Partners in UK offshore wind

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Environmental Statement

Volume 2, Chapter 12: Climate change

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Glossary

Term	Meaning
Applicant	Morgan Offshore Wind Limited.
Climate change	A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.
CO_2e	'carbon dioxide equivalent.' Used to measure and compare emissions from greenhouse gases based on how severely they contribute to global warming
Emissions	An amount of a substance that is produced and sent out into the air that is harmful to the environment, especially carbon dioxide.
Fossil fuel	A hydrocarbon-containing material formed naturally in the earth's crust from the remains of dead plants and animals.
Greenhouse Gas (GHG)	A gas that absorbs and emits radiant energy within the thermal infrared range, causing the greenhouse effect. Examples include carbon dioxide and methane.
International commitments	Commitments made publicly on the international level.
Life Cycle Assessment	The systematic analysis of the potential environmental impacts of products or services during their entire life cycle.
Marginal generation source	Accounts for sustained changes in energy consumption for the purposes of cost-benefit analysis, including policy appraisal.
Net zero	A target of completely negating the amount of greenhouse gases produced by human activity either worldwide or by a country or organisation, to be achieved by reducing emissions and implementing methods of absorbing carbon dioxide from the atmosphere.
Renewable energy	Energy from a source that is not depleted when used, such as wind or solar power.
UK Grid Carbon Intensity	Carbon intensity is a measure of how clean UK Grid electricity is. It refers to how many grams of carbon dioxide (CO_2) are released to produce a kilowatt hour (kWh) of electricity.
Well-to-tank	All greenhouse gas emissions from the production, transportation, transformation and distribution of the fuel used to power the equipment or vehicle.

Acronyms

Acronym	Description
BEIS	Department for Business, Energy and Industrial Strategy
CEA	Cumulative Effects Assessment
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide
DCO	Development Consent Order
DESNZ	Department for Energy Security and Net Zero
EIA	Environmental Impact Assessment

Acronym	Description
GHG	Greenhouse Gas
GWP	Global warming potential
ICCI	In-combination climate impacts
ICE	Inventory of Carbon and Energy
IPCC	Intergovernmental Panel on Climate Change
LCA	Life cycle assessment
MDS	Maximum Design Scenario
MSL	Mean sea level
NPS	National Policy Statements
NSIP	Nationally Significant Infrastructure Project
OSP	Offshore Substation Platform
PEIR	Preliminary Environmental Information Report
UNFCC	United Nations Framework Convention on Climate Change

Units

Unit	Description
ºC	Degree celcius
%	Percentage
Km	kilometres
km^2	Square kilometres
m	meter
m^2	Square meters
m/s	Meter per second
MWh	Megawatt hour
kWh	Kilowatt hour
GW	Gigawatt
Kg	Kilogram
T	Tonne
Gt	Giggatonne
MW	megawatt
nm	Nautical miles
CO_2e	Carbon dioxide equivalent
$GtCO_2e$	Giga tonnes carbon dioxide equivalent

12 Climate change

12.1 Introduction

12.1.1 Overview

12.1.1.1 This chapter of the Environmental Statement presents the assessment of the potential impact of the Morgan Offshore Wind Project Generation Assets, hereafter referred to as the Morgan Generation Assets, on and from climate change. Specifically, this chapter considers the potential impact of the Morgan Generation Assets within the climate change study area during the construction, operations and maintenance, and decommissioning phases.

12.1.1.2 Climate change in the context of Environmental Impact Assessment (EIA) can be considered broadly in two parts:

- The effect of greenhouse gas (GHG) emissions caused directly or indirectly by the Morgan Generation Assets, which may have the potential to contribute to climate change.
- The potential effect of changes in climate on the Morgan Generation Assets, which could affect it directly or could modify its other environmental impacts. Consideration of in-combination climate impacts (ICCI) is considered within each relevant technical chapter of the Environmental Statement and not within this Climate change chapter.

12.1.1.3 The assessment presented is informed by the following technical chapters:

- Volume 2, Chapter 2: Benthic subtidal ecology of the Environmental Statement
- Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement.

12.1.1.4 This chapter also draws upon information contained within the following technical reports:

- Volume 4, Annex 12.1: Technical greenhouse gas assessment of the Environmental Statement
- Volume 4, Annex 12.2 Climate change risk assessment of the Environmental Statement.

12.1.1.5 In particular, this Environmental Statement chapter:

- Presents the existing and future environmental baseline conditions established from desk studies.
- Identifies any assumptions and limitations encountered in compiling the environmental information.
- Presents the potential environmental effects on climate change (GHG emissions) from the Morgan Generation Assets and from climate change (risk and resilience) on the Morgan Generation Assets, based on the information gathered and the analysis and assessments undertaken.

- Details any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects of the Morgan Generation Assets on and from climate change.

12.2 Legislative and policy context

12.2.1 Legislation

12.2.1.1 The Climate Change Act 2008, as amended (2019), 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 greenhouse gases the UK can emit over a 5-year period) for the whole of the UK.

12.2.1.2 At present, the Third, Fourth, Fifth and Sixth Carbon Budgets, set through The Carbon Budget Orders 2009, 2011, 2016 and 2021 are 2.54 giga tonnes carbon dioxide equivalent ($GtCO_2e$) for 2018 to 2022, 1.95 $GtCO_2e$ for 2023 to 2027, 1.73 $GtCO_2e$ for 2028 to 2032 and 0.97 $GtCO_2e$ 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.

12.2.1.3 The UK's nationally determined contribution (BEIS, 2022c) under the Paris Agreement to the United Nations Framework Convention on Climate Change (UNFCCC), submitted in December 2020, commits the UK to reducing economy wide GHG emissions by at least 68% by 2030, compared to 1990 levels.

12.2.2 Planning policy context

12.2.2.1 The Morgan Generation Assets will be located in English offshore waters (beyond 12 nm from the English coast). As set out in Volume 1, Chapter 1: Introduction of the Environmental Statement, as the Morgan Generation Assets is an offshore generating station with a capacity of greater than 100 MW located in English waters, it is a Nationally Significant Infrastructure Project (NSIP) as defined by Section 15(3) of the Planning Act 2008 (as amended) (the 2008 Act). As such, there is a requirement to submit an application for a Development Consent Order (DCO) to the Planning Inspectorate to be decided by the Secretary of State for the Department for Energy Security and Net Zero.

12.2.3 National Policy Statements

12.2.3.1 There are currently six energy National Policy Statements (NPSs), three of which contain policy relevant to offshore wind development and two of which are specific to the Morgan Generation Assets:

- Overarching NPS for Energy (NPS EN-1) which sets out the UK Government's policy for the delivery of major energy infrastructure (Department for Energy Security & Net Zero, 2023a)

- NPS for Renewable Energy Infrastructure (NPS EN-3) (Department for Energy Security & Net Zero, 2023b)

12.2.3.2 NPS EN-1 and NPS EN-3 include guidance on what matters are to be considered in the assessment. These are summarised in Table 12.1. NPS EN-1 and NPS EN-3 also highlight a number of factors relating to the determination of an application and in relation to mitigation. These are summarised in Table 12.2.

Table 12.1: Summary of the NPS EN-1 and NPS EN-3 provisions relevant to climate change.

Summary of NPS EN-3 and EN-1 provision	How and where considered in the Environmental Statement
NPS EN-1	
GHG emissions	
'Operational GHG emissions are a significant adverse impact from some types of energy infrastructure which cannot be totally avoided' and that *'all proposals for energy infrastructure projects should include a GHG assessment as part of their ES'.* [Paragraphs 5.3.11 and 5.3.4].	Section 12.9 provides an assessment of CO_2e emissions and other relevant greenhouse gases of the Morgan Generation Assets and draws on information provided in Volume 4: Annex 12.1: Technical greenhouse gas assessment of the Environmental Assessment. This includes consideration of whole life emissions (section 12.11) across: • construction including embodied carbon (section 12.9.2) and land use/seabed change (section 12.9.3); • operation and maintenance (section 12.9.5); and • decommissioning phases (section 12.9.4).
With regards specifically to mitigation, *'a GHG assessment should be used to drive down GHG emissions at every stage of the proposed development and ensure that emissions are minimised as far as possible for the type of technology'*. [Paragraph 5.3.5].	Mitigation measures (commitments) to reduce emissions associated with Morgan Generation Assets are detailed from Section 12.9 paragraph 12.9.3.13.
Climate adaptation and resilience	
With regards to climate change adaptation, applicants must consider the impacts of climate change and that an Environmental Statement *'should set out how the proposal will take account of the projected impacts of climate change'*. [Paragraph 4.10.9].	Section 12.10 provides an assessment of climate risk and resilience for the relevant elements of the Morgan Generation Assets and draws on information provided in Volume 4: Annex 12.2: Climate change risk assessment of the Environmental Assessment.
'Where energy infrastructure has safety critical elements… the applicant should apply a credible maximum climate change scenario'. [Paragraph 4.10.12].	

Summary of NPS EN-3 and EN-1 provision	How and where considered in the Environmental Statement
NPS EN-3	
Climate adaptation and resilience	
'*Offshore wind farms will not be affected by flooding… applicants should particularly set out how the proposal would be resilient to storms.*(paragraph 2.4.8 of NPS EN-3).	There is no land based infrastructure with the Morgan Generation Assets and as such no assessment concerning onshore, land based infrastructure has been conducted. This chapter (section 12.10) provides an assessment of climate risk and resilience for the relevant elements of the Morgan Generation Assets and draws on information provided in Volume 4: Annex 12.2: Climate change risk assessment of the Environmental Assessment.

Table 12.2: Summary of NPS EN-1 and NPS EN-3 policy on decision making relevant to climate change.

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
NPS EN-1	
GHG emissions	
NPS EN-1 sets out how the energy sector can help deliver the Government's climate change objectives by clearly setting out the need for new low carbon energy infrastructure to contribute to climate change mitigation. [Paragraphs 2.3.3 to 2.3.4].	Volume 1, Chapter 2: Policy and legislative context of the Environmental Statement.
'The Secretary of State must be satisfied that the applicant: has as far as possible assessed the GHG emissions of all stages of the development;… taken all reasonable steps to reduce the GHG emissions of the construction and decommissioning stage of the development;… give appropriate weight to projects that embed nature-based or technological processes to mitigate or offset the emissions of construction and decommissioning within the proposed development. Paragraph 5.3.8-5.3.10 *The Secretary of State does not, therefore need to assess individual applications for planning consent against operational carbon emissions and their contribution to carbon budgets, net zero and our international climate commitments. The Secretary of State does not, therefore need to assess individual applications for planning consent against operational carbon emissions and their contribution to carbon budgets, net zero and our international climate commitments.'* Paragraph 5.3.12	Section 12.9 provides an assessment of CO_2e emissions and other relevant greenhouse gases of the Morgan Generation Assets and draws on information provided in Volume 4: Annex 12.1: Technical greenhouse gas assessment of the Environmental Assessment. This includes consideration of whole life emissions (section 12.11) across: • construction including embodied carbon (section 12.9.2) and land use/seabed change (section 12.9.3); • operation and maintenance (section 12.9.5); and • decommissioning phases (section 12.9.4).

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
Climate adaptation and resilience	
'The Secretary of State should be satisfied that applicants for new energy infrastructure have taken into account the potential impacts of climate change using the latest UK Climate Projections and associated research and expert guidance available at the time the ES was prepared to ensure they have identified appropriate mitigation or adaptation measures.' (Paragraph 4.10.13)	This chapter (section 12.10) provides an assessment of climate risk and resilience for the relevant elements of the Morgan Generation Assets and draws on information provided in Volume 4: Annex 12.2: Climate change risk assessment of the Environmental Assessment.
'Adaptation measures should be required to be implemented at the time of construction where necessary and appropriate to do so.' (Paragraph 4.10.19)	This chapter (section 12.10) provides an assessment of climate risk and resilience for the relevant elements of the Morgan Generation Assets and draws on information provided in Volume 4: Annex 12.2: Climate change risk assessment of the Environmental Assessment.
NPS EN-3	
GHG emissions	
Provides the primary policy for decisions by the Secretary of State on applications they receive for nationally significant renewable energy infrastructure defined at section 1.6 of NPS EN-3.	Volume 1, Chapter 2: Policy and legislative context of the Environmental Statement.

