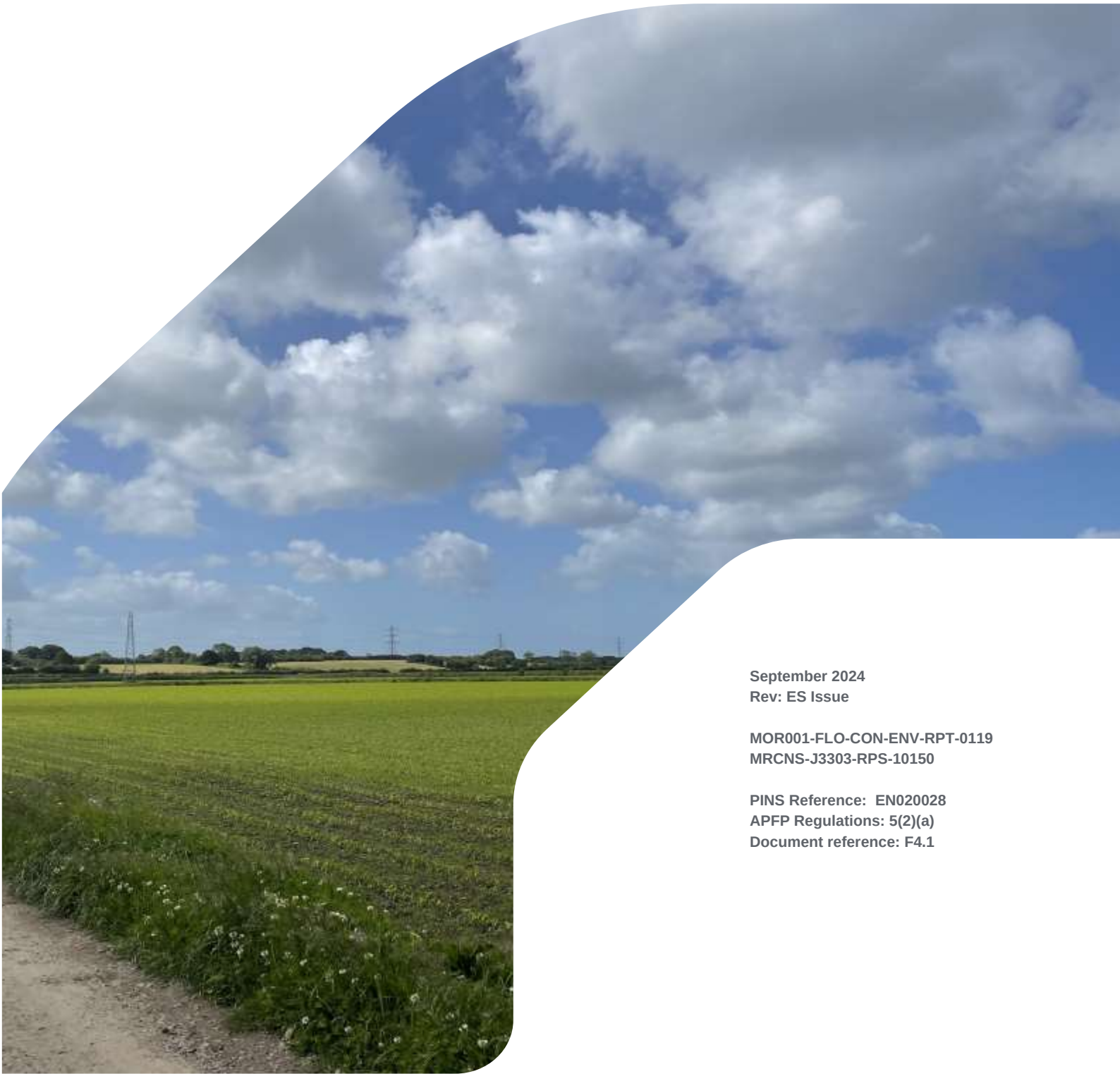
MORGAN AND MORECAMBE OFFSHORE WIND FARMS: TRANSMISSION ASSETS

Environmental Statement

Volume 4, Chapter 1: Climate change



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Prepared by:

RPS

Prepared for:

Morgan Offshore Wind Limited, Morecambe Offshore Windfarm Ltd

Contents

Tables

Annexes (See Volume 4, Annexes)

Annex number	Annex title
1.1	Greenhouse gas assessment
1.2	Climate change risk assessment

Figures (See Volume 4, Figures)

