e and the sensitivity of the receptor is considered to be high. As discussed in paragraph 18.11.4.9, it is likely that the use of the long-run marginal projections represents an underestimate of the true value of avoided emissions from Morven North. Additionally, emissions associated with O&M do not account for the continued decarbonisation of UK industry, as set out in Section 18.7.5, which is anticipated to reduce emissions associated with the O&M phase.

18.11.4.15 The magnitude of emissions is unable to be contextualised within the UK Carbon Budgets given the O&M phase falls outside of such budgets. However, the O&M phase falls within the proposed Scottish Carbon Budgets for the 2034-2040 and 2041-2045 periods and comprises between -0.04% to -8.2%, and 0.3% to -43.2%, respectively.

18.11.4.16 Morven North will produce electricity at an emissions intensity of 7.8gCO_2e/kWh (considering both the lifetime energy output reported in Table 18.16, and emissions associated with O&M reported in Table 18.15). This is lower than the current grid average (177gCO_2e/kWh), fossil fuel generation (437gCO_2e/kWh) and the Climate Change Committee's electricity emissions intensity target for 2030 (10gCO_2e/kWh) (Climate Change Committee, 2020). While Morven North's emissions intensity is not lower than the Climate Change Committee's electricity emissions intensity projections for 2040 (7gCO_2e/kWh) and 2050 (1gCO_2e/kWh) (Climate Change Committee, 2025), it should be noted that

the O&M emissions associated with material replacement and fuel consumption are likely to decarbonise over the lifetime of Morven North in line with UK decarbonisation policy. Furthermore, such emissions present a conservative assessment informed by the MDS. Therefore, the reported emissions intensity presents a conservative approach likely to reduce over the lifetime of Morven North.

18.11.4.17 Within the context of national policy, the purpose of Morven North is to provide a source of renewable energy, thereby contributing towards UK and Scottish climate change policy goals and associated renewable energy targets. The effect will, therefore, be of **beneficial** effect, which is significant in EIA terms.

Secondary mitigation and residual effect

18.11.4.18 No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is beneficial.

18.11.5 Greenhouse Gas emissions arising from decommissioning works and the recovery (or disposal) of materials

Decommissioning phase

18.11.5.1 The majority of emissions during decommissioning of Morven North relate to the use of plant/equipment for decommissioning, disassembly, transportation to a waste site, and ultimate disposal and/or recycling of the equipment and other site materials.

18.11.5.2 As stated in Volume 1, Chapter 3: Project Description, the sequence of activities in the decommissioning phase will generally be the reverse of the construction sequence and will involve similar equipment. It is anticipated all wind turbines (including foundations) and OSPs (including foundations) will be removed; inter-array and interconnector cables will be removed where possible and appropriate to do so. It is assumed that cable and scour protection will also be removed.

18.11.5.3 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 and foundations, cables and associated protection retrieved during decommissioning. Any elements left in situ 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. This impact is not assessed further.

18.11.5.4 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 (excluding emissions associated with the transport of materials and products to the construction port), totalling 255,377tCO_2e, as outlined in Table 18.14. Given carbon emissions associated with use of plant and fuel is expected to have achieved good levels of decarbonisation at the decommissioning phase of Morven North, this is likely to present a conservative MDS.

Magnitude of Impact

18.11.5.5 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 255,377tCO_2e.

Sensitivity of the receptor

18.11.5.6 In accordance with paragraph 18.8.4.4, 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

18.11.5.7 Overall, the magnitude of the impact is deemed to be 255,377tCO_2e and the sensitivity of the receptor is considered to be high. The magnitude of emissions is unable to be contextualised within the UK and proposed Scottish Carbon Budgets, as required by paragraph 18.8.4.10, 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** effect, which is not significant in EIA terms.

Secondary mitigation and residual effect

18.11.5.8 No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.

18.11.6 Net whole lifetime Greenhouse Gas impacts of Morven North

18.11.6.1 As detailed in Section 18.8, consideration of Morven North's whole life impact is an important consideration when assessing Morven North's impacts and subsequent effects on climate change. As such, the consideration of Morven North's net emissions in the context of existing and emerging policy commitments and UK carbon budgets is necessary.

18.11.6.2 Over its lifetime, the net impact of Morven North would result in between 4,511,520tCO_2e and -56,637,588tCO_2e. 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 Morven North. Negative emissions represent net avoided emissions. Morven North would have a carbon payback period of two years (at the earliest) when accounting for construction, O&M and decommissioning phase emissions (see Table 18.18 below). As discussed in paragraph 18.11.4.11, the true avoided emissions value is likely to lie between these values.

Table 18.18: Summary of Morven North net whole life Greenhouse Gas emissions

	DESNZ long-run marginal	Current UK Grid average	DESNZ 'non-renewable fuels'
Construction Emissions (tCO_2e) [1]	3,542,526		
O&M Emissions (tCO^2e) [1, 2]	713,617	-30,289,438	-60,435,491
Decommissioning Emissions (tCO_2e)	255,377		
Net Emissions (tCO_2e) [1]	4,511,520	-26,491,535	-56,637,588
Payback Period (Years)	No payback	4 years	2 years

[1] Including emissions associated with blue carbon. The greatest magnitude of emissions released have been reported within this table, to provide a conservative estimate of net GHG emissions from Morven North.

[2] The range of values presented account for the calculation of avoided emissions during the O&M using the long-run marginal, UK Grid average, and 'non-renewable fuels' emissions factors. See Section 18.11.4 for further detail.

18.11.6.3 Consideration of Morven North's net emissions performance can be considered with the following contextualisation:

- it contributes to reducing carbon budget expenditure at a national level;
- it is in keeping with Scottish and UK energy and climate policy.