12.2.4 National Planning Policy Framework

12.2.4.1 The Morgan Generation Assets study area includes areas of the English Mainland (North West England). The National Planning Policy Framework (NPPF) (September 2023) provides overarching advice regarding development. The aim of achieving sustainable development is the main theme of the NPPF. Those sections of particular relevance to climate change are set out in Table 12.3, below. In addition, Table 12.4 provides relevant advice and provisions from national energy and climate change policy.

Table 12.3: English National Planning Policy Framework.

Summary of NPPF provision	How and where considered in the Environmental Statement
Paragraph 152 states that the planning system should '*shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience*'.	This chapter and the assessment (section 12.9) presents the likely contribution of the Morgan Generation Assets to decarbonising the UK electricity Grid and transitioning towards a low carbon economy.

Summary of NPPF provision	How and where considered in the Environmental Statement
New development should '*avoid vulnerability to the range of impacts arising from climate change… care should be taken to ensure that risks can be managed through suitable adaptation measures*'.	This chapter (section 12.10) provides an assessment of climate risk and resilience for the relevant elements of the Morgan Generation Assets and draws on information provided in Volume 4: Annex 12.1: Technical greenhouse gas assessment of the Environmental Assessment.

Table 12.4: National energy and climate change policy.

Policy	Summary	How and where considered in the Environmental Statement
Climate Change Act 2008	• Commits the UK government to reducing greenhouse gas emissions by 100% of 1990 levels by 2050 and created a framework for setting a series of interim national carbon budgets and plans for national adaptation to climate risks.	An assessment of CO_2e emissions and other relevant greenhouse gases of the Morgan Generation Assets is provide in section 12.9. A detailed assessment is provided within Volume 4, Annex 12.1 Technical greenhouse gas assessment of the Environmental Statement.
Clean Growth Strategy 2017	• The 2017 Clean Growth Strategy for the UK (BEIS, 2017) contains a key objective of 'Delivering Clean, Smart, Flexible Power' and details specific policies through which this can be achieved: – Policy 33 of the report states the government's intention to phase out the use of unabated coal for electricity production by 2025 – Policy 35 sets government's intentions to improve the route to market for renewable technologies – Policy 36 details plans to target a total carbon price in the power sector which will give businesses greater clarity on the total price they will pay for each tonne of emissions.	An assessment of CO_2e emissions and other relevant greenhouse gases of the Morgan Generation Assets is provide in section 12.9. A detailed assessment is provided within Volume 4, Annex 12.1 Technical greenhouse gas assessment of the Environmental Statement.
Energy White Paper: Powering Our Net Zero Future 2020	• The Energy White Paper (BEIS, 2020) builds on the Ten Point Plan to set energy-related measures in a long-term strategic vision, working towards the net zero emissions target for 2050. It establishes a shift from fossil fuels to cleaner energy in terms of power, buildings and industry, whilst creating jobs and growing the economy.	An assessment of CO_2e emissions and other relevant greenhouse gases of the Morgan Generation Assets is provide in section 12.9. A detailed assessment is provided within Volume 4, Annex 12.1 Technical greenhouse gas assessment of the Environmental Statement.

Policy	Summary	How and where considered in the Environmental Statement
National Infrastructure Strategy 2020	• The National Infrastructure Strategy (HM Treasury, 2020) focuses on the investment and delivery of infrastructure, which is fundamental to delivering net zero emissions by 2050. The strategy sets out the UK Government's plans to deliver on this target, decarbonising the economy and adapting to climate change: – Work towards meeting the net zero emissions target by 2050 – Decarbonise the UK's power, heat and transport networks, and take steps to adapt to climate change impacts. This will require increased investments in network infrastructure, storage and increased renewable and low carbon generation capacity – It is anticipated that the bulk of the low-carbon generation needed by 2050 will be provided by low cost renewables – Reducing emissions across whole sectors of the economy must be done in a sustainable way that minimises cost.	An assessment of CO_2e emissions and other relevant greenhouse gases of the Morgan Generation Assets is provide in section 12.9. A detailed assessment is provided within Volume 4, Annex 12.1 Technical greenhouse gas assessment of the Environmental Statement.
Net Zero Strategy: Build Back Greener, 2021	• This strategy (BEIS, 2021a) 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.	An assessment of CO_2e emissions and other relevant greenhouse gases of the Morgan Generation Assets is provide in section 12.9. A detailed assessment is provided within Volume 4, Annex 12.1 Technical greenhouse gas assessment of the Environmental Statement.

Policy	Summary	How and where considered in the Environmental Statement
British Energy Security Strategy, 2022	The offshore wind process shall be supported by: • *'Reducing consent time from up to four years down to one year* • *Strengthening the Renewable National Policy Statements to reflect the importance of energy security and net zero* • *Introducing strategic compensation environmental measures, including for projects already in the system, to offset environmental effects and reduce delays to projects* • *Reviewing the way in which the Habitats Regulations Assessments are carried out for all projects making applications from late 2023 to maintain valued protection for wildlife, whilst reducing reams of paperwork* • *Implementing a new Offshore Wind Environmental Improvement Package including an industry-funded Marine Recovery Fund and nature-based design standards to accelerate deployment whilst enhancing the marine environment* • *Working with the Offshore Wind Acceleration Task Force; a group of industry experts brought together to work with Government, Ofgem and National Grid on further cutting the timeline.* • *Establishing a fast-track consenting route for priority cases where quality standards are met, by amending Planning Act 2008 so that the relevant Secretary of State can set shorter examination timescales'* (BEIS, 2022a).	An assessment of CO_2e emissions and other relevant greenhouse gases of the Morgan Generation Assets is provide in section 12.9. A detailed assessment is provided within Volume 4, Annex 12.1 Technical greenhouse gas assessment of the Environmental Statement.

12.2.5 North West Inshore and North West Offshore Marine Plans

12.2.5.1 The climate change impact assessment has also been made with consideration to the specific policies set out in the North West Inshore and North West Offshore Marine Plans (MMO, 2021). Key provisions are set out in Table 12.5 along with details as to how these have been addressed within the assessment.

Table 12.5: North West Inshore and North West Offshore Marine Plan policies of relevant to climate change.

Policy	Key provisions	How and where considered in the Environmental Statement
NW-REN-1	• Proposals that enable the provision of renewable energy technologies and associated supply chains, will be supported.	Volume 1, Chapter 2: Policy and legislative context of the Environmental Statement.

Policy	Key provisions	How and where considered in the Environmental Statement
NW-REN-2	• Proposals for new activity within areas held under a lease or an agreement for lease for renewable energy generation should not be authorised, unless it is demonstrated that the proposed development or activity will not reduce the ability to construct, operate or decommission the existing or planned energy generation project.	Volume 1, Chapter 2: Policy and legislative context of the Environmental Statement.
NW-REN-3	• Proposals for the installation of infrastructure to generate offshore renewable energy, inside areas of identified potential and subject to relevant assessments, will be supported.	Volume 1, Chapter 2: Policy and legislative context of the Environmental Statement.
NW-CC-2	• Proposals in the north west marine plan areas should demonstrate for the lifetime of the project that they are resilient to the impacts of climate change and coastal change.	A climate risk assessment (Volume 4, Annex 12.2: Climate change risk assessment of the Environmental Statement) has been carried out to assess the projects resilience to likely changes to the climate. The assessment of climate change risk is presented in section 12.10 of this chapter.
NW-CC-3	• Proposals in the north west marine plan areas, and adjacent marine plan areas, that are likely to have significant adverse impact on coastal change, or on climate change adaptation measures inside and outside of the proposed project areas, should only be supported if they can demonstrate that they will, in order of preference: a) Avoid b) Minimise c) Mitigate - adverse impacts so they are no longer significant.	The assessment (section 12.9) presents the likely significant effects on climate change and the proposed mitigation that would avoid, minimise or otherwise mitigate.

12.3 Consultation

12.3.1.1 A summary of the key matters raised during consultation activities undertaken to date specific to climate change is presented in Table 12.6, together with how these matters have been considered in this chapter.

Table 12.6: Summary of key matters raised during consultation activities undertaken for the Morgan Generation Assets relevant to climate change.

Date	Consultee and type of response	Matters raised	Response to issue raised and/or where considered in this chapter
June 2022	The Planning Inspectorate - Scoping Opinion	*'The Scoping Report states that the Proposed Development is proposed to incorporate engineering safety headroom into design for resilience, and evidence drawn from the Met Office (2018) states that peak wind speeds and wave heights are not likely to be increased by climate change during the Proposed Development's lifetime.* *Climate projections have been updated since 2018 and the Environment Agency have more up to date modelled projections that have not been considered in the Scoping Report. These indicate an increase in both wave height and wind speed. The Environmental Statement should assess the vulnerability of the Proposed Development to climate change using the most up to date allowances and make effort to agree the approach with the Environment Agency.* *The Environmental Statement should also describe and assess the adaptive capacity that has been incorporated into the design of the Proposed Development.'*	A climate risk assessment (Volume 4, Annex 12.2: Climate change risk assessment of the Environmental Statement) has been carried out to assess the Morgan Generation Assets resilience to likely changes to the climate. The assessment of climate change risk is presented in section 12.10 of this chapter.
June 2022	The Planning Inspectorate - Scoping Opinion	*'The Scoping Report explains that inter-related effects will be assessed within each relevant aspect chapter, assessing how climate change may affect the future baseline scenario. The Inspectorate is content with this approach. The Environmental Statement should cross-reference other relevant chapters where this is assessed in for clarity.'*	Inter-related effects are presented in section 12.15. The main areas where there is a potential for inter-related effects, subject to assessment, are considered to be: - Volume 2, Chapter 2: Benthic ecology of the Environmental Statement - Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement

Date	Consultee and type of response	Matters raised	Response to issue raised and/or where considered in this chapter
June 2023	Isle of Man Department of Infrastructure	*'Chapter 17 Climate Change* • *The PEIR report is comprehensive and ties into UK National Planning policy, plus energy and climate policy* • *The GHG emissions are clearly stated across each stage, construction, operations and decommissioning* • *The whole-life avoided-emissions are clearly stated and show that the developments, despite being emitters, are positive for overall global emissions when comparing them to fossil fuels* • *Adaptation risks have been considered* • *The PEIR report is a fair and reasonable assessment.* *In addition, noting the concerns regarding the potential effects on shipping and navigation route as a result of this proposed development; from a climate change point of view the shipping and navigation section seems to be well assessed, and since ferries are by far the lowest emitting way to travel to and from the Island, it is very important that these routes are not significantly affected by this development proposal.'*	The shipping and navigation chapter (Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement) has considered the impact on route deviation as a result of the Morgan Generation Assets. Section 12.9.5 and the GHG technical report (Volume 4, Annex 12.1: Technical greenhouse gas assessment of the Environmental Statement) has considered the indirect impact on GHG emissions as a result.
June 2023	Isle of Man Steam Packet Company	*'Section 4: Environmental Impact on Route Diversion* *As an example and to illustrate the Environmental impact caused on Douglas-Heysham diversion by the Ben-My-Chree as result of the Morgan project and in way of additional carbon dioxide (CO_2) emission, 848 tonnes of CO_2 per year will be produced as result. The additional amount of CO_2 emissions indicated does not include those created during adverse weather routing which will significantly increase (diversion of 40 minutes per trip and on the basis of conservative 10% of the annual number of trips will add further 422 tonnes of CO_2 emissions).'*	The shipping and navigation chapter (Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement) has considered the impact on route deviation as a result of the Morgan Generation Assets. Section 12.9.5 and the GHG technical report (Volume 4, Annex 12.1: Technical greenhouse gas assessment of the Environmental Statement) has considered the indirect impact on GHG emissions as a result.
June 2023	Section 42 Consultation response	*'Shipping: The standard route from Heysham to Douglas will increase by 1.1 nm (and the Liverpool to Douglas by 0.4 nm). With several sailings per day all year round there will be a cumulative impact on*	The shipping and navigation chapter (Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement) has considered the impact on route deviation as a result of