Figure number	Figure title
1.1	Transmission Assets Order Limits

Glossary

Term	Meaning
400 kV grid connection cables	Cables that will connect the proposed onshore substations to the existing National Grid Penwortham substation.
Applicants	Morgan Offshore Wind Limited (Morgan OWL) and Morecambe Offshore Windfarm Ltd (Morecambe OWL).
Baseline	The status of the environment without the Transmission Assets in place.
Carbon Budgets	A carbon budget places restrictions on the total amount of greenhouse gases that can be emitted from a nation. The budget balances the input of carbon dioxide to the atmosphere by emissions from human activities, by the storage of carbon (i.e., in carbon reservoirs on land or in the ocean).
Commitment	This term is used interchangeably with mitigation and enhancement measures. The purpose of commitments is to avoid, prevent, reduce or, if possible, offset significant adverse environmental effects. Primary and tertiary commitments are taken into account and embedded within the assessment set out in this Environmental Statement. Secondary commitments are incorporated to reduce effects to environmentally acceptable levels following initial assessment.
Development Consent Order	An order made under the Planning Act 2008, as amended, granting development consent.
EIA Scoping Report	A report setting out the proposed scope of the Environmental Impact Assessment process. The Transmission Assets Scoping Report was submitted to The Planning Inspectorate (on behalf of the Secretary of State) for the Morgan and Morecambe Offshore Windfarms Transmission Assets in October 2022.
Effect	The term used to express the consequence of an impact. The significance of effect is determined by correlating magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
Environmental Impact Assessment	The process of identifying and assessing the significant effects likely to arise from a project. This requires consideration of the likely changes to the environment, where these arise as a consequence of a project, through comparison with the existing and projected future baseline conditions.
Environmental Statement	The document presenting the results of the Environmental Impact Assessment process.
Generation Assets	The generation assets associated with the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm include the offshore wind turbines, inter-array cables, offshore substation platforms and platform link (interconnector) cables to connect offshore substations.
Greenhouse gas	A gas that absorbs and emits radiant energy within the thermal infrared range, causing the greenhouse effect. Examples include carbon dioxide and methane.
Impact	Change that is caused by an action/proposed development, e.g., land clearing (action) during construction which results in habitat loss (impact).

Term	Meaning
Intertidal Infrastructure Area	The temporary and permanent areas between MLWS and MHWS.
Life Cycle Assessment	The systematic analysis of the potential environmental impacts of products or services during their entire life cycle.
Maximum design scenario	The realistic worst case scenario, selected on a topic-specific and impact specific basis, from a range of potential parameters for the Transmission Assets.
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	The offshore export cables, landfall and onshore infrastructure for the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm. This includes the offshore export cables, landfall site, onshore export cables, onshore substations, 400 kV grid connection cables and associated grid connection infrastructure such as circuit breaker compounds. Also referred to in this report as the Transmission Assets, for ease of reading.
National Policy Statement(s)	The current national policy statements published by the Department for Energy Security and Net Zero in 2023 and adopted in 2024.
Offshore export cables	The cables which would bring electricity from the Generation Assets to the landfall.
Offshore Permanent Infrastructure Area	The area within the Transmission Assets Offshore Order Limits (up to MLWS) where the permanent offshore electrical infrastructure (i.e. offshore export cables) will be located.
Onshore export cables	The cables which would bring electricity from the landfall to the onshore substations.
Onshore Infrastructure Area	The area within the Transmission Assets Order Limits landward of Mean High Water Springs. Comprising the offshore export cables from Mean High Water Springs to the transition joint bays, onshore export cables, onshore substations and 400 kV grid connection cables , and associated temporary and permanent infrastructure including temporary and permanent compound areas and accesses. Those parts of the Transmission Assets Order Limits proposed only for ecological mitigation/biodiversity benefit are excluded from this area.
Onshore substations	The onshore substations will include a substation for the Morgan Offshore Wind Project: Transmission Assets and a substation for the Morecambe Offshore Windfarm: Transmission Assets. These will each comprise a compound containing the electrical components for transforming the power supplied from the generation assets to 400 kV and to adjust the power quality and power factor, as required to meet the UK Grid Code for supply to the National Grid.
Renewable energy	Energy from a source that is not depleted when used, such as wind or solar power.
Study area	This is an area which is defined for each environmental topic which includes the Transmission Assets Order Limits as well as potential spatial and temporal considerations of the impacts on relevant receptors. The study area for each topic is intended to cover the area within which an impact can be reasonably expected.
Substation	Part of an electrical transmission and distribution system. Substations transform voltage from high to low, or the reverse by means of electrical transformers.