18.11.6.4 Morven North's net emissions accounting for the construction phase up to the end of the UK Sixth Carbon Budget are detailed in Table 18.19 below. As outlined at paragraph 18.7.5.8, there is some uncertainty regarding Morven North's exact operational dates. However, given the indicative commissioning year of 2038 (as described in Volume 1, Chapter 3: Project Description, subject to the necessary grid connection agreements), the avoided emissions resulting from the O&M phase of Morven North will likely lie outside the scope of the currently quantified UK carbon budgets, which end in 2037 (HM Government, 2008). GHG emissions associated with the construction phase have been applied to the relevant carbon budget periods. When accounting for the five years of Morven North's construction phase GHG emissions (3,542,526tCO_2e) to the end of the Sixth Carbon Budget (2037), this corresponds to approximately 0.37% of the UK Carbon Budget for the same period. The whole life context of Morven North within Scottish Carbon Budgets is presented within Table 18.20.

Table 18.19: Greenhouse Gas impacts in the context of the United Kingdom's carbon budgets

Parameter	2033-2037
UK Carbon Budget (tCO_2e)	965,000,000
Morven North GHG Impacts (tCO_2e)	3,542,526
Morven North emissions as percentage of UK Carbon Budget (%)	0.37%

Table 18.20: Greenhouse Gas impacts in the context of the proposed Scottish carbon budgets

Parameter	2031-2035	2036-2040	2041-2045
Proposed Scottish Carbon Budget (tCO_2e)	126,000,000	81,000,000	24,000,000
Morven North GHG Impacts (tCO_2e)	2,125,515	-5,226,865 to 1,387,248	-10,373,319 to 78,486
Morven North emissions as percentage of proposed Scottish Carbon Budget (%)	1.7%	-6.5% to 1.7%	-43.2% to 0.3%

18.11.6.5 Morven North's net emission intensity, when accounting for construction, O&M, and decommissioning emissions alongside total generation output, is 34.8gCO_2e/kWh. There are no established emission intensity benchmarks available for the industry that Morven North's net emission intensity can be compared against.

18.11.6.6 Morven North is in line with the Scottish NMP's principle of supporting new offshore wind and marine renewable energy, in addition to their associated infrastructure, in order to contribute to reductions in GHG emissions. In addition, the anticipated 1.5GW capacity from Morven North, 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.

18.11.6.7 Further, Morven North is supported by national energy and climate change policy (including the National Infrastructure Strategy (HM Treasury, 2020), Net Zero Strategy (BEIS, 2021), Energy and Just Transition Plan (Scottish Government, 2023) and Scotland's Climate Change Plan (Scottish Government, 2019) 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 Morven North are necessary in order to meet GHG reduction targets.

18.11.6.8 In addition, National Grid modelling anticipates an increase in annual electricity demand across the UK to between 570TWh and 726TWh per year by 2050, compared to 286TWh per year in 2022

(National Grid ESO, 2023). By facilitating the expansion of renewable energy supply, Morven North would assist the UK Government target of achieving clean power by 2030, and the UK and Scottish Government's aim to become net zero by 2050 and 2045 respectively.

Magnitude of impact

18.11.6.9 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. between 4,511,520tCO_2e and -56,637,588tCO_2e. This range reflects displacement of alternative energy generation sources from a range of future baseline scenarios.

Sensitivity of the receptor

18.11.6.10 In accordance with paragraph 18.8.4.4, 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

18.11.6.11 Overall, the magnitude of the impact is deemed to be between 4,511,520tCO_2e and -56,637,588tCO_2e. and the sensitivity of the receptor is considered to be high. As discussed in paragraph 18.11.4.9, it is likely that the use of the long-run marginal projections represents an underestimate of the true value of avoided emissions from Morven North. Consistent with paragraph 18.8.4.10, the magnitude of emissions comprise 0.37% of the Sixth UK Carbon Budget (set out in Table 18.19). When accounting for the proposed Scottish carbon budgets, this corresponds to approximately 1.7% of the 2031-35 budget, -6.5% to 1.7%of the 2036-40 budget, and -43.2% to 0.3% of the 2041-2045 budget. In addition to this, the operational emissions intensity from generated electricity is predicted to be 7.8gCO_2e/kwh over the operational lifetime of Morven North. This is likely to be an overestimate as it does not take into account decarbonisation of fuel and the construction industry during the O&M phase. Therefore, Morven North's operational emissions intensity is likely to align with targets set by the Climate Change Committee (see Section 18.11.4).

18.11.6.12 Within the context of national policy, the purpose of Morven North 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). The effect will, therefore, be of **beneficial** effect, which is significant in EIA terms.

Secondary mitigation and residual effect

18.11.6.13 No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is beneficial.

18.11.7 Vulnerability of Morven North to climate change

Operation and Maintenance phase

18.11.7.1 Volume 3, Annex 18.1: Shared Climate Change Risk Assessment, identifies the following hazards:

- 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 MSL;
- increased wave height;
- changes in the tidal range.

18.11.7.2 These hazards could lead to the following potential impacts:

- efficiency losses and more frequent wind turbine shut-downs, reducing output of Morven North;
- the failure of electrical equipment, increasing O&M activities;
- damage to infrastructure, increasing O&M activities;
- reduced accessibility for maintenance and inspection.

18.11.7.3 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, Annex 18.1: Shared Climate Change Risk Assessment summarises the potential climatic changes in the coming decades and considers the potential consequences for Morven North in a risk assessment format, including scoring for each risk.

18.11.7.4 The risk assessment presented in Volume 3, Annex 18.1: Shared Climate Change Risk Assessment considers the exposure and vulnerability of Morven North and its users to identified climatic hazards and potential impacts.

18.11.7.5 The assessment of effects has considered the measures adopted as part of Morven North (Section 18.10) in determining the exposure and vulnerability of Morven North and its users. A significance matrix (see Table 18.11) is then used to identify significant effects which is presented in the 'significant effect' column. Should an effect be significant, secondary mitigation is presented where relevant to reduce the residual effect to negligible and not significant in EIA terms.