Date	Consultee and type of response	Matters raised	Response to issue raised and/or where considered in this chapter
		carbon emissions linked to the Isle of Man due to additional distances travelled. Increases in bad weather steaming times are more significant and will have a greater impact on such emissions.'	the Morgan Generation Assets. Section 12.9.5 and the GHG technical report (Volume 4, Annex 12.1: Technical greenhouse gas assessment of the Environmental Statement) has considered the indirect impact on GHG emissions as a result.
June 2023	Stena Line	*'INITIATIVES* *Stena Line has been spearheading sustainable practice for many years. In 2015, Stena Line converted the Stena Germanica to run on both diesel and methanol, making it the world's first Roll-on Passenger (RoPax) vessel to do so.2 Since then, Stena Line has developed the new E-Flexer class vessels and the NewMax vessels.* *GREEN ENERGY* *Stena Line has set a target to reduce CO_2 emissions from its vessels by 30% by 2030.* *GREEN ENERGY* *At present, 100% renewable electricity is used in Stena Line's shore operation (by purchasing green credits for three of its ports) and about 20% of all Stena Line terminals offer shore power connections to Stena Line vessels.* *GREEN ENERGY* *Stena Line is also investing in new green technologies including battery power, quayside powerbanks for charging electric ferries, alternative fuels (including methanol), utilising artificial intelligence in route planning and efficient ship designs.* *GREEN ENERGY* *The construction of the Wind Farms poses a concern to Stena Line's sustainability strategy insofar as Stena Line's vessels will be forced to deviate and take longer routes to safely transit around the Wind Farms' footprint. As noted above, this is in turn will increase fuel consumption and consequently greenhouse gas emissions. In addition, the impact on Stena Line's route operations may make it more difficult to ensure compliance with international and regional*	The shipping and navigation chapter (Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement) has considered the impact on route deviation as a result of the Morgan Generation Assets. Section 12.9.5 and the GHG technical report (Volume 4, Annex 12.1: Technical greenhouse gas assessment of the Environmental Statement) has considered the indirect impact on GHG emissions as a result.

Date	Consultee and type of response	Matters raised	Response to issue raised and/or where considered in this chapter
		emissions regulations (including the IMO's Energy Efficiency Existing Ship Index and Carbon Intensity Indicator regulations and the EU Emissions Trading System). *Accordingly, the Wind Farms' green energy credentials need to be assessed in the round, and according to the impact it will have on Stena Line's, and numerous other stakeholders', own sustainability strategies.* *Another concern that Stena Line have is the potential environmental impact caused by increased emissions from the additional transit distance and resulting fuel consumption. This may also adversely affect Stena Line's ability to comply with regional and international maritime emissions regulations, including the IMO's CII regulations.'*	
June 2023	Travelwatch Northwest	*'North West Public Transport Users' Forum Community Interest Company trading as TravelWatch NorthWest Company No. 6181713 Registered Office: 11 Harvelin Park, Todmorden, Lancs OL14 6HX. It will not help the work to tackle climate change if ferry companies have to use more fuel avoiding windfarms because of a lack of adequate consideration of the needs of the ferry companies and their passengers.'*	The shipping and navigation chapter (Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement) has considered the impact on route deviation as a result of the Morgan Generation Assets. Section 12.9.5 and the GHG technical report (Volume 4, Annex 12.1: Technical greenhouse gas assessment of the Environmental Statement) has considered the indirect impact on GHG emissions as a result.

12.4 Baseline methodology

12.4.1 Relevant guidance

12.4.1.1 The main guidance used for the assessment of GHG emissions in EIA is the Institute of Environmental Management and Assessment (IEMA) guide to 'Assessing Greenhouse Gas Emissions and Evaluating their Significance' (IEMA, 2022).

12.4.1.2 The main guidance document with regard to climate risk and resilience assessment (including ICCI assessment) within the context of EIA is the Environmental Impact Assessment Guidance on: Climate Change Resilience & Adaptation (IEMA, 2020).

12.4.1.3 Additional guidance used for the quantification of GHG emissions has included:

- The Greenhouse Gas Protocol suite of documents (World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD), 2004)
- UK Government GHG Conversion Factors for Company Reporting (Department for Energy Security and Net Zero (DESNZ) and Department for Environment, Food and Rural Affairs (Defra), 2023).

12.4.2 Scope of the assessment

12.4.2.1 The scope of this Environmental Statement has been developed in consultation with relevant statutory and non-statutory consultees as detailed in Table 12.7. This assessment of climate change considers both the effect of GHG emissions caused directly or indirectly (including vessel rerouting) by the Morgan Generation Assets, which have the potential to contribute to climate change (e.g., emissions arising from the manufacturing and installation of the Morgan Generation Assets) and the potential effect of changes in climate on the Morgan Generation Assets.

12.4.2.2 Taking into account the scoping and consultation process, Table 12.7 summarises the impacts considered as part of this assessment.

Table 12.7: Impacts considered within this assessment.

Activity	Potential effects scoped into the assessment
Construction phase	
Manufacturing and installation of the Morgan Generation Assets such as use of plant/equipment fuel and vessel use, embodied carbon of materials.	GHG emissions arising from such activities would contribute to global GHG emissions and climate change.
Installation of the Morgan Generation Assets.	Land use (seabed) change – GHG emissions arising from land use change would contribute to global GHG emissions concentrations and climate change.

Activity	Potential effects scoped into the assessment
Operations and maintenance	
Consumption of materials (replacement) and activities required to facilitate the operations and maintenance phase, such as use of plant, fuel and vessel use, embodied carbon of materials. In addition to, deviation for ferry and cargo vessels. Estimated abatement of UK Grid emissions	GHG emissions arising from such activities would contribute to global GHG emissions concentrations and climate change.
Operations and maintenance of the Morgan Generation Assets.	Land use (seabed) change – GHG emissions arising from land use (seabed) change would contribute to global GHG emission concentrations and climate change.
	Effect of projected future climate change on the Morgan Generation Assets (i.e. climate risk).
Decommissioning	
Decommissioning activities, such as use of plant, fuel and vessel use, and the recovery (or disposal) of materials.	GHG emissions arising from such activities would contribute to global GHG emissions concentrations and climate change.
Decommissioning of the Morgan Generation Assets	Land use (seabed) change – GHG emissions arising from land use (seabed) change would contribute to global GHG emissions concentrations and climate change.

12.4.2.3 Effects which are not considered likely to be significant have been scoped out of the assessment. A summary of the effects scoped out, together with justification for scoping them out and whether the approach has been agreed with key stakeholders through scoping, is presented in Table 12.8.

Table 12.8: Impacts scoped out of the assessment for climate change.

Potential impact	Justification
The impact of GHG emissions arising from the consumption of materials and activities required to facilitate the operation and maintenance of the Morgan Generation Assets during the construction and decommissioning phases.	Only applicable to the operations and maintenance phase of the Morgan Generation Assets. Offshore assets (wind turbines, subsea cables and offshore substation platforms) are designed to be resilient to storm events with an engineering safety headroom. There is no clear evidence that peak wind speeds or wave heights are likely to be increased by climate change during the development's lifetime (Met Office, 2018). The construction and decommissioning phases will not be lengthy enough for significant climate change risks compared to the present-day baseline to occur. The developer will employ good health & safety practices with respect to risks such as heatstroke or storm events offshore.

Potential impact	Justification
The impact of estimated abatement of UK Grid emissions during construction or decommissioning phases.	Only applicable to the operations and maintenance phase of the Morgan Generation Assets. No abatement of fossil fuels will be possible throughout the decommissioning or construction phases.
The impact of the effects of climate change on the Morgan Generation Assets through construction and decommissioning	Due to the length of the programme for construction and decommissioning phases, variations in climatic parameters would be minimal compared to the present day baseline. Offshore construction work practices are adapted to existing climate conditions and weather in the UK. It is assumed that offshore construction work practices would likely evolve with time with climatic variations. Such impacts are assessed within the operations and maintenance stage only.

12.4.3 Methodology to inform baseline

12.4.3.1 No site-specific surveys have been undertaken to inform the EIA for climate change. This is because climatic data and GHG emissions is gathered from recognised third party published data as detailed in Table 12.9 below.

12.4.4 Study area

12.4.4.1 The Morgan Generation Assets climate change study area is illustrated in **Figure 12.1** and has been defined as the offshore components of the Morgan Generation Assets itself, in the context of domestic and international scope as developed on the basis of established IEMA guidance (IEMA, 2022) utilised throughout this chapter. Domestic scope considers the local and national policy and targets concerning GHG and climate resilience.

12.4.4.2 GHG emissions have a global (international) effect rather than directly affecting any specific local receptor. The impact of GHG emissions occurring due to the Morgan Generation Assets on the global atmospheric concentration of the relevant GHGs, expressed in CO_2e is therefore considered within this assessment.

12.4.4.3 The climate change risk study area (**Figure 12.1**) is concentrated to the Morgan Array Area for the offshore elements.

12.4.4.4 With regards to cumulative effects assessment (CEA) all developments that emit, avoid or sequester GHGs have the potential to impact the atmospheric mass of GHGs as a receptor, and so may have a cumulative impact on climate change and upon the development. Consequently, cumulative effects due to other specific local development projects are not individually considered but are taken into account when considering the impact of the Morgan Generation Assets and probabilistic projections used in the climate change risk assessment. As such, no specific study area beyond that of the Morgan Generation Assets redline boundary is relevant for the CEA for climate change.

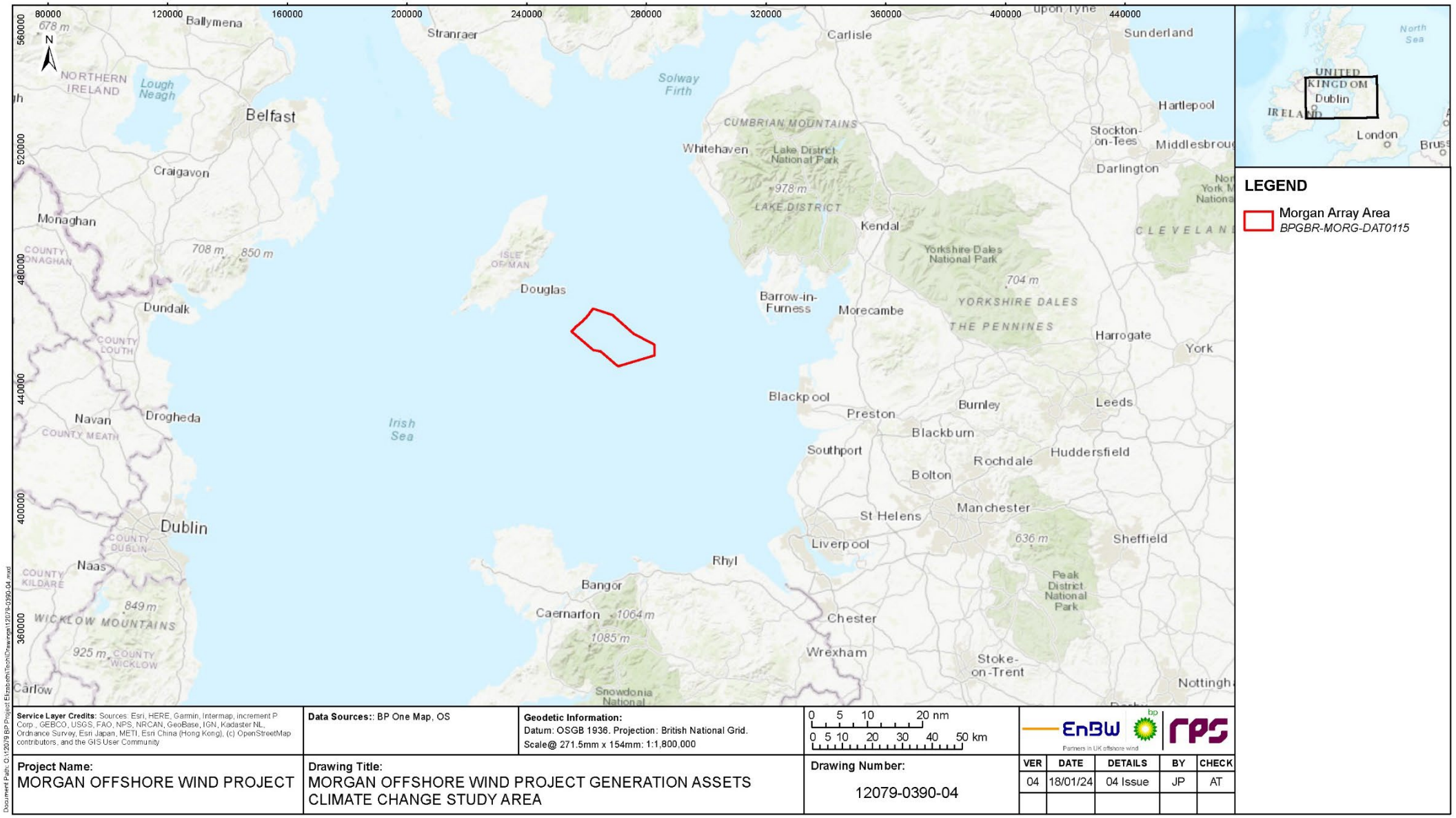

Figure 12.1: Climate change study area.