Term	Meaning
Transmission Assets	See Morgan and Morecambe Offshore Wind Farms: Transmission Assets (above).
Transmission Assets Order Limits	The area within which all components of the Transmission Assets will be located, including areas required on a temporary basis during construction and/or decommissioning.
UK Grid	UK national electricity network.
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 are released to produce a kilowatt hour of electricity.

Acronyms

Acronym	Meaning
ALC	Agricultural Land Classification
BEIS	The former Department for Business, Energy & Industrial Strategy
CCRA	Climate Change Risk Assessment
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CoCP	Code of Construction Practice
Defra	Department For Environment, Food and Rural Affairs
DESNZ	The Department for Energy Security and Net Zero
DMRB	Design Manual for Rods and Bridges
EIA	Environmental Impact Assessment
ES	Environmental Statement
GHG	Greenhouse Gas
GWP	Global Warming Potential
IEMA	Institute of Environmental Management and Assessment
IPCC	Intergovernmental Panel on Climate Change
LCA	Life Cycle Assessment
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MOHC	Met Office Hadley Centre
NPPF	National Planning Policy Framework
NPS	National Policy Statement
PEIR	Preliminary Environmental Information Report
RCP	Representative Concentration Pathway

Acronym	Meaning
RICS	Royal Institute of Chartered Surveyors
UK	United Kingdom
UKCP18	United Kingdom Climate Projections 2018
UNFCCC	United Nations Framework Convention on Climate Change
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

Units

Unit	Description
%	Percentage
$GtCO_2e$	Giga tonnes carbon dioxide equivalent
°C	Degrees Celsius
km	Kilometres
kg	Kilograms
kn	Knot
mm	Millimetre
m/s	Metres per second (Speed)
MW	Megawatt
nm	Nautical mile

1 Climate change

1.1 Introduction

1.1.1 Overview

1.1.1.1 This chapter of the Environmental Statement (ES) presents the findings of the Environmental Impact Assessment (EIA) undertaken for the Morgan and Morecambe Offshore Wind Farms: Transmission Assets. For ease of reference the Morgan and Morecambe Offshore Wind Farms: Transmission Assets are referred to in this chapter as the 'Transmission Assets'. This ES accompanies the application to the Planning Inspectorate for development consent for the Transmission Assets.

1.1.1.2 The purpose of the Transmission Assets is to connect the Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets (referred to collectively as the 'Generation Assets') to the National Grid. This will contribute to:

- the UK Government's ambition to deliver 50 GW of offshore wind by 2030;
- delivering much needed investment and securing construction and operations jobs in the UK;
- securing our energy supply; and
- the UK's response to the climate change crisis.

1.1.1.3 The projects, therefore, have an important part to play in securing the timely delivery of the Government's renewable energy strategy and achieving legally binding emissions reduction targets.

1.1.1.4 Further details of the need for the Morgan Offshore Wind Project, the Morecambe Offshore Windfarm and the Transmission Assets are provided in Volume 1, Chapter 2: Policy and legislation context of the ES.

1.1.1.5 The Generation Assets will be consented separately (see Volume 1, Chapter 1: Introduction of the ES for further details). Therefore, the focus of this chapter is on the impacts of the Transmission Assets. A description of the Transmission Assets can be found in Volume 1, Chapter 3: Project description of the ES.

1.1.1.6 This chapter considers the likely impacts and effects of and to the Transmission Assets on climate change during the construction, operation and maintenance and decommissioning phases. This includes the onshore and offshore elements of the Transmission Assets as detailed within Volume 1, Chapter 3: Project description of the ES.

1.1.1.7 However, given their purpose, the Transmission Assets would never operate in isolation. As such, the cumulative impacts of the Transmission Assets together with the Generation Assets on the global atmospheric mass of CO_2 have been assessed. The findings of this cumulative assessment are set out in **section 1.13**.

1.1.2 Scope of this chapter

1.1.2.1 Climate change in the context of EIA can be considered broadly in three parts:

- the effect of greenhouse gas (GHG) emissions caused directly or indirectly by the Transmission Assets, which may have the potential to contribute to climate change;
- the effect of changes in climate on the Transmission Assets, which could affect it directly resulting in climate risk; and
- the effect of changes in climate on the Transmission Assets, which could modify its other environmental impacts (i.e., in-combination climate change impacts).