18.11.7.6 No hazards and resultant potential impacts to Morven North due to climate change have been identified as significant before mitigation (see Volume 3, Annex 18.1: Shared Climate Change Risk Assessment). As such, the effect on Morven North has been determined to be **negligible** which is not significant in EIA terms.

18.11.8 Proposed monitoring

18.11.8.1 No climate change monitoring to test the predictions made within the assessment of potential effects on climate change is considered necessary.

18.12 Whole project assessment and Cumulative Effects Assessment methodology

18.12.1 Methodology

18.12.1.1 The Morven Programme comprises four distinct projects: Morven North, Morven South, MHPGC Project, and MBAGC Project.

18.12.1.2 With respect to the CEA assessment for climate change effects, 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, in line with IEMA guidance (2022), cumulative effects due to other specific local development projects are not individually considered but are taken into account when considering the impact of Morven North by defining the atmospheric mass of GHGs as a high **sensitivity** receptor. The construction, O&M and decommissioning phase effects of the assessment of Morven North takes account of cumulative changes in GHG emissions from other energy generation sources. As such, no specific study area beyond that of the Morven North Boundary is relevant for the CEA for climate change.

18.12.1.3 However, it is important to note that Morven North cannot realise the avoided emissions and associated significant beneficial effect without the MHPGC Project and MBAGC Project to enable connection of Morven North to the Grid. The two grid connection projects, outlined in paragraph 18.12.1.1, have associated emissions for their construction, O&M and decommissioning phases that must be considered within the cumulative assessment for climate change. Therefore, the following

assessment scenarios have been considered to identify the potential effects of Morven North in combination with other projects on the same receptor, as follows (and summarised in Table 18.21):

- whole project assessment: to identify the potential impacts associated with Morven North together with each grid connection project in turn (Scenario 1: with MHPGC Project and Scenario 2: with MBAGC Project), each of which would comprise a "whole project";
- CEA: to identify the potential impacts associated with the four distinct projects of the Morven Programme together (i.e. Morven North, Morven South, MHPGC Project, and MBAGC Project).

18.12.1.4 The whole project assessment and CEA have been undertaken in accordance with the methodology described in Volume 1, Chapter 6: EIA Methodology.

Table 18.21: Scenarios to be considered in the Morven North whole project assessment and Cumulative Effects Assessment for Climate Change

Whole project assessment		Cumulative Effects Assessment
Scenario 1	Scenario 2	Morven North + Morven South + MHPGC Project + MBAGC Project
Morven North + MHPGC Project	Morven North + MBAGC Project	

18.12.1.5 The projects and plans selected as relevant to the CEA presented within this chapter are based upon the above scope of assessment detailed within paragraphs 18.12.1.2 and 18.12.1.3.

18.12.1.6 The potential impacts that have been considered in the whole project assessment and CEA (listed in Table 18.22) are a subset of those considered for the Morven North alone assessment. This is because some of the potential impacts identified and assessed for the Morven North alone assessment are localised and temporary in nature, or have been assessed to have negligible **significance**. It is considered therefore, that these potential impacts have limited or no potential to interact with similar changes associated with other plans or projects. These have therefore been scoped out of the whole project and CEA. These impacts include:

- the vulnerability of Morven North (and whole project/cumulative projects) to climate change during the O&M phase.

18.12.2 Maximum Design Scenario

18.12.2.1 The cumulative MDSs identified in Table 18.22 have been selected as those having the potential to result in the greatest cumulative effect on an identified receptor or receptor group. The cumulative MDSs have been based on the Morven North alone assessment MDS (Table 18.12), the Morven South alone assessment MDS, the Project Description contained within the MHPGC Project Scoping Report and limited project information available for the MBAGC Project. Further detail regarding the MHPGC Project and MBAGC Project design parameters used to inform the assessment are set out within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report.

Table 18.22: Maximum Design Scenario considered for the assessment of potential whole project and cumulative effects on Climate Change

C= Construction, O= O&M, D= Decommissioning phases

"✓" is used to denote the phase the potential impact can occur, "X" outlines there is no impact within this project phase

Potential Cumulative Effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
The impact of GHG emissions arising from seabed change.	✓	✓	✓	**Scenario 1** MDS as described for Morven North (Table 18.12), assessed cumulatively with the MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 18.12), assessed cumulatively with the MBAGC Project. **Cumulative Effects Assessment** MDS as described for Morven North (Table 18.12), assessed cumulatively with the MBAGC Project, MHPHC Project and Morven South.	The greatest footprint of Morven North, the MHPGC and MBAGC Projects, and greatest additional disturbance during construction and O&M phases will result in the greatest overall disturbance to the seabed, representing the greatest potential to disturb the maximum amount of carbon stored in benthic sediments (if these present significant carbon stores).
The impact of GHG emissions arising from manufacturing and installation, including vessel movements.	✓	×	×	**Scenario 1** MDS as described for Morven North (Table 18.12), assessed cumulatively with the MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 18.12), assessed cumulatively with the MBAGC Project. **Cumulative Effects Assessment** MDS as described for Morven North (Table 18.12), assessed cumulatively with the MBAGC Project, MHPHC Project and Morven South.	The greatest quantity of materials and fuel consumption represents the greatest potential for GHG emissions.
The impact of GHG emissions arising from the consumption of materials and activities required to facilitate the	×	✓	×	**Scenario 1** MDS as described for Morven North (Table 18.12), assessed cumulatively with the MHPGC Project. **Scenario 2**	The greatest number of vessel movements and maximum amount of maintenance activities will result in the greatest consumption of