12.4.5 Desktop study

12.4.5.1 Information on climate change within the climate change study area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 12.9 below.

Table 12.9: Summary of key desktop reports.

Title	Source	Year	Author
Valuation of Energy Use and Greenhouse Gas: Supplementary guidance to the HM Treasury Green Book	Department for Energy Security and Net Zero (DESNZ)	2023	DESNZ (2023c)
UK Government GHG Conversion Factors for Company Reporting.	DESNZ and Department for Environment, Food and Rural Affairs (Defra)	2023	DESNZ and Defra
Inventory of Carbon and Energy (ICE) database	Jones & Hammond	2019	Jones & Hammond
UK Offshore Energy Strategic Environmental Assessment: Appendix 1F: The Physical Science Basis	Intergovernmental Panel on Climate Change (IPCC)	2021	IPCC

12.5 Baseline environment

12.5.1 Current baseline

12.5.1.1 To understand the impact of the Morgan Generation Assets on climate change, the baseline environment must be considered. The Morgan Generation Assets is located within the Irish Sea Region and, therefore, necessitates the consideration of the offshore climate baseline environment.

GHG emissions assessment baseline environment

12.5.1.2 To determine the greenhouse gas emissions assessment baseline environment, information has been sourced and cross referenced from Volume 2, Chapter 7: Benthic subtidal ecology of the Environmental Statement.

12.5.1.3 The baseline consists of various subtidal habitats including subtidal sand and muddy sand sediments to subtidal coarse and mixed sediments with diverse benthic communities. The baseline environment will be temporarily affected by the Morgan Generation Assets throughout the construction phase and through the operations and maintenance phase. This would have a potential permanent release of GHG as a result of the disturbance.

12.5.1.4 The Morgan Generation Assets will likely contribute to the abatement of the amount of fossil fuel generation within the UK Grid (i.e. UK Grid carbon intensity). As such, the current baseline with regard to UK Grid-average emission factor for electricity generation, without the Morgan Generation

Assets, is 252.974 kgCO_2e/MWh (including well-to-tank but as-generated, excluding transmission and distribution losses) (DESNZ and Defra, 2023).

Climate change risk assessment (CCRA) baseline environment

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

12.5.1.6 Mean air temperatures range from lows of 7°C in January to 14°C in July, with surface air temperatures exceeding sea surface temperatures during the spring and summer months and falling below sea surface temperatures during the autumn and winter months (BEIS, 2022b).

12.5.1.7 Precipitation generally falls for an average of 18 days per month during the winter, and 10-15 days per month during the summer. Rainfall intensity and duration varies greatly from day to day (BEIS, 2022b).

12.5.1.8 High wind speeds can be expected at the Morgan Array Area. Wind conditions are generally westerly and south-westerly throughout the year. During the winter, winds occasionally exceed 14 m/s (approximately 20% to 25% of the time) in the Irish Sea to the east of the Isle of Man. During the summer, the chance of these higher wind speeds drops to 2% chance (BEIS, 2022b).

12.5.1.9 Mean sea level (MSL) is a crucial element of climate change-related risks for offshore wind farms – global MSL rose by 0.2 m between 1901 and 2018, and continue to rise (IPCC, 2021).

12.5.2 Future baseline scenario

12.5.2.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 requires that *'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'* is included within the Environmental Statement. In the event that the Morgan Generation Assets does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

GHG emissions assessment future baseline

12.5.2.2 The future baseline GHG emissions for existing land use (sea bed) without the Morgan Generation Assets are expected to remain similar.

12.5.2.3 The future baseline for electricity generation that would be displaced by the Morgan Generation Assets depends broadly on future energy and climate policy in the UK, and more specifically (with regard to day-to-day emissions) on the demand for operation of the Morgan Generation Assets compared to other generation sources available, influenced by commercial factors and National Grid's needs.

12.5.2.4 Several future baseline scenarios have therefore been considered, using DESNZ (formerly BEIS) projections of the carbon intensity of long-run marginal

electricity generation during the Morgan Generation Asset's operating lifetime (DESNZ, 2023a) and assumptions about specific generation sources that could be displaced. These are detailed in Volume 4, Annex 12.1: Technical greenhouse gas assessment of the Environmental Statement.

12.5.2.5 The carbon intensity of baseline UK Grid electricity generation (see paragraph 12.5.1.4) is projected to reduce over time and so too would the intensity of the marginal generation source, displaced at a given time.

CCRA future baseline

12.5.2.6 It is expected that sea surface temperatures will continue to increase in the 21st century, with global mean sea surface temperatures predicted to increase by approximately 2.9°C by 2100 under Representative Concentration Pathway (RCP) 8.5. It is anticipated that the north Atlantic, and as such Irish Sea, will warm at a slower rate in comparison to other oceans (IPCC, 2021).

12.5.2.7 Average sea level rise around the UK is expected to be up to 1 m by 2100 reducing from south to north. The average wave height is predicted to decrease around much of the UK at a factor of about 10% to 20% over the 21st century, with average wave heights in the Irish Sea decreasing by approximately 0.1 m (Jaroszweski *et al.,* 2021). However, maximum wave heights in the Irish Sea are anticipated to increase, with projections showing a change in elevation of the height of maximum waves of up to 2 m to the end of the century (Jaroszweski *et al.,* 2021).

12.5.2.8 Further information has been presented within Volume 4, Annex 12.2: Climate change risk assessment of the Environmental Statement.

12.5.3 Data limitations

12.5.3.1 There is uncertainty about future climate and energy policy plus market responses, which affect the likely future carbon intensity of energy supplies, and thereby the future carbon intensity of the electricity generation being displaced by the Morgan Generation Assets. Government projections consistent with national carbon budget commitments have been used in the assessment.

12.5.3.2 The majority of the construction stage GHG emissions associated with the manufacturing of components are likely to occur outside the territorial boundary of the UK and hence outside the scope of the UK's national carbon budget, policy and governance. However, in recognition of the climate change effect of GHG emissions (wherever occurring), and the need to avoid 'carbon leakage' overseas when reducing UK emissions, emissions associated with the construction stage have been presented within the assessment and quantification of GHG emissions, as part of the Morgan Generation Assets.

12.5.3.3 Additionally, due to the early stage in the development design, the specific wind turbine technology and design of associated infrastructure (including Offshore substation platforms etc.) that would be used by the Morgan Generation Assets have not yet been confirmed. Thus, there is a degree of uncertainty regarding the construction stage GHG emissions resulting from the manufacturing and construction of wind turbines and infrastructure. The

assessment seeks to limit the impact this might have by utilising peer reviewed published data, representing a range with regards to emission intensity to present a conservative position concerning magnitude of GHG impact.

12.5.3.4 An assumed operational lifetime of 35 years (2029-2064) has been applied to the assessment of avoided GHG emissions associated with the operations and maintenance stage of the Morgan Generation Assets and consideration of replacement and maintenance activities.

12.5.3.5 Principal sources relied upon for the quantification of GHG emissions for the Morgan Generation Assets date back to 2012 (RICS, 2012). It is acknowledged that the design and equipment available in the present day compared with pre-2012 is significantly different. Nevertheless, the pre-2012 benchmarks represent a conservative (worst case) assumption concerning GHG emissions for the purposes of the assessment.

12.5.3.6 Furthermore, the specific materials, operations and maintenance vehicles/vessels that would be used by the Morgan Generation Assets have not yet been specified. Thus, there is a degree of uncertainty regarding the construction and operations/ maintenance-stage GHG emissions of the Morgan Generation Assets.

12.5.3.7 When assessing climate risks, uncertainty arises from both modelling uncertainty and natural variability in the potential magnitude of future changes in climate. A high magnitude of change scenario and the high end of probabilistic projections have therefore been used, to provide a precautionary worst case approach. This is discussed further in Volume 4, Annex 12.2: Climate change risk assessment of the Environmental Statement.

12.5.3.8 The above uncertainties are integral to the assessment of climate change effects but a precautionary approach has been taken as far as practicable to provide a reasonable worst case assessment. On the basis of the above, it is considered that limitations to the assessment have been minimised and that the results provide a robust estimate of the effects of the Morgan Generation Assets.

12.5.3.9 The Morgan Generation Assets are dependent on the transmission assets and grid connection in order to realise the potential avoided emissions associated with the production of wind energy. The transmission assets for the Morgan Offshore Wind Project are being taken forward separately as part of the Morgan and Morecambe Offshore Wind Farms: Transmission Assets DCO. As such, an assessment is required to understand the construction emissions for both the Morgan Generation Assets and Transmission Assets applications in order to establish the whole Morgan Generation Assets net emissions.

12.6 Impact assessment methodology

12.6.1 Overview

12.6.1.1 The climate change impact assessment has followed the methodology set out in Volume 1, Chapter 5: EIA methodology of the Environmental Statement. Specific to the climate change impact assessment, the following guidance documents have also been considered:

- Institute of Environmental Management and Assessment (IEMA) Guidance on Climate Change Adaption and Resilience (IEMA, 2020)
- IEMA guidance on 'Assessing Greenhouse Gas Emissions and Evaluating their Significance' (IEMA, 2022).

12.6.1.2 In addition, the climate change impact assessment has considered the legislative framework as defined by:

- Local planning policies
- National climate change policies (see section 12.2)
- International climate change legislation.

12.6.1.3 In order to undertake a climate change impact assessment, information gathered in Volume 4, Annex 12.1: Technical greenhouse gas assessment and Annex 12.2: Climate change risk assessment of the Environmental Statement have been utilised. This information is sourced from primary calculations and secondary sources to calculate the effect of the Morgan Generation Assets on and from climate change.

GHG emissions assessment methodology

12.6.1.4 GHG emissions have been estimated by applying published emissions factors to activities in the baseline and to those required for the Morgan Generation Assets. The emissions factors relate to a given level of activity, or amount of fuel, energy or materials used, to the mass of GHGs released as a consequence. The GHGs considered in this assessment are those in the 'Kyoto basket' of global warming gases expressed as their 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 Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (IPCC, 2013) or as otherwise defined for national reporting under the UNFCCC.

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

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

12.6.1.6 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 Greenhouse Gas 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 to construct, operate, maintain and decommission an installation)

- Scope 2 emissions: caused indirectly by consumption of purchased energy, (e.g. from generating electricity supplied through the UK 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.

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

12.6.1.8 The assessment has considered:

1. The GHG emissions arising from the Morgan Generation Assets
2. Any GHG emissions that the Morgan Generation Assets displaces or avoids, compared to the current or future baseline.
3. The net impact on climate change due to these changes in GHG emissions overall.

12.6.1.9 As previously discussed in paragraph 12.5.3.2, as a conservative assumption the majority of the construction-stage GHG emissions associated with the manufacturing of components are likely to occur outside the territorial boundary of the UK and hence outside the scope of the UK's national carbon budget. However, in recognition of the climate change effect of GHG emissions (wherever occurring) and the need, as identified in national policy, to avoid 'carbon leakage' overseas when reducing UK emissions, the full life cycle GHG emissions of the Morgan Generation Assets, including construction-stage emissions, have been evaluated where possible when determining the significance of effects.