1.1.2.2 This ES chapter:

- identifies the key legislation, policy and guidance relevant to climate change;
- details the EIA scoping and consultation process undertaken to date for climate change;
- confirms the study area for the assessment, the methodology used to identify baseline environmental conditions and sets out the existing and future environmental baseline conditions, established from desk studies, surveys and consultation;
- details the mitigation and/or monitoring measures that are proposed to prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process;
- defines the project design parameters used to inform the impact assessment;
- identifies the impact assessment methodology and presents an assessment of the likely impacts and effects in relation to the construction, operation and maintenance, and decommissioning phases of the Transmission Assets on climate change (GHG emissions) and, where relevant, the impacts and effects of climate change on the Transmission Assets (risk and resilience, including in-combination climate impacts); and
- identifies any cumulative, transboundary and/or inter-related effects in relation to the construction, operation and maintenance, and decommissioning phases of the Transmission Assets.

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

- Volume 2, Chapter 2: Benthic subtidal and intertidal ecology of the ES;
- Volume 3, Chapter 6: Land use and recreation of the EA; and
- Volume 3, Chapter 7: Traffic and transport of the ES.

1.1.2.4 This chapter also draws upon additional information to support the assessment contained within the following technical reports:

- Volume 4, Annex 1.1: Greenhouse gas assessment of the ES; and
- Volume 4, Annex 1.2: Climate change risk assessment of the ES.

1.2 Legislation, policy and guidance

1.2.1 Legislation

1.2.1.1 The Climate Change Act 2008, as amended (2019), created 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 for the whole of the UK.

1.2.1.2 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.

1.2.1.3 The UKs nationally determined contribution (HM Government, 2020) 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.

1.2.2 Planning policy context

1.2.2.1 The Transmission Assets will be located in English offshore waters (beyond 12 nautical miles (nm) from the English coast) and inshore waters (within 12 nm from the English coast), with the onshore infrastructure located wholly within England. As set out in Volume 1, Chapter 1: Introduction of the ES, the Secretary of State for the Department for Energy Security and Net Zero (DESNZ) (formerly the Department for Business, Energy and Industrial Strategy (BEIS)) directed that the Transmission Assets are to be treated as development for which development consent is required under the Planning Act 2008, as amended.

National Policy Statements

1.2.2.2 There are currently six energy National Policy Statements (NPSs), three of which contain policy relevant to offshore wind development and the Transmission Assets, specifically:

- 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); and
- NPS for Electricity Networks Infrastructure (NPS EN-5) (Department for Energy Security & Net Zero 2023c).

1.2.2.3 **Table 1.1:** sets out a summary of the policies within the current NPSs, relevant to climate change.

1.2.2.4 The policies within the current NPSs relevant to all topics in the ES can be viewed in the National Policy Statement tracker (document reference J26) and Planning Statement (document reference J28), submitted with the application.

Table 1.1: Summary of the NPS EN-1, NPS EN-3, and NPS EN-5 requirements relevant to this chapter

Summary of NPS provision	How and where considered in the ES
NPS EN-1 (DESNZ, 2024a)	
In developing measures to support climate adaptation, applicants should maximise the use of nature-based solutions and integrated approaches (for example, hydrology and biodiversity solutions), alongside other conventional techniques (paragraphs 4.10.5 to 4.10.7 of NPS EN-1).	This chapter sets out the climate change risk assessment for the relevant elements of the Transmission Assets - **paragraphs 1.11.4.1** to **1.11.4.10** assess the impact of climate change on the Transmission Assets during the operation and maintenance and decommissioning phases. Further details are provided within Volume 4, Annex 1.2: Climate change risk assessment of the ES. Solutions in relation to hydrology, flood risk, biodiversity and landscape are set out in Volume 3, Chapter 2: Hydrology and flood risk, Volume 3, Chapter 3: Onshore ecology and nature conservation, and Chapter 10: Landscape and visual resources of the ES. The development of the outline design at the onshore substations has taken an integrated approach, considering hydrology, flood risk, landscape and biodiversity and this is reflected in the Outline Operational Drainage Management Plan (document reference J10), Outline Landscape Management Plan (document reference J2) and Onshore Biodiversity Benefit Statement (document reference J11).
Applicants must consider the impacts of climate change when planning the location, design, build, operation and decommissioning of new energy infrastructure (paragraph 4.10.8 of NPS EN-1).	This chapter considers the climate change risk assessment for the relevant elements of the Transmission Assets (the subject of the application for development consent) - **paragraphs 1.11.4.1** to **1.11.4.10** assess the impact of climate change on the Transmission Assets during the operation and maintenance and decommissioning phases. Further details are provided within Volume 4, Annex 1.2: Climate change risk assessment of the ES. Solutions in relation to hydrology, flood risk, biodiversity and landscape are set out in Volume 3, Chapter 2: Hydrology and flood risk, Volume 3, Chapter 3: Onshore ecology and nature conservation, and Chapter 3, Chapter 10: Landscape and visual resources of the ES. Volume 1, Chapter 4: Site selection and consideration of alternatives of the ES describes the factors considered during the site selection and design evolution process. The development of the outline design at the onshore substations has taken an integrated approach, considering hydrology, flood risk, landscape and biodiversity and this is reflected in Volume 3, Annex 2.3: Flood risk assessment of the ES, the Outline Operational Drainage Management Plan (document reference J10), Outline Landscape Management Plan (document reference J2) and Onshore Biodiversity Benefit Statement (document reference J11).