Potential Cumulative Effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
O&M phase and the impact of estimated abatement of UK Grid emissions during the O&M phase.				MDS as described for Morven North (Table 18.12), assessed cumulatively with the MBAGC Project. **Cumulative Effects Assessment** MDS as described for Morven North (Table 18.12), assessed cumulatively with the MBAGC Project, MHPHC Project and Morven South.	fuel and materials representing the greatest potential for GHG emissions. Greatest quantity of materials and fuel consumption represents the greatest potential for GHG emissions.
The impact of GHG emissions arising from decommissioning works (e.g. plant, fuel and vessel use) and the recovery (or disposal) of materials.	×	×	✓	**Scenario 1** MDS as described for Morven North (Table 18.12), assessed cumulatively with the MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 18.12), assessed cumulatively with the MBAGC Project. **Cumulative Effects Assessment** MDS as described for Morven North (Table 18.12), assessed cumulatively with the MBAGC Project, MHPHC Project and Morven South.	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.
Net whole life GHG impacts	✓	✓	✓	**Scenario 1** MDS as described for Morven North (Table 18.12), assessed cumulatively with the MHPGC Project. **Scenario 2** MDS as described for Morven North (Table 18.12), assessed cumulatively with the MBAGC Project. **Cumulative Effects Assessment** MDS as described for Morven North (Table 18.12), assessed cumulatively with the MBAGC Project, MHPHC Project and Morven South.	The greatest footprint of Morven North and greatest additional disturbance during construction and O&M phases will result in the greatest overall disturbance to the seabed, representing the greatest potential to disturb the maximum amount of carbon stored in benthic sediments (if these present significant carbon stores). The greatest quantity of materials and fuel consumption represents the greatest potential for GHG emissions, across all phases.

Potential Cumulative Effect	Phase			Maximum Design Scenario	Justification
	C	O	D		
					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, across all phases.

18.13 Whole project assessment and Cumulative Effects Assessment

18.13.1 Overview

A description of the significance of cumulative effects upon the climate change receptor arising from each identified impact is given below. The whole project assessment and CEA for Morven North is presented in Table 18.23 and Table 18.28.

18.13.1.1 The climate change whole topic study area comprises the Morven North Climate Change Study Area, in addition to the redline boundary of the MHPGC Project (in Scenario 1) and the MBAGC Project (in Scenario 2). The Cumulative Climate Change Study Area includes these components, as well as the Morven South Climate Change Study Area, laid out in Figure 18.1 (for the CEA).

18.13.2 Greenhouse Gas emissions arising from seabed change

18.13.2.1 There is potential for further emissions arising from disturbance to blue carbon stocks, during construction, O&M, and decommissioning activities within the whole project and Cumulative Climate Change Study Area. Activities include seabed disturbance through cable, foundation and scouring installation.

18.13.2.2 These activities are relevant for Scenarios 1 and 2, and the CEA. As previously stated in Section 18.12.

18.13.2.3 The summary of the whole project assessment for climate change is presented in Table 18.23, and CEA for climate change is presented in Table 18.28.

18.13.2.4 Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report, provides detail regarding the magnitude of emissions reported below regarding the MHPGC and MBAGC Projects.

18.13.3 Greenhouse Gas emissions arising from manufacturing and installation including vessel movements

18.13.3.1 There is potential for further emissions arising from manufacturing and installation of Morven North, including vessel movements within the whole project and Cumulative Climate Change Study Area. Activities include construction of arrays and connection points, and vessel and transport movements throughout the construction phase.

18.13.3.2 These activities are relevant for Scenarios 1 and 2, and the CEA. As previously stated in Section 18.12.

18.13.3.3 The summary of the whole project assessment for climate change is presented in Table 18.24, and CEA for climate change is presented in Table 18.29.

18.13.3.4 Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report, provides detail regarding the magnitude of emissions reported below regarding the MHPGC and MBAGC Projects.

18.13.4 Greenhouse Gas emissions arising from the consumption of materials and activities required to facilitate the Operation and Maintenance phase and estimated abatement of United Kingdom Grid emissions

18.13.4.1 There is potential for further emissions arising from the consumption of materials and activities required to facilitate the O&M phase and the impact of estimated abatement of UK Grid emissions during the O&M phase, within the whole project and Cumulative Climate Change Study Area. Activities include repair and maintenance, vessel movements, and abated emissions due to the nature of both Morven North and Morven South.

18.13.4.2 These activities are relevant for Scenarios 1 and 2, and the CEA. As previously stated in Section 18.12.

18.13.4.3 The summary of the whole project assessment for climate change is presented in Table 18.25, and CEA for climate change is presented in Table 18.30.

18.13.4.4 Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report, provides detail regarding the magnitude of emissions reported below regarding the MHPGC and MBAGC Projects.

18.13.5 Greenhouse Gas emissions arising from decommissioning works and the recovery (or disposal) of materials

18.13.5.1 There is potential for further emissions arising from decommissioning works (e.g. plant, fuel and vessel use) and the recovery (or disposal) of materials within the whole project and Cumulative Climate Change Study Area. Activities include removal of infrastructure (and associated transport movements), and recovery or disposal of materials.

18.13.5.2 These activities are relevant for Scenarios 1 and 2, and the CEA. As previously stated in Section 18.12.

18.13.5.3 The summary of the whole project assessment for climate change is presented in Table 18.26, and CEA for climate change is presented in Table 18.31.

18.13.5.4 Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report, provides detail regarding the magnitude of emissions reported below regarding the MHPGC and MBAGC Projects.

18.13.6 Net whole lifetime Greenhouse Gas impacts

18.13.6.1 There is potential for further impacts on net GHG emissions, as a result of the Morven Programme's construction, O&M, and decommissioning activities within the whole project and Cumulative Climate Change Study Area. The activities include seabed disturbance through cable, foundation and scouring installation, construction of arrays and connection points, vessel and transport movements throughout each phase, repair of infrastructure, and operation of Morven North.

18.13.6.2 These activities are relevant for Scenarios 1 and 2, and the CEA. As previously stated in Section 18.12.

18.13.6.3 The summary of the whole project assessment for climate change is presented in Table 18.27, and CEA for climate change is presented in Table 18.32.