Climate Change Risk Assessment methodology

12.6.1.10 Baseline offshore climatic conditions (based on 30 years of data (December 1984-November 2014)) 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). Information from the UKCP18 RCP8.5 has been drawn upon in addition to the UK Climate Risk Independent Assessment (CCRA3) to establish UK marine climate projections for the 21st century through to 2100.

12.6.1.11 Further detail of the approach and data input is given in Volume 4, Annex 12.2: Climate change risk assessment of the Environmental Statement.

12.6.1.12 A high level screening risk assessment has been undertaken, considering the hazard, potential severity of impact on the Morgan Generation Assets and its users, probability of that impact, and level of influence the Morgan Generation Assets design can have on the risk.

12.6.1.13 Where potentially significant risks have been identified at the screening stage prior to any mitigation, further assessment has been undertaken with

consideration of appropriate mitigation to determine whether significant residual risks are likely.

12.6.2 Impact assessment criteria

Overview

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

- Assessment of the significance of the effect of the Morgan Generation Assets on climate change (GHG assessment)
- Assessment of the significance of the effect from climatic changes on the Morgan Generation Assets.

Impact assessment criteria: GHG emissions

12.6.2.2 Determining the overall significance of the effect of the Morgan Generation Assets on GHG emissions is a three-stage process that involves defining:

- Magnitude of the impact
  - In accordance with the IEMA Guidance (2022) 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 this is expressed qualitatively
- 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)
- Significance of effect
  - 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. To aid in considering whether effects are significant, the guidance 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.
  - Taking the guidance into account, the following have been considered in contextualising the Morgan Generation Assets GHG emissions:

- The magnitude of net GHG emissions as a percentage of national and local carbon budgets (where feasible)
- Whether the Morgan Generation Assets 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 (BEIS 2022c)

– Effects from GHG emissions are described in this chapter as adverse, 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 12.10.

Table 12.10: IEMA (2022) Guidance definitions of significance.

Significance	Definition
Major adverse	The Morgan Generation Assets' GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type.
Moderate adverse	The Morgan Generation Assets' GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type.
Minor adverse	The Morgan Generation Assets' GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type.
Negligible	The Morgan Generation Assets' GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050.
Beneficial	The Morgan Generation Assets' 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.

12.6.2.3 Major and moderate adverse effects 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.

12.6.2.4 GHG emissions associated with a proposed project are often reported as a whole life figure (net emissions) that takes account of all Morgan Generation Assets stages. The net whole life figure is the key element for determining Morgan Generation Assets 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 the Morgan Generation Assets, alongside the sections that assess construction, operations and maintenance and decommissioning effects in isolation.

Impact assessment criteria: climate change risk

12.6.2.5 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*'.

12.6.2.6 The climate change risk assessment 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 climate change risk assessment cannot easily 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.

12.6.2.7 As is detailed in Volume 4, Annex 12.2: Climate change risk assessment of the Environmental Statement, a risk assessment has been undertaken, considering the hazard, potential severity of impact on the Morgan Generation Assets and its users (including their sensitivity and vulnerability), probability of that impact, and level of influence the Morgan Generation Assets design can have on the risk. A risk score of five or more (the minimum score where more than one element of the risk assessment score is above 'one') has been defined as a risk that could lead to a significant adverse or beneficial effect in EIA terms. By considering measures adopted as part of the Morgan Generation Assets, professional judgement is used in determining whether impacts are likely to result in significant adverse or beneficial, or non-significant negligible effects in EIA terms.

12.6.2.8 The criteria for defining severity, probability and influence factor in this chapter are outlined in Table 12.11 below.

Table 12.11: Severity, probability and influence factor definitions.

Factor	Score definitions
Severity: the magnitude and likely consequences of the impact should it occur.	**1 =** unlikely or low impact (e.g. low-cost and easily repaired property damage; small changes in occupiers' behaviour).
	2 = moderate impacts with greater disruption and/or costs
	3 = severe impact, (e.g. risk to individual life or public health, widespread property damage or disruption to business)
Probability: reflects both the range of possibility of climatic parameter changes illustrated in CP18 projections and the probability that the possible changes would cause the impact being considered	**1 =** unlikely or low probability of impact; impact would occur only at the extremes of possible change illustrated in projections
	2 = moderate probability of impact, plausible in the central range of possible change illustrated in projections
	3 = high probability of impact, likely even with the smaller changes illustrated as possible in the projections
Influence: the degree to which design of the proposed development can affect the severity or probability of impacts	**1 =** no or minimal potential to influence, outside control of developer, (e.g. reliance on national measures or individuals' attitudes/actions; or hypothetical measures would be impracticable)
	2 = moderate potential to influence, (e.g. a mixture of design and user behaviour or local and national factors; measures may have higher costs or practicability challenges)
	3 = strong potential to influence through measures that are within the control of the developer and straightforward to implement

12.7 Key parameters for assessment

12.7.1 Maximum Design Scenario

12.7.1.1 The Maximum Design Scenarios (MDSs) identified in Table 12.13 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 Project Design Envelope provided in Volume 1, Chapter 3: Project description of the Environmental Statement. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (e.g. different infrastructure layout), to that assessed here be taken forward in the final design scheme.

Table 12.12: MDS considered for the assessment of potential impacts on climate change.

[a] C=construction, O=operations and maintenance, D=decommissioning

Potential impact	Phase[a]			MDS	Justification
	C	O	D		
The impact of GHG emissions arising from the consumption of materials and activities required to facilitate the operations and maintenance	×	✓	×	**Operations and maintenance phase** • The greatest number of infrastructure and maintenance vessels across the lifetime of the Morgan Generation Assets • The greatest volume of consumables and frequency of replacement. (3 no. major component replacement on OSPs, 1 no. inter-array cable repair event every 3 years, 3 no. inter-connector cable repair event in 10 years). • Maximum number of transport vessel and helicopter movements – 719 return trip vessels, and 639 helicopter trips.	The greatest number of wind turbines, foundations and maximum inter-array and inter-connector cable lengths represent the greatest potential for GHG emissions from the consumption of materials and activities required to facilitate operations and maintenance.
The impact of GHG emissions arisings from land use (seabed) change during the construction, operations and maintenance decommissioning phases	✓	✓	✓	**Construction, operations and maintenance and decommissioning phases** • The total array area is 280 km^2 with up to 96 wind turbines. • The maximum length of the inter-array cables is 390 km. • The maximum extent of the inter-connector cables is 60 km. • The maximum amount of scour protection is 2,143,540 m^3 for wind turbines, OSPs and cabling. • There are up to four Offshore Substation Platforms (OSPs) of 375 MW capacity; the substations are 80 m long 60 m wide (excluding towers, helipads, masts and cranes). The suction bucket jacket (SBJ) foundations for up to four OSPs will be constructed using piling or drilling methods for the construction phase.	The greatest volume of material of the generation structures will result in the greatest consumption of fuel and materials representing the greatest potential for GHG emissions.

Potential impact	Phase[a]			MDS	Justification
	C	O	D		
The impact of GHG emissions arising from the manufacturing and installation of the generation assets.	✓	×	×	**Construction phase** • There are up to 96 wind turbines, and a tower diameter of 7 to 10 m. There are SBJ foundations for 96 wind turbines that will be constructed using piling or drilling methods • There are up to four OSPs of 375 MW capacity; the OSPs are 80 m long 60 m wide (excluding towers, helipads, masts and cranes). The SBJ foundations for up to four OSPs will be constructed using piling or drilling methods for the construction phase. • The maximum length of the inter-array cables is 390 km. • The maximum length of the inter-connector cables is 60 km. The maximum amount of scour protection is 2,143,540 m^3 for wind turbines, OSPs and cabling. • Maximum number of installation vessels movements – 1,929 return trips and 1,095 helicopter journeys.	The greatest number of wind turbines, offshore substation platforms and foundations and greatest length of the inter-array and inter-connector cables represent the greatest potential for GHG emissions from the construction and installation of the generation assets.
The impact of GHG emissions from decommissioning works (plant and equipment, fuel and vessel use) and recovery or disposal of materials	×	×	✓	**Decommissioning phase** • There are up to 96 wind turbines, with a tower diameter of 7 to 10 m. There are foundations for 96 wind turbines constructed using piling or drilling methods • There are up to four OSPs of 375 MW capacity; the OSPs are 80 m long and 60 m wide. There are SBJ foundations for up to four OSPs constructed using piling or drilling methods • The maximum length of the inter-array cables is 390 km. • The maximum length of the inter-connector cables is 60 km. • Greatest number of maintenance vessels and helicopters and machinery across the decommissioning period.	The greatest number and size of structures and maximum length of the inter-array and inter-connector cables will result in the greatest consumption of fuel and materials representing the greatest potential for GHG emissions from the decommissioning works.
The impact of estimated abatement of UK Grid emissions during the operations and maintenance phase.	×	✓	×	**Operations and maintenance phase** The potential generating capacity of the Morgan Generation Assets is 1.5 GW.	The greatest generating capacity represents the greatest abatement of fossil fuels from the UK Grid.

Potential impact	Phase[a]			MDS	Justification
	C	O	D		
Impact of the effects of climate change on the Morgan Generation Assets	×	✓	×	**Operations and maintenance phase** Consistently heightened temperatures, changes to rainfall patterns, increased wind speeds, wave height and increased frequency of extreme events such as floods and 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 operations and maintenance activities. • The following industry best practice measures have been included within Project design and operational planning to ensure resilience of the Project to the effects of climate change: – Application of anti-corrosion protective coatings; – Integrated scour protection to offshore equipment where necessary; – Safety margin within the wind turbine design to be fitted with automatic shutdowns/lockdowns with regards to spinning too fast; – If located internally, the substation building will house auxiliary equipment e.g. appropriate cooling plant for an in building substation solution to account for a range of temperature conditions; – Regular inspections to be carried out to assess wind turbine condition; and – Regular inspections to be carried out to assess substation condition where appropriate (i.e. following severe weather events).	The worst case scenario of the effects of climate change on the offshore infrastructure.

12.7.1.2 The MDS when considering the impact of and from climate change relates to the largest amount of sea bed area take and the largest amount of material including, greatest number of wind turbines, longest cable route and largest OSP area. This approach would combine scenarios, however, would represent the maximum design scenario as a conservative approach for the assessment of potential impacts.

12.8 Measures adopted as part of the Morgan Generation Assets

12.8.1.1 For the purposes of the EIA process, the term 'measures adopted as part of the project' is used to include the following measures (adapted from IEMA, 2016):

- Measures included as part of the project design. These include modifications to the location or design of the Morgan Generation Assets which are integrated into the application for consent. These measures are secured through the consent itself through the description of the development and the parameters secured in the DCO and/or marine licences (referred to as primary mitigation in IEMA, 2016)
- Measures required to meet legislative requirements, or actions that are generally standard practice used to manage commonly occurring environmental effects and are secured through the DCO requirements and/or the conditions of the marine licences (referred to as tertiary mitigation in IEMA, 2016).

12.8.1.2 Measures (primary and tertiary) have been adopted as part of the Morgan Generation Assets to reduce the potential for impacts on climate change. Industry best practice approaches are included within the standard design and operation of the Morgan Generation Assets which enable the Project to be resilient to future predicted climate change, detail provided in full within Volume 4, Annex 12.2: Climate change risk assessment technical report (refer to Table 1.3). Such design approaches are as follows:

- Application of anti-corrosion protective coatings
- Integrated scour protection to offshore equipment where this is considered necessary and appropriate
- Safety margin within the wind turbine design to be fitted with automatic shutdowns/lockdowns with regards to spinning too fast
- If located internally, the substation building will house auxiliary equipment e.g. appropriate cooling plant for an in building substation solution to account for a range of temperature conditions
- Regular inspections to be carried out to assess wind turbine condition
- Regular inspections to be carried out to assess substation condition where appropriate (i.e. following severe weather events).

12.8.1.3 As these are considered inherently part of the design of the Morgan Generation Assets and have therefore been considered in the assessment presented in section 12.9 below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

12.8.1.4 Where significant effects have been identified, further mitigation measures (referred to as secondary mitigation in IEMA, 2016) 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 12.9 below.