18.13.6.4 Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report, provides detail regarding the magnitude of emissions reported below regarding the MHPGC and MBAGC Projects.

Table 18.23: Morven North whole project assessment for Greenhouse Gas emissions arising from seabed change

Whole project assessment		
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
Construction phase		
Magnitude of impact	The whole project assessment for Scenario 1 considers Morven North together with the MHPGC Project. Magnitude is considered to be the GHG emissions resulting from disturbance to blue carbon stocks associated with the construction of Morven North and the MHPGC Project. This is presented quantitatively, as total CO_2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. A range of emissions is provided given uncertainty regarding remineralisation potential, consistent with the assessment provided at Section 18.11.2. The whole project 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 12,189tCO_2e to 60,947tCO_2e.	The Whole Project assessment for Scenario 2 considers Morven North together with the MBAGC Project. Magnitude is considered to be the GHG emissions resulting from disturbance to blue carbon stocks associated with the construction of Morven North and the MHPGC Project. This is presented quantitatively, as total CO_2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. A range of emissions is provided given uncertainty regarding remineralisation potential, consistent with the assessment provided at Section 18.11.2. The whole project 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 7,991tCO_2e to 39,956tCO_2e.
Sensitivity of receptor	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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor). 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	Overall, the magnitude of the whole project impact is deemed to be 12,189tCO_2e to 60,947t CO_2e and the sensitivity of the receptor is considered to be high. The whole project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	Overall, the magnitude of the whole project impact is deemed to be 7,991tCO_2e to 39,956tCO_2e and the sensitivity of the receptor is considered to be high. The whole project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Whole project assessment		
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
Further mitigation and residual significance	No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.	
Operations and maintenance phase		
Magnitude of impact	As set out in Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report, blue carbon sequestration rates in offshore sediments in the North Sea are deemed to be negligible. Furthermore, O&M activities are unlikely to result in further disturbance of sediment beyond that already disturbed during the construction phase. Therefore, it is considered that any impact of emissions arising from disturbance to blue carbon stocks will be negligible.	
Sensitivity of receptor	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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor). 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	Overall, the magnitude of impact is deemed to negligible. The effect will, therefore, be of **negligible adverse** significance, which is not significant in EIA terms.	
Further mitigation and residual significance	No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.	
Decommissioning phase		
Magnitude of impact	As set out in Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report, blue carbon sequestration rates in offshore sediments in the North Sea are deemed to be negligible, there is therefore not anticipated to be any material change to the blue carbon stocks over Morven North's, the MHBGC Project's and the MBAGC Project's lifetimes. Therefore, any disturbance to the seabed and blue carbon habitats that may result from infrastructure removal at the decommissioning phase is not likely to result in the release of additional emissions not captured by the range of likely emissions presented in the assessment of construction effects.	
Sensitivity of receptor	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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor). 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.	

Whole project assessment		
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
Significance of effect	Overall, the magnitude of impact is deemed to be negligible. The effect will, therefore be of **negligible** significance, which is not significant in EIA terms.	
Further mitigation and residual significance	No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.	

Table 18.24: Morven North whole project assessment for Greenhouse Gas emissions arising from manufacturing and installation including vessel movements

Whole project assessment		
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
Construction phase		
Magnitude of impact	The whole project assessment for Scenario 1 considers Morven North together with the MHPGC Project. Magnitude is considered to be the GHG emissions resulting from the construction of Morven North and the MHPGC Project. This is presented quantitatively, as total CO_2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. The designed in measures (detailed in Table 18.13) have not been able to be quantitatively assessed. As such, it can be expected that their implementation will result in a reduced magnitude of emissions than that presented within this assessment. Their impact on the significance of effect assessed has been considered qualitatively. The whole project 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 4,423,008tCO_2e.	The whole project assessment for Scenario 2 considers Morven North together with the MBAGC Project. Magnitude is considered to be the GHG emissions resulting from the construction of Morven North and the MBAGC Project. This is presented quantitatively, as total CO_2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. The designed in measures (detailed in Table 18.13) have not been able to be quantitatively assessed. As such, it can be expected that their implementation will result in a reduced magnitude of emissions than that presented within this assessment. Their impact on the significance of effect assessed has been considered qualitatively. The whole project 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 3,803,847tCO_2e.
Sensitivity of receptor	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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor). 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	Overall, the magnitude of the whole project impact is deemed to be 4,423,008tCO_2e and the sensitivity of the receptor is considered to be high. The whole project effect	Overall, the magnitude of the whole project impact is deemed to be 3,803,847tCO_2e and the sensitivity of the receptor is considered to be high. The whole project effect will, therefore, be

Whole project assessment		
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
	will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	of **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not of adverse significance in EIA terms.	

Table 18.25: Morven North whole project assessment for Greenhouse Gas emissions arising from the consumption of materials and activities required to facilitate the Operation and Maintenance phase and estimated abatement of United Kingdom grid emissions

Whole project assessment		
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
Operation phase		
Magnitude of impact	The whole project assessment for Scenario 1 considers Morven North together with the MHPGC Project. Magnitude is considered to be the GHG emissions resulting from the O&M of Morven North and the MHPGC Project. This is presented quantitatively, as total CO_2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. A range of emissions is provided to reflect the displacement of alternative energy generation sources from a range of future baseline scenarios, consistent with the assessment provided at Section 18.11.4. The whole project 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 therefore, considered to be between 817,982tCO_2e and -60,331,126CO_2e.	The whole project assessment for Scenario 2 considers Morven North together with the MBAGC Project. Magnitude is considered to be the GHG emissions resulting from the O&M of Morven North and the MBAGC Project. This is presented quantitatively, as total CO_2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. A range of emissions is provided to reflect the displacement of alternative energy generation sources from a range of future baseline scenarios, consistent with the assessment provided at Section 18.11.4. The whole project 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 therefore, considered to be between 746,673tCO_2e and -60,402,436tCO_2e.