12.9 Assessment of significant effects

12.9.1 Overview

12.9.1.1 The impacts of the construction, operations and maintenance and decommissioning phases of the Morgan Generation Assets have been assessed on climate change. The potential impacts arising from the construction, operations and maintenance and decommissioning phases of the Morgan Generation Assets are listed in Table 12.12, along with the MDS against which each impact has been assessed.

12.9.1.2 A description of the potential effect on climate change receptors caused by each identified impact is given below.

12.9.1.3 The impacts of the construction, operations/maintenance and decommissioning phases of the Morgan Generation Assets on GHG emissions have been assessed below in line with the GHG emissions impact assessment criteria:

- Magnitude of the impact
- Sensitivity of receptor
- Significance of effect.

12.9.1.4 The operations and maintenance of the Morgan Generation Assets would lead to consumption of fuel and replacement of materials throughout the operational lifetime of the Morgan Generation Assets. This would result in the greatest potential for GHG emissions. In Volume 4, Annex 12.1: Technical greenhouse gas assessment of the Environmental Statement, the life cycle assessment embodied carbon is divided into:

Materials and construction (A1-A5)

Operations and maintenance (B1-B5)

Decommissioning (C1-C4).

12.9.2 The impact of GHG emissions arisings from land-use (seabed) change during the construction, operations and maintenance decommissioning phases of the Morgan Generation Assets

Construction, Operations and Maintenance and Decommissioning

Magnitude of impact

12.9.2.1 The impact is predicted to be of regional spatial extent, long term duration, intermittent and medium reversibility. It is predicted that the impact will affect the receptor (benthic habitat) indirectly. The benthic habitat in the Morgan Array Area would be impacted for the duration of the construction and in some cases operations and maintenance phases primarily through the land (seabed) take for wind turbines, cables and OSPs. However, through the decommissioning process it is anticipated that the existing baseline environment for climate change, which was not a carbon store, would be similar at the end of decommissioning. As such, the quantity of change in a

tCO_2e owing to land use (seabed) change across the Morgan Generation Assets' whole life is considered to be **negligible.**

Sensitivity of receptor

12.9.2.2 In accordance with paragraph 12.6.2.2, the receptor (global climate) 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

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

12.9.3 The impact of GHG emissions arising from the manufacturing and installation of the Morgan Generation Assets and consumption of materials

12.9.3.1 The below considers the embodied carbon emissions associated with materials for offshore elements. This impact entails an assessment of the greatest number of wind turbines and foundations representing the greatest potential for GHG emissions from the construction and installation of generation assets as a conservative estimate of impact. Up to four OSPs and the maximum length of inter-array cables and inter-connector cables will result in the greatest consumption of fuel and materials representing the greatest potential for GHG emissions from the construction and installation phase.

Construction

12.9.3.2 As detailed in paragraph 12.9.1.4 and Volume 4, Annex 12.1: Technical greenhouse gas assessment of the Environmental Statement, the life cycle assessment embodied carbon is divided into three stages. The GHG emissions arising from the consumption of materials and activities required to construct the Morgan Generation Assets are outlined below. Calculations to reach such emissions consider the maximum number of wind turbines and OPSs, and maximum lengths of all cables, representing the greatest potential for GHG emissions from the construction and installation of the Morgan Generation Assets as a conservative estimate of impact. The following items are considered within this assessment:

- Wind turbines
- OSPs
- Inter-array cables
- Interconnector cables
- Scour protection and cable protection
- Vessel and helicopter movements.

12.9.3.3 Detailed and current life cycle assessment (LCA) are not available for all items specific to generation and transmission infrastructure. As such, a combined approach has been undertaken 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.

12.9.3.4 The potential impact of the wind turbines and foundations, OSP topsides and foundations, and inter-array and inter-connector cabling has been estimated using appropriate material emission intensities (sourced from the ICE database, Jones & Hammond, 2019), scaled by material estimates for each element. Material quantities and the emissions factor by which they have been scaled are listed within Volume 4, Annex 12.1: Technical greenhouse gas assessment of the Environmental Statement.

12.9.3.5 Construction stage emissions associated with the proposed OSPs has been captured using an intensity for the manufacturing GWP of 2,190 $kgCO_2e$ per MW (ABB, 2003). This was scaled by the indicative Morgan Generation Assets output capacity of 1,500 MW to give an estimated embodied emission value of 3,285 tCO_2e.

12.9.3.6 At this stage of design, material estimates regarding the offshore substation platforms have some uncertainty in terms of the amounts and grouping into the main categories of material rather than it being possible to specify all products to be used in the final, detailed design. As a means of comparison, a published benchmark (RICS, 2012) has therefore also been used to estimate possible emissions from the substation buildings.

12.9.3.7 The benchmark data is expressed in $kgCO_2e/m^2$ of OSP floorspace as an intensity which is applied against the total floor area for all four substation buildings. When using the RICS intensity for other Industrial/utilities/specialist uses with the substation floor area we result this results in in an estimated embodied carbon emission of 6,377 tCO_2e.

12.9.3.8 Emissions associated with fuel combustion from vessels and helicopters have been calculated based on the maximum number of movements proposed during the construction phase, assuming the longest journey distance travelled to reach a conservative estimate. Anticipated fuel consumption for each movement was scaled by an appropriate emissions factor to give total estimated emissions of 53,719 tCO_2e during the construction phase.

12.9.3.9 Table 12.13 summarises the calculated construction stage emissions associated with the Morgan Generation Assets, which totals 1,909,116 tCO_2e.

Table 12.13: Construction stage GHG emissions.

Item	Value	Unit
Wind Turbines and foundations	1,658,383	tCO_2e
OSPs and foundations	108,680	tCO_2e
Inter-array and inter-connector Cables	36,160	tCO_2e
Scour protection	61,295	tCO_2e

Item	Value	Unit
Substation	9,662	tCO_2e
Transport	53,802	tCO_2e
Total	**1,927,897**	**tCO_2e**

Magnitude of impact

12.9.3.10 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 (global climate) indirectly. The magnitude is therefore, considered to be **1,927,897 tCO_2e** for the construction period.

Sensitivity of receptor

12.9.3.11 In accordance with paragraph 12.6.2.2 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

12.9.3.12 Overall, the magnitude of the impact is deemed to be **1,927,897 tCO_2e** and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **moderate adverse** effect, which is significant in EIA terms.

Further mitigation and residual effect

12.9.3.13 A moderate adverse effect is predicted for GHG emissions produced as a result of construction activity associated with the Morgan Generation Assets. This is significant in EIA terms. In order to mitigate this effect, the Applicant is committed to exploring options to reduce construction related emissions. Areas to be explored by the Applicant could include:

- improving construction and operational activity to reduce emissions (e.g. potentially related to vessel scheduling, co-ordination of shipping/delivery of materials and the identification energy efficiency mechanisms)
- working with the supply chain and its partners to reduce emissions during construction and operation.
- considering the inclusion of low carbon criteria within procurement activities, in partnership with the supply chain.

12.9.3.14 Any further risk controls will be explored through engagement with the relevant stakeholders, where necessary, to ensure they are appropriate for reducing risks to as low as reasonably practicable.

12.9.3.15 It is expected that the above measures would be included within the relevant future final management plans. With these commitments to look at opportunities to reduce construction related emissions, the impact magnitude is predicted to reduce and the residual effect will be minor adverse, which is not significant in EIA terms.

12.9.4 The impact of GHG emissions from decommissioning works (plant/equipment, fuel and vessel use) and recovery or disposal of materials

12.9.4.1 The majority of emissions during this phase relate to the use of plant for Morgan Generation Assets decommissioning, disassembly, transportation to a waste site, and ultimate disposal and/or recycling of the equipment and other site materials.

12.9.4.2 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 which at the assumed end of life stage (35 years from opening year) all new energy from waste facilities would be equipped with carbon capture and storage (Climate Change Committee, 2020). 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.

12.9.4.3 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. Given carbon emissions associated with use of plant and fuel is expected to have achieved good levels of decarbonisation at the decommissioning phase of the Morgan Generation Assets, this is likely to present a conservative maximum emission scenario.

12.9.4.4 The GHG emissions arising from activities required to facilitate the decommissioning of the Morgan Generation Assets total 53,719 tCO_2e.

Magnitude of impact

12.9.4.5 The impact is predicted to be of international spatial extent, medium term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor (global climate) indirectly. The magnitude is therefore, considered to be **53,719 tCO_2e.**

Sensitivity of receptor

12.9.4.6 In accordance with 12.6.2.2, 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

12.9.4.7 Overall, the magnitude of the impact is deemed to be 53,719 tCO_2e, and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** effect, which is not significant in EIA terms.

12.9.5 The impact of GHG emissions arising from the consumption of materials and activities required to facilitate the operations and maintenance of the Morgan Generation Assets and impact of estimated abatement of UK Grid emissions

12.9.5.1 The greatest generating capacity represents the greatest abatement of fossil fuels from the UK Grid. The primary purpose of the operational stage 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 impact of GHG emissions arising from the consumption of materials and activities required to facilitate the operations and maintenance of the Morgan Generation Assets.

12.9.5.2 The GHG emissions arising from the consumption of materials and activities required to facilitate the operations and maintenance of the Morgan Generation Assets are presented in Table 12.14 below, detailed further in Volume 4, Annex 12.1: Technical greenhouse gas assessment of the Environmental Statement. The majority of emissions result from the replacement of OSPs and cables, informed by conservative assumptions for material replacement rates. Remaining emissions are associated with vessel and helicopter movements required to undertake maintenance activities over the Morgan Generation Assets lifetime.

12.9.5.3 In addition, there are indirect impacts on existing ferry and cargo vessels as a result of the Morgan Generation Assets causing deviations to shipping routes. This has indirect emissions increases that have been consider within the operations and maintenance phase. The Navigation Risk Assessment (NRA) (Volume 4, Annex 7.1: Navigational risk assessment of the Environmental Statement) and the shipping and navigation chapter (Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement) include details on navigation simulations which were undertaken as part of the assessment to establish the impact and consequential route deviation for existing routes as a result of the Morgan Generation Assets.

12.9.5.4 Based on information from the NRA a number of ferry (Stena Line, Seatruck and Isle of Man Steam Packet Company (IoMSPC)) and cargo routes would be affected. As detailed in Volume 4, Annex 12.1: Technical Greenhouse gas assessment of the Environmental Statement, the deviation of ferry and cargo routes would result in 678.17 tCO_2e per annum. This figure does not account for any decarbonisation in vessel fuel emissions or fluctuations in route crossings.

Table 12.14: Operations and maintenance stage GHG emissions.

Item	Value	Unit
Materials	57,047	tCO_2e
Offshore transport	18,212	tCO_2e
Third Party Route Deviation	23,736	tCO_2e
Total	**98,995**	**tCO_2e**

12.9.5.5 It should be noted that when considering the Morgan Generation Assets impact on climate change, the emissions as a result of operations and maintenance activities must be considered alongside the displacement marginal alternative sources of electricity generation. This is presented in Table 12.15 and further considered in the assessment below.

Table 12.15: Energy flows from Morgan Generation Assets.

* It should be noted that the BEIS Allocation Framework for Rounds 3 (BEIS, 2019) and 4 (BEIS 2021b) states that all new offshore wind projects shall achieve a load factor of 58.4% and 63.1% respectively. Use of higher load factors would result in higher output and subsequent avoided emissions. As such, a lower capacity factor (based on average actual offshore wind load factors between 2004 & 2022 as opposed to forward looking projected factors) represents a conservative assumption for this assessment. Further detail can be found in Volume 4, Annex 12.1: Technical greenhouse gas assessment of the Environmental Statement.

Parameter	Value	Unit	Source
Input indicative parameter - rated power	1,500	MW	Assumed export capacity in line with Crown Estates Round 4 leasing requirements (Crown Estates, 2021)
Input parameter – capacity factor	34.9	%	DESNZ (2023d)
Input parameter – degradation factor	1.6	%	Staffell & Green (2014)
Input parameter – total annual operating hours	8,760	hrs	Total number of hours in year
Output parameter - annual energy output (year one)	4,585,860	MWh	Calculation of MW multiplied by total hours

12.9.5.6 The input and output figures for the operations and maintenance stage of the Morgan Generation Assets have been scaled against the assumptions stated within the DESNZ long-run marginal emissions factor. This allows for a direct presentation of the cumulative GHG emissions avoided throughout the operational lifetime of the Morgan Generation Assets and therefore, how the Morgan Generation Assets contribute towards reaching the UK's net zero targets.