Whole project assessment		
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
Sensitivity of receptor	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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor). 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	Overall, the magnitude of the whole project impact is deemed to be between 817,982tCO_2e and -60,331,126tCO_2e, and the sensitivity of the receptor is considered to be high. The whole project effect will, therefore, be of **beneficial** significance, which is significant in EIA terms.	Overall, the magnitude of the whole project impact is deemed to between 746,673tCO_2e and -60,402,436tCO_2e, and the sensitivity of the receptor is considered to be high. The whole project effect will, therefore, be of **beneficial** significance, which is significant in EIA terms.
Further mitigation and residual significance	No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not of adverse significance in EIA terms.	

Table 18.26: Morven North whole project assessment for Greenhouse Gas emissions arising from decommissioning works and the recovery (or disposal) of materials

Whole project assessment		
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
Decommissioning phase		
Magnitude of impact	The whole project assessment for Scenario 1 considers Morven North together with the MHPGC Project. Magnitude is considered to be the GHG emissions resulting from the decommissioning of Morven North, with the MHPGC Project. This is presented quantitatively, as total CO_2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. The whole project 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 330,692tCO_2e.	The whole project assessment for Scenario 2 considers Morven North together with the MBAGC Project. Magnitude is considered to be the GHG emissions resulting from the decommissioning of Morven North, with the MBAGC Project. This is presented quantitatively, as total CO2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. The whole project 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 279,480tCO_2e.
Sensitivity of receptor	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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor). 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	Overall, the magnitude of the whole project impact is deemed to be 330,692tCO_2e and the sensitivity of the receptor is considered to be high. The whole project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	Overall, the magnitude of the whole project impact is deemed to be 279,480tCO_2e and the sensitivity of the receptor is considered to be high. The whole project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.	

Table 18.27: Morven North whole project assessment for net whole lifetime Greenhouse Gas impacts

Whole project assessment		
	Scenario 1: Morven North + MHPGC Project	**Scenario 2: Morven North + MBAGC Project**
Construction, Operation and Decommissioning Phases		
Magnitude of impact	The whole project assessment for Scenario 1 considers Morven North together with the MHPGC Project. Magnitude is considered to be the net GHG emissions, resulting from the construction, operation and decommissioning of Morven North, with the MHPGC Project. This is presented quantitatively, as total CO_2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. A range of emissions is provided to reflect the displacement of alternative energy generation sources from a range of future baseline scenarios, consistent with the assessment provided at Section 18.11.4. The whole project 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 therefore, considered to be between 5,632,629tCO_2e and -55,516,480tCO_2e.	The whole project assessment for Scenario 2 considers Morven North together with the MBAGC Project. Magnitude is considered to be the GHG emissions resulting from the construction, operation and decommissioning of Morven North, with the MBAGC Project. This is presented quantitatively, as total CO_2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. A range of emissions is provided to reflect the displacement of alternative energy generation sources from a range of future baseline scenarios, consistent with the assessment provided at Section 18.11.4. The whole project 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 therefore, considered to be between 4,869,955tCO_2e and -56,279,153tCO_2e.
Sensitivity of receptor	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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor). 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	Overall, the magnitude of the whole project impact is deemed to be between 5,632,629tCO_2e and -55,516,480tCO_2e, and the sensitivity of the receptor is considered to be high. The whole project effect will, therefore, be of **beneficial** significance, which is significant in EIA terms.	Overall, the magnitude of the whole project impact is deemed to between 4,869,955tCO_2e and -56,279,153tCO_2e, and the sensitivity of the receptor is considered to be high. The whole project effect will, therefore, be of **beneficial** significance, which is significant in EIA terms.

Whole project assessment	
Further mitigation and residual significance	No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.

Table 18.28: Morven North Cumulative Effects Assessment for Greenhouse Gas emissions arising from seabed change

Cumulative Effects Assessment	
Construction phase	
Magnitude of impact	The CEA considers the Morven Programme. Magnitude is considered to be the GHG emissions resulting from disturbance to blue carbon stocks associated with the construction of Morven North, Morven South, with the MHPGC Project and the MBAGC Project. This is presented quantitatively, as total CO_2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. A range of emissions is provided given uncertainty regarding remineralisation potential, consistent with the assessment provided at Section 18.11.2. The cumulative effect 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 19,335tCO_2e to 96,674tCO_2e.
Sensitivity of receptor	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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor). 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	Overall, the magnitude of the cumulative impact is deemed to be 19,335tCO_2e to 96,674tCO_2e and the sensitivity of the receptor is considered to be high. The whole project effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.
Operations and maintenance phase	
Magnitude of impact	As set out in Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report, blue carbon sequestration rates in offshore sediments in the North Sea are deemed to be negligible. Furthermore, O&M activities are unlikely to result in further disturbance of sediment beyond that already disturbed during the construction phase. Therefore, it is considered that any impact of emissions arising from disturbance to blue carbon stocks will be negligible.
Sensitivity of receptor	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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor).

Cumulative Effects Assessment	
	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	Overall, the magnitude of impact is deemed to be negligible. Therefore, the effect will be of **negligible** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.
Decommissioning phase	
Magnitude of impact	As set out in Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report, blue carbon sequestration rates in offshore sediments in the North Sea are deemed to be negligible, there is therefore not anticipated to be any material change to the blue carbon stocks over Morven North's, Morven South's, the MHBGC Project's and the MBAGC Project's lifetimes. Therefore, any disturbance to the seabed and blue carbon habitats that may result from infrastructure removal at the decommissioning phase is not likely to result in the release of additional emissions not captured by the range of likely emissions presented in the assessment of construction effects.
Sensitivity of receptor	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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor). 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	Overall, the magnitude of impact is deemed to be negligible. Therefore, the effect will be of **negligible** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.