12.9.5.7 The resulting estimated avoided emissions associated with the operation of the Morgan Generation Assets would be 2,404,980 tCO_2e avoided emissions associated with the abatement of the UK Grid emissions factor.

Sensitivity analysis

12.9.5.8 The long run marginal carbon intensity figures, which have been used in the assessment are dynamic and show year-on-year decarbonisation of UK electricity grid towards the UK's committed net zero 2050 pledge. The long run marginal carbon intensity figures account for variations over time for both generation and consumption activity reflecting the different types of power plants generating electricity across the day and over time, each with different emissions factors. However, the long run marginal figures are projections and cannot be taken with absolute certainty. Furthermore, the long-run marginal

includes assumed abatement of fossil fuel generation sources within the UK electricity grid. As such it is likely that the true value of the avoided emissions displaced as a result of the Morgan Generation Assets' contribution to the UK electricity grid would be higher than that of avoided emissions detailed above in paragraph 12.9.5.7.

12.9.5.9 Although the use of the current UK electricity grid average and DESNZ 'non-renewable fuels' carbon intensities would conclude greater whole life avoided emissions (Table 12.16) and an ultimate reduction in carbon payback period, these are static baselines and do not account for future UK electricity grid decarbonisation. As such, the long run marginal provides a conservative quantification of avoided emissions for the purpose of this assessment.

Table 12.16: Whole life 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	123,505,766	2,404,980	31,277,273	53,411,680

Operations and Maintenance

Magnitude of impact

12.9.5.10 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 (global climate) directly. The magnitude is therefore, considered to be GHG emissions reductions from displacement of projected typical marginal generation sources at approximately **2,305,986 tCO_2e** avoided emissions.

Sensitivity of receptor

12.9.5.11 In accordance with **paragraph 12.6.2.2,** 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

12.9.5.12 Overall, the magnitude of the impact is deemed to be 2,305,986 tCO_2e avoided emissions, and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **beneficial effect**, which is significant in EIA terms.

12.10 Assessment of significant effects: climate change risk

12.10.1 Overview

12.10.1.1 The risks identified in Volume 4, Annex 12.2: Climate change risk assessment of the Environment Statement, are summarised in this section in relating to their impact upon the construction, operations and maintenance and

decommissioning phases of the Morgan Generation Assets, in accordance with the following assessment criteria:

- Severity of the impacts
- Probability of the potential impacts
- Influence factor.

12.10.2 The impact of the effects of climate change on the Morgan Generation Assets through the operations and maintenance phase

Operations and Maintenance

12.10.2.1 Consistently heightened temperatures, changes to rainfall patterns, increased wind speeds and increased frequency of extreme events such as floods and 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 operations and maintenance activities.

12.10.2.2 The impact is predicted to be of national spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor indirectly. Volume 4, Annex 12.2: Climate change risk assessment of the Environmental Statement summarises the potential climatic changes in the coming decades and considers the potential consequences for the Morgan Generation Assets in a risk assessment format.

12.10.2.3 The risk assessment presented in Volume 4, Annex 12.2: Climate change risk assessment of the Environmental Statement considers in its scoring the level of influence the design, construction and operation of the Morgan Generation Assets can have upon the risks, in addition to its severity and probability. Those risks over which the developer has little or no influence are therefore, typically not considered significant effects of the Morgan Generation Assets, save where the severity and/or probability are highest.

12.10.2.4 The assessment of effects has considered the design measures included within the Morgan Generation Assets (as listed at paragraph 12.8.1.2) in determining the combined risk score. As detailed in paragraph 12.6.2.7 a score of 5 or more is assessed as a significant effect which is presented in the 'significant effect' column. Should an effect be significant, further mitigation is presented where relevant to reduce the residual effect to negligible and not significant in EIA terms.

12.10.2.5 No risks to the Morgan Generation Assets due to climate change have been identified as significant. As such, the effect on the Morgan Generation Assets has been determined to be **negligible**.

12.11 GHG emissions – net effects

12.11.1 Overview

12.11.1.1 As detailed in **paragraph 12.6.2.4** consideration of the Morgan Generation Assets' whole life impact is an important consideration when assessing the

Morgan Generation Assets' impacts and subsequent effects on climate change. As such, the consideration of the Morgan Generation Assets net emissions in the context of existing and emerging policy commitments and UK Carbon budgets is important.

12.11.1.2 Over the lifetime of the Morgan Generation Assets, it would result in 324,815 tCO_2e of avoided emissions. The Morgan Generation Assets would likely have a carbon payback period[1] of 10 years when accounting for 1,927,897 tCO_2e construction stage emissions, 53,719 tCO_2e decommissioning stage emissions and -2,404,980 tCO_2e operational avoided emissions. This is under the most conservative scenario and payback is likely to be earlier than this maximum design scenario.

12.11.1.3 Consideration of the Morgan Generation Assets net emissions performance can be considered with the following contextualisation:

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

12.11.1.4 The Morgan Generation Assets net emissions accounting from both construction and operations/maintenance stages up to the end of the Sixth Carbon Budget are detailed in the below Table 12.17. When accounting for the total Morgan Generation Assets construction stage GHG emissions (1,927,897 tCO_2e) against the operations and maintenance avoided emissions (-1,821,936 tCO_2e) from full operating year (2030) to the end of the Sixth Carbon Budget (2037) net emissions would be 327,151 tCO_2e, approximately 0.018% of the UK Carbon Budget for the same period. Although this is heavily weighted towards total construction stage carbon reported in year one of operation.

Table 12.17: GHG impacts in the context of the UK's Carbon Budgets.

*Represents only two years of the defined budget for 2030 to 2032 in line with Morgan Generation Assets opening year.

LCA Stage	2028 to 2032*	2033 to 2037	Total
UK Carbon Budget (tCO_2e)	865,000,000	960,000,000	1,825,000,000
Morgan Generation Assets GHG impacts (tCO_2e)	1,172,846	-845,695	327,151
Development avoided emissions as percentage of UK carbon budget	0.136%	-0.088%	0.018%

[1] The period of time for which a wind turbine needs to be in operation before it has, by displacing generation from fossil-fuelled power stations, avoided as much carbon dioxide as was released in its lifecycle.

12.11.1.5 The Morgan Generation Assets is in line with the NPS EN-3s principle of supporting new renewable and low carbon energy developments, in addition to their associated infrastructure, in order to contribute to reductions in GHG emissions.

12.11.1.6 Further, the Morgan Generation Assets is supported by national energy and climate change policy (including the National Infrastructure Strategy, Sixth Carbon Budget and Net Zero Strategy) which highlight the need for an end to the use of unabated fossil fuel generation, whilst also significantly ramping up electricity generation capacity in order to meet the demands of increased electrification of transport, heat and industry. As such, government policy dictates that large-scale deployment of renewable energy generators such as the Morgan Generation Assets are necessary in order to meet GHG reduction targets.

12.11.1.7 By facilitating the expansion of renewable energy supply, the Morgan Generation Assets would assist both the UK Government target of achieving a fully decarbonised power system by 2035, and to become net zero by 2050.

Magnitude of impact

12.11.1.8 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 (global climate) indirectly. The magnitude is therefore, considered to be – 324,370 tCO_2e for the whole life time of the Project.

Sensitivity of receptor

12.11.1.9 In accordance with **paragraph 12.6.2.2**, 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

12.11.1.10 When considering the above magnitude of avoided emissions across the whole life time of the project (324,370 tCO_2e of avoided emissions), in addition to, the contribution toward the UK achieving its net zero goals and policy, and the high sensitivity of the climate as a receptor, the Morgan Generation Assets would have a **beneficial** net effect which would be significant in EIA terms.

12.11.2 Future monitoring

12.11.2.1 No climate change monitoring to test the predictions made within the impact assessment is considered necessary.

12.12 Cumulative effects assessment methodology

12.12.1.1 All developments that emit, avoid or sequester GHGs have the potential to impact the atmospheric mass of GHGs as a receptor, and so may have a cumulative impact on climate change. Consequently, cumulative effects due to other specific local development projects are not individually considered but are taken into account when considering the impact of the Morgan Generation Assets by defining the atmospheric mass of GHGs as a **high sensitivity** receptor. The construction, operations and maintenance and decommissioning phase effects of the assessment of the Morgan Generation

Assets takes account of cumulative changes in GHG emissions from other energy generation sources.

12.12.1.2 The CEA takes into account the impacts associated with the Morgan Generation Assets together with the Morgan and Morecambe Offshore Wind Farms: Transmission Assets and the Morecambe Offshore Windfarm Generation Assets. The projects and plans selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise (see Volume 5, Annex 5.1: CEA screening matrix of the Environmental Statement).

12.12.1.3 The climate change CEA methodology has followed the methodology set out in Volume 1, Chapter 5: EIA methodology of the Environmental Statement where relevant.

12.13 Cumulative effects assessment

12.13.1.1 A description of the significance of cumulative effects upon climate change receptors arising from each identified impact is given below.

12.13.1.2 The CEA is presented in a series of tables (one for each potential cumulative impact), and considers the following:

- Scenario 1: Morgan Generation Assets together with the Morgan and Morecambe Offshore Wind Farms Transmission Assets
- Scenario 2: Morgan Generation Assets together with the Morecambe Offshore Windfarm Generation Assets and the Morgan and Morecambe Offshore Wind Farms Transmission Assets
- Scenario 3: Assessment of the Morgan Generation Assets, together with the Transmission Assets, with all other relevant Tier 1, Tier 2 and Tier 3 projects.

12.13.1.3 It should be noted that in line with paragraph 12.12.1.1 Scenario 3 is not applicable to climate change consideration of CEA and as such is not considered further.

12.13.1.4 As noted in Volume 1, Chapter 1: Introduction of the Environmental Statement, the Morgan Generation Assets forms the Generation Assets only of the Morgan Offshore Wind Project. The Transmission Assets project is associated with both the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm which are subject to separate DCO applications. The Transmission Assets will enable the export of electricity from both windfarm sites to landfall and onwards to a connection point to the National Grid electricity transmission network at Penwortham in Lancashire. This will include installation and operation and maintenance of offshore and onshore export cables and new onshore substation(s).

12.13.1.5 Both the generation assets and transmission assets are required for the windfarm to supply renewable energy and contribute to the decarbonisation of the UK electricity Grid. As such, GHG emissions associated with the Morgan Offshore Wind Project in its entirety require consideration. The Morgan Generation Assets whole lifecycle emissions have been considered, combined with whole lifecycle emissions arising from the Transmission Assets (scenario

1 as detailed in paragraph 12.13.1.2) in addition to Morecambe Generation Assets and Transmission Assets (scenario 2 as detailed in paragraph 12.13.1.2**).**

12.13.2 Net GHG emissions

12.13.2.1 Table 12.18 presents the cumulative effects for the two scenarios as detailed in paragraph 12.13.1.2.

Table 12.18: Net GHG emissions

	Scenario 1 Morgan Generation Assets + Transmission Assets	Scenario 2: Morgan Generation Assets + Morecambe Offshore Windfarm Generation Assets + Transmission Assets
Construction		
Magnitude of impact	2,895,782 tCO_2e	3,649,369 tCO_2e
Sensitivity of receptor	High	High
Significance of effect	Moderate adverse	Moderate adverse
Further mitigation and residual significance	In order to mitigate this effect, Morgan Generation Assets (the Applicant) is committed to exploring options to reduce construction related emissions. Areas to be explored by the Applicant could include: • improving optimisation of construction and operational activity to reduce emissions (e.g. potentially related to vessel scheduling, co-ordination of shipping/delivery of materials and the identification energy efficiency mechanisms) • working with the supply chain and its partners to Identification of opportunities to reduce emissions in the supply chain during construction and operation. • considering the inclusion of Inclusion of low carbon criteria within procurement activities, in	In order to mitigate this effect, Morgan Generation Assets (the Applicant) is committed to exploring options to reduce construction related emissions. Areas to be explored by the Applicant could include: • improving optimisation of construction and operational activity to reduce emissions (e.g. potentially related to vessel scheduling, co-ordination of shipping/delivery of materials and the identification energy efficiency mechanisms) • working with the supply chain and its partners to Identification of opportunities to reduce emissions in the supply chain during construction and operation. • considering the inclusion of Inclusion of low carbon criteria within procurement activities, in partnership with the supply chain.