Table 18.29: Morven North Cumulative Effects Assessment for Greenhouse Gas emissions arising from manufacturing and installation including vessel movements

Cumulative Effects Assessment	
Construction phase	
Magnitude of impact	The CEA considers the Morven Programme. Magnitude is considered to be the GHG emissions resulting from the construction of Morven North, Morven South, the MHPGC Project and the MBAGC Project. This is presented quantitatively, as total CO_2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. The designed in measures (detailed in Table 18.13) have not been able to be quantitatively assessed. As such, it can be expected that their implementation will result in a reduced magnitude of emissions than that presented within this assessment. Their impact on the significance of effect assessed has been considered qualitatively. The cumulative effect 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 8,157,941tCO_2e.
Sensitivity of receptor	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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor). 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	Overall, the magnitude of the cumulative impact is deemed to be 8,157,941tCO_2e and the sensitivity of the receptor is considered to be high. The whole project effect will, therefore, be of **minor adverse**, which is not significant in EIA terms.
Further mitigation and residual significance	No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not of adverse significance in EIA terms.

Table 18.30: Morven North Cumulative Effects Assessment for Greenhouse Gas emissions arising from the consumption of materials and activities required to facilitate the Operation and Maintenance phase and estimated abatement of United Kingdom grid emissions

Cumulative Effects Assessment	
Operation phase	
Magnitude of impact	The CEA considers the Morven Programme. Magnitude is considered to be the GHG emissions resulting from the O&M of Morven North, Morven South, the MHPGC Project, and the MBAGC Project. This is presented quantitatively, as total CO_2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. A range of emissions is provided to reflect the displacement of alternative energy generation sources from a range of future baseline scenarios, consistent with the assessment provided at Section 18.11.4. The cumulative effect 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 therefore, considered to be between 1,613,784tCO_2e and -120,684,433tCO_2e.
Sensitivity of receptor	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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor). 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	Overall, the magnitude of the cumulative impact is deemed to be between 1,613,784tCO_2e and -120,684,433tCO_2e, and the sensitivity of the receptor is considered to be high. The whole project effect will, therefore, be of **beneficial** significance, which is significant in EIA terms.
Further mitigation and residual significance	No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not of adverse significance in EIA terms.

Table 18.31: Morven North Cumulative Effects Assessment for Greenhouse Gas emissions arising from decommissioning works and the recovery (or disposal) of materials

Cumulative Effects Assessment	
Decommissioning phase	
Magnitude of impact	The CEA considers the Morven Programme. Magnitude is considered to be the GHG emissions resulting from the decommissioning of Morven North, Morven South, the MHPGC Project and the MBAGC Project. This is presented quantitatively, as total CO2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. 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 is therefore, considered to be 635,489tCO_2e.
Sensitivity of receptor	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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor). 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	Overall, the magnitude of the cumulative impact is deemed to be 635,489tCO_2e, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.
Further mitigation and residual significance	No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.

Table 18.32: Morven North Cumulative Effects Assessment for net whole lifetime Greenhouse Gas impacts

Cumulative Effects Assessment	
Whole project net effects	
Magnitude of impact	The CEA considers the Morven Programme. Magnitude is considered to be the net GHG emissions, resulting from the construction, operation and decommissioning of Morven North, Morven South, the MHPGC Project and the MBAGC Project. This is presented quantitatively, as total CO_2e emissions. Detailed methodology regarding the quantification of associated emissions is detailed within Volume 3, Annex 18.2: Climate Change Shared Greenhouse Gases Technical Report. A range of emissions is provided to reflect the displacement of alternative energy generation sources from a range of future baseline scenarios, consistent with the assessment provided at Section 18.11.4. The cumulative 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 therefore, considered to be between 10,503,888tCO_2e and -111,794,329tCO_2e.
Sensitivity of receptor	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 CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor). 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	Overall, the magnitude of the cumulative impact is deemed to be between 10,503,888tCO_2e and -111,794,329tCO_2e, and the sensitivity of the receptor is considered to be high. The whole project effect will, therefore, be of **beneficial** significance, which is significant in EIA terms.
Further mitigation and residual significance	No climate change mitigation is considered necessary because the likely effect in the absence of mitigation is not of adverse significance in EIA terms.

18.14 Transboundary effects

18.14.1.1 All developments that emit GHGs have the potential to impact the atmospheric mass of GHGs as a receptor, and so may have a transboundary impact on climate change. Consequently, transboundary impacts of Morven North are considered by defining the atmospheric mass of GHGs as a high sensitivity receptor. Each country has its own policy 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.

18.15 Summary of impacts, mitigation, Likely Significant Effects and monitoring

18.15.1.1 Information on climate change within the Morven North Climate Change Study Area was collected through a desktop study, which is set out in Section 18.6.2

18.15.1.2 Table 18.33 presents a summary of the potential impacts, mitigation measures and the conclusion of LSE[1] on climate change in EIA terms. The impacts assessed include:

- the impact of GHG emissions arising from seabed change;
- the impact of GHG emissions arising from the manufacturing and installation of Morven North including vessel movements;
- the impact of GHG emissions arising from the consumption of materials and activities required to facilitate the O&M phase and the impact of estimated abatement of UK Grid emissions during the O&M phase;
- the impact of GHG emissions arising from decommissioning works (e.g. plant, fuel and vessel use) and the recovery (or disposal) of materials;
- the vulnerability of Morven North to climate change during the O&M phase;
- the net whole lifetime GHG impacts of Morven North.

18.15.1.3 Overall, it is concluded that there will be the following LSE[1] arising from Morven North during the construction, O&M or decommissioning phases:

- GHG emissions arising from the consumption of materials and activities required to facilitate the O&M phase and estimated abatement of UK grid emissions (beneficial);
- net whole lifetime GHG impacts of Morven North (beneficial).