	Scenario 1 Morgan Generation Assets + Transmission Assets	Scenario 2: Morgan Generation Assets + Morecambe Offshore Windfarm Generation Assets + Transmission Assets
	partnership with the supply chain.	
Residual effect	Minor adverse, which is not significant in EIA terms.	Minor adverse, which is not significant in EIA terms.
Operations and maintenance		
Magnitude of impact	-1,884,449 to -52,891,149 tCO_2e	-3,124,470 to -89,840,534 tCO_2e
Sensitivity of receptor	High	High
Significance of effect	Beneficial	Beneficial
Further mitigation and residual significance	No further mitigation required	No further mitigation required
Decommissioning		
Magnitude of impact	71,401 tCO_2e	82,723 tCO_2e
Sensitivity of receptor	High	High
Significance of effect	Minor adverse	Minor adverse
Further mitigation and residual significance	No further mitigation required	No further mitigation required

12.13.2.2 It should be noted that the emissions total for the Transmission Assets includes transmission infrastructure and activities for both the Morgan Generation Assets and Morecambe Generation Assets. This CEA assesses the total emissions for the Transmission Assets and does not apportion such GHG emissions to each generation project as relevant. As such, Scenario 1 likely presents an overestimate as it apportions total emissions for the Transmission Assets to the Morgan Generation Assets.

12.13.2.3 There are elements of double counting within the reported PEIR figures for the Transmission Assets which are also included within the Morgan Generation Assets. These include the OSPs, Booster Station and interconnector cables. This would equate to 419,854 tCO_2e over the lifetime of the projects based on the Transmission Assets PEIR calculations.

12.13.2.4 While each phase is considered separately, as is detailed within paragraph 12.6.2.4, the IEMA guidance (IEMA, 2022) confirms that due to the nature of GHG emissions, it is good practice to include a section that reports on the whole life GHG emissions. In order to understand the true whole project impact of the three projects, consideration of the net effects as opposed to individual

stages in isolation is detailed below. When considering the whole life GHG emissions for each CEA scenario, the following net GHG emissions can be concluded.

- Scenario 1: between 1,225,537 and -49,923,966 tCO_2e
- Scenario 2: between 733,069 and -86,108,442 tCO_2e.

12.13.2.5 The emission totals for both scenarios are calculated using a number of conservative assumptions particularly during the operations and maintenance phase of the projects and reported avoided emissions, in addition to elements of double counting (Morgan only). The range in values presented (both for the operations and maintenance phase, and net GHG emissions) are due to the use of both long run marginal carbon intensity figures and 'non-renewable fuels' carbon intensities to calculate avoided emissions. It is likely that the true value of avoided emissions displaced as a result of Scenario 1 and Scenario 2 would lie within the ranges presented. The use of such emissions intensities are detailed in paragraphs 12.9.5.8 and 12.9.5.9.

12.13.2.6 It should also be noted that the final Environmental Statement for the Transmission Assets has not yet been published. Further design evolution is likely to rationalise the reported GHG emissions further. As such, the final assessment of the CEA should be considered in the context of the Transmission Assets Environmental Statement which will follow this submission under a separate application.

12.13.2.7 Even though the whole lifecycle and combined emission totals likely overstate the predicted impact (for construction GHG emissions), there will be emissions saved from the provision of renewable energy to the grid to replace other forms of energy generation, and the Generation and Transmission Assets of the Morgan Offshore Wind Project will result in a positive contribution to the UK meeting its emission reduction targets.

Magnitude of impact

12.13.2.8 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 (global climate) indirectly. The magnitude is therefore, considered to be (for the whole life time of the projects):

- Scenario 1: between 1,225,537 and -49,923,966 tCO_2e
- Scenario 2: between 733,069 and -86,108,442 tCO_2e

Sensitivity of receptor

12.13.2.9 In accordance with **paragraph 12.6.2.2**, 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

12.13.2.10 When considering the above magnitude of avoided emissions across the whole life time of the projects (Scenario 1: between 1,225,537 and -49,923,966 tCO_2e; and Scenario 2: between 733,069 and -86,108,442 tCO_2e), in addition to, the contribution toward the UK achieving its net zero goals and policy, and the high sensitivity of the climate

as a receptor, the CEA for Scenario 1 and Scenario 2 would have a net **beneficial** effect which would be significant in EIA terms.

12.13.3 Future monitoring

12.13.3.1 No climate change monitoring to test the predictions made within the impact assessment is considered necessary.

12.14 Transboundary effects

12.14.1.1 All developments which emit GHGs have the potential to impact the atmospheric mass of GHGs as a receptor (this includes manufacturing of materials in other territories), and so may have a transboundary impact on climate change. Consequently, transboundary effects due to other specific international development projects are not individually identified but would be taken into account when considering the impact of the Morgan Generation Assets 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 county's defined budget and international commitments.

12.15 Inter-related effects

12.15.1.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of the proposal on the same receptor. The assessment of inter-related effects with climate change is provided in each topic chapter of the Environmental Statement. The main areas where there is a potential for inter-related effects, subject to assessment, are considered to be:

- Volume 2, Chapter 2: Benthic subtidal ecology of the Environmental Statement – potential changes in the sensitivity of habitats or species to development impacts in the future due to the effects of climate change
- Volume 2, Chapter 7: Shipping and navigation of the Environmental Statement consideration of GHG emissions associated with deviation of ferry and cargo routes.

12.16 Summary of impacts, mitigation measures and monitoring

12.16.1.1 Information on climate change within the climate change study area was collected through desktop review.

12.16.1.2 The potential impact of GHG emissions due to the Morgan Generation Assets, resulting in an effect on the global atmospheric GHG concentration that contributes to climate change, has been assessed and reported in this chapter. The impacts of climate change on the Morgan Generation Assets have also been assessed and reported.

12.16.1.3 Table 12.19 presents a summary of the potential impacts, measures adopted as part of the Morgan Generation Assets and residual effects in respect to climate change. The impacts assessed include:

- The impact of GHG emissions arisings from land-use (seabed) change

- The impact of GHG emissions arising from the manufacturing and installation of the generation assets
- The impact of GHG emissions from decommissioning works (plant, fuel and vessel use) and recovery or disposal of materials
- The impact of GHG emissions arising from the consumption of materials and activities required to facilitate the operations and maintenance of the Morgan Generation Assets and of estimated abatement of UK Grid emissions during the operations and maintenance phase.
- Impact of the effects of climate change on the Morgan Generation Assets offshore infrastructure.

12.16.1.4 Overall, it is concluded that there will be the following significant effects arising from the Morgan Generation Assets during the construction, operations and maintenance phases:

- Construction phase: emissions from the manufacturing the offshore infrastructure would result in supply chain emissions of up to **1,927,897 tCO_2e.** This would be a **significant moderate adverse** effect (in EIA terms) with a residual effect of **minor adverse**, which is not significant in EIA terms, when accounting for further mitigation. The construction phase must also be evaluated in terms of whole lifetime emissions from the Morgan Generation Assets
- Operations and maintenance phase: The operations phase of the Morgan Generation Assets would enable the use of renewable electricity and the displacement of fossil fuels. This would result in a positive GHG impact. When considering the avoided emissions, in addition to operational/maintenance emissions, the operational impact results in the order of approximately **2,305,986 tCO_2e** savings by 2064. This would result in a significant **beneficial effect** in EIA terms.

12.16.1.5 Despite the high GHG emissions resulting from the construction-phase of the development, the magnitude of avoided emissions resulting from the operational-phase of the development allows the Morgan Generation Assets to enable avoided emissions from the end of the tenth year of operation (carbon payback period).

12.16.1.6 Over the lifetime of the Morgan Generation Assets, it would result in **324,370 tCO_2e** of avoided emissions when accounting for construction, operations and maintenance and decommissioning phases.

12.16.1.7 Consideration of the Morgan Generation Assets' net emissions performance can be considered with the following contextualisation:

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

12.16.1.8 The Morgan Generation Assets is in line with the NPS EN-3s principle of supporting new renewable and low carbon energy developments, in addition to their associated infrastructure, in order to contribute to reductions in GHG emissions.

12.16.1.9 Further, the Morgan Generation Assets is supported by national energy and climate change policy (including the National Infrastructure Strategy, Sixth Carbon Budget, Net Zero Strategy which highlight the need for an end to the use of unabated fossil fuel generation, whilst also significantly ramping up electricity generation capacity in order to meet the demands of increased electrification of transport, heat and industry. As such, government policy dictates that large-scale deployment of renewable energy generators such as the Morgan Generation Assets are necessary in order to meet GHG reduction targets.

12.16.1.10 By facilitating the expansion of renewable energy supply, the Morgan Generation Assets would assist the UK Government target of achieving a fully decarbonised power system by 2035, and the aim to become net zero by 2050.

Table 12.19: Summary of potential environmental effects, mitigation and monitoring.

[a] C=construction, O=operations and maintenance, D=decommissioning

Description of impact	Phase[a]			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
The impact of GHG emissions arisings from land-use (seabed) change during the construction, operations and maintenance decommissioning phases.	✓	✓	✓	None	C: Negligable O: Negligable D: Negligible	C: High O: High D: High	Neglible (Not Significant)	None	C: Negligable O: Negligable D: Negligible (Not Significant)	None
The impact of GHG emissions arising from the manufacturing and installation of the Morgan Generation Assets and consumption of materials.	✓	X	X	None	1,927,897tCO_2e	High	Moderate adverse effect (Significant)	The Applicant is committed to exploring options to reduce construction related emissions. The Applicant is currently exploring opportunities to: • Improve construction and operational activity to reduce emissions (e.g. potentially related to vessel scheduling, co-ordination of shipping/delivery of materials and the identification energy	Minor adverse (Not Significant)	None

Description of impact	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
								efficiency mechanisms) • Work with the supply chain and its partners to reduce emissions during construction and operation. • Consider the inclusion of low carbon criteria within procurement activities, in partnership with the supply chain.		
The impact of GHG emissions from decommissionoing works (plant, fuel and vessel use) and recovery or disposal of materials during decommissioning.	X	X	✓	None	53,718 tCO_2e	High	Minor adverse effect (Not Significant)	None	Minor adverse (Not Significant)	None
The impact of GHG emissions arising from the consumption of materials and	X	✓	X	None	2,305,986 tCO_2e avoided emissions	High	Beneficial effect (Significant)	None	Beneficial (Significant)	None

Description of impact	Phase[a] C	O	D	Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
activities required to facilitate the operations and maintenance of the Morgan Generation Assets and estimated abatement of UK Grid emissions.										
Impact of the effects of climate change on the Morgan Generation Assets infrastructure through the operations and maintenance phase	X	✓	X	• Application of anti-corrosion protective coatings and integrated scour protection to offshore equipment. • Wind turbine design to incorporate control of blade speed/braking and power backup system, retro fits to improve airflow and reduce drag and to be fitted with automatic shutdowns/lockdowns to prevent spinning too fast from storms.	N/A	N/A	Negligible (Not Significant)	None	Negligible (Not Significant)	None

Table 12.20: Summary of potential cumulative environmental effects, mitigation and monitoring.

[a] C=construction, O=operations and maintenance, D=decommissioning

Description of impact	Phase[a]			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
Scenario 1										
Whole life GHG emissions	✓	✓	✓		1,225,537 to -49,923,966 tCO_2e	High	Beneficial (significant)	None	Beneficial (significant)	None
Scenario 2										
Whole life GHG emissions	✓	✓	✓		773,069 to -86,108,442 tCO_2e	High	Beneficial (significant)	None	Beneficial (significant)	None

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