18.15.1.4 Table 18.34 presents a summary of the potential cumulative impacts, mitigation measures and the conclusion of LSE[1] on climate change in EIA terms. The cumulative effects assessed include:

- the impact of GHG emissions arising from seabed change;
- the impact of GHG emissions arising from the manufacturing and installation of the OWF Project including vessel movements;
- the impact of GHG emissions arising from the consumption of materials and activities required to facilitate the O&M phase and the impact of estimated abatement of UK Grid emissions during the O&M phase;
- the impact of GHG emissions arising from decommissioning works (e.g. plant, fuel and vessel use) and the recovery (or disposal) of materials;
- the net whole lifetime GHG impacts.

18.15.1.5 Overall, it is concluded that there will be the following likely significant cumulative effects from Morven North alongside other projects/plans:

- GHG emissions arising from the consumption of materials and activities required to facilitate the O&M phase of Scenarios 1 and 2, and the CEA, and estimated abatement of UK grid emissions (beneficial);
- net whole lifetime GHG impacts of Scenarios 1 and 2, and the CEA (beneficial).

18.15.1.6 No likely significant transboundary effects have been identified in regard to effects of Morven North.

Table 18.33: Summary of Likely Significant Effects, mitigation and monitoring

C= Construction, O= O&M, D= Decommissioning phases

"✓" is used to denote the phase the potential impact can occur, "X" outlines there is no impact within this project phase

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
	C	O	D							
The impact of GHG emissions arising from seabed change.	✓	✓	✓	N/A	C: 5,908tCO_2e to 29,540tCO_2e O: Negligible D: Negligible	C: High O: High D: High	C: Minor adverse (not significant) O: Negligible (not significant) D: Negligible (not significant)	N/A	N/A	N/A
The impact of GHG emissions arising from the manufacturing and installation of Morven North including vessel movements.	✓	×	×	Provision of a GHG Reduction Strategy detailing the processes and measures to be implemented to manage carbon throughout the construction phase (further detail provided in Table 18.13).	3,512,986tCO_2e	High	Minor adverse (not significant)	N/A	N/A	N/A
GHG emissions arising from the consumption of materials and activities required to facilitate the O&M phase and estimated	×	✓	×	N/A	Between 713,617tCO_2e (long-run marginal) and -60,435,491tCO_2e (DESNZ 'non-renewable fuels mix')	High	Beneficial (significant)	N/A	N/A	N/A

Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
	C	O	D							
abatement of UK grid emissions										
The impact of GHG emissions arising from decommissioning works (e.g. plant, fuel and vessel use) and the recovery (or disposal) of materials.	×	×	✓	When disposing of wind turbines during the decommissioning phase, recycling is the preferred solution.	255,377tCO_2e	High	Minor adverse (not significant)	N/A	N/A	N/A
Net whole life GHG impacts of Morven North	✓	✓	✓	N/A	Between 4,511,520tCO_2e (long-run marginal) and -56,637,588tCO_2e (DESNZ 'non-renewable fuels mix')	high	Beneficial (significant)	N/A	N/A	N/A
The vulnerability of Morven North to climate change during the O&M phase.	×	✓	×	Detailed descriptions of designed-in mitigations are laid out in Table 18.13	N/A	N/A	Negligible (not significant)	N/A	N/A	N/A

Table 18.34: Summary of likely significant cumulative environment effects, mitigation and monitoring

C= Construction, O= O&M, D= Decommissioning phases

"✓" is used to denote the phase the potential impact can occur, "X" outlines there is no impact within this project phase

Scenario	Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
		C	O	D							
Scenario 1	GHG emissions arising from seabed change	✓	✓	✓	N/A	C: 12,189tCO_2e to 60,947 tCO_2e O: Negligible D: Negligible	C: High O: High D: High	C: Minor Adverse (not significant) O: Negligible (not significant) D: Negligible (not significant)	N/A	N/A	N/A
Scenario 2						C: 7,991tCO_2e to 39,956tCO_2e O: Negligible D: Negligible					
CEA						C: 19,335 tCO_2e to 96,674tCO_2e O: Negligible D: Negligible					
Scenario 1	GHG emissions arising from manufacturing and installation	✓	×	×	Provision of a GHG Reduction Strategy detailing the	4,423,008tCO_2e	High	Minor Adverse (not significant)	• N/A	N/A	N/A
Scenario 2						3,803,847tCO_2e					

Scenario	Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
		C	O	D							
CEA	including vessel movements				processes and measures to be implemented to manage carbon throughout the construction phase (further detail provided in Table 18.13).	8,157,941tCO_2e					
Scenario 1	GHG emissions arising from the consumption of materials and activities required to facilitate the O&M phase and estimated abatement of UK grid emissions	×	✓	×	N/A	Between 817,982tCO_2e and -60,331,126tCO_2e	High	Beneficial (significant)	N/A	N/A	Regular inspections to be carried out to assess wind turbine and OSP condition, where conditions allow
Scenario 2						Between 746,673tCO2e and -60,402,436tCO2e					
CEA						Between 1,613,784tCO_2e and -120,684,433tCO_2e					

Scenario	Description of impact	Phase			Designed-in measures	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional mitigation measures	Significance of residual effect	Proposed monitoring
		C	O	D							
Scenario 1	GHG emissions arising from decommissioning works and the recovery (or disposal) of materials	×	×	✓	When disposing of wind turbines during the decommissioning phase, recycling is the preferred solution.	330,692tCO_2e	High	Minor Adverse (not significant)	N/A	N/A	N/A
Scenario 2						279,480tCO_2e					
CEA						635,489tCO_2e					
Scenario 1	Net whole lifetime GHG impacts	✓	✓	✓	N/A	Between 5,632,629tCO_2e and -55,516,480tCO_2e	High	Beneficial (significant)	N/A	N/A	N/A
Scenario 2						Between 4,869,955tCO_2e - 56,279,153tCO_2e.					
CEA						Between 10,503,888tCO_2e and -111,794,329tCO_2e					

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