Summary of NPS provision	How and where considered in the ES
With regards to climate change adaptation, applicants must consider the impacts of climate change. An ES should set out how the proposal will take account of the projected impacts of climate change (paragraph 4.10.9 of NPS EN-1).	This chapter provides a climate change risk assessment for the relevant elements of the Transmission Assets - **paragraphs 1.11.4.1** to **1.11.4.10** assess the impact of climate change on the Transmission Assets during the operation and maintenance and decommissioning phases. Further details are provided within Volume 4, Annex 1.2: Climate change risk assessment of the ES. The assessment of the impact of climate change on the Transmission Assets is based on the latest available climate projections, as described in paragraphs **1.6.2.4** to **1.6.2.8** and Volume 4, Annex 1.2: Climate change risk assessment of the ES. Volume 4, Annex 1.2: Climate change risk assessment of the ES considers the maximum climate change scenario, informed by climate projections using the representative concentration pathway (RCP) 8.5, a high-emissions scenario assuming 'business as usual' growth globally with little additional mitigation. This represents a maximum credible scenario. The chapter has been prepared taking into account the latest guidance available from IEMA (IEMA, 2022). Consideration of onshore flood risk has been addressed within Volume 3, Chapter 2: Hydrology and flood risk of the ES and Volume 3, Annex 2.3: Flood risk assessment of the ES and the Outline Operational Drainage Management Plan (document reference J10).
Applicants should assess the impacts on and from their project across a range of climate change scenarios, in line with appropriate guidance available at the time (paragraph 4.10.10 of NPS EN-1).	
Where energy infrastructure has safety critical elements, the applicant should apply a credible maximum climate change scenario (paragraph 4.10.12 of NPS EN-1)).	
The Secretary of State should be satisfied that applicants have taken into account the potential impacts of climate change using the latest UK Climate Projections. The Secretary of State should be satisfied that there are not features of the proposal that may be seriously affected by more radical changes to the climate beyond the latest climate projections (paragraphs 4.10.13 to 4.10.15 of NPS EN-1).	
Applicants should demonstrate that proposals have a high level of climate change resilience built in and demonstrate how proposals can be adapted to remain resilient to a credible maximum climate change scenario over their lifetimes (paragraph 4.10.11 of NPS EN-1).	This chapter provides an assessment of climate risk and resilience for the Transmission Assets - **paragraphs 1.11.4.1** to **1.11.4.10** assess the impact of climate change on the Transmission Assets during the operation and maintenance and decommissioning phases. Further details are provided within Volume 4, Annex 1.2: Climate change risk assessment of the ES. Volume 4, Annex 1.2: Climate change risk assessment of the ES considers the maximum climate change scenario, informed by climate projections using the representative concentration pathway (RCP) 8.5, a high-emissions scenario assuming 'business as usual' growth globally with little additional mitigation. This represents a maximum credible scenario. Consideration of onshore flood risk has been addressed within Volume 3, Chapter 2: Hydrology and flood risk of the ES, Volume 3, Annex 2.3: Flood risk assessment of the ES and the Outline Operational Drainage Management Plan (document reference J10).
Paragraphs 4.10.16 to 4.10.19 relate to adaptation measures. The Secretary of State should consider the impact of such measures and be satisfied that such measures are based on the latest climate projections and climate change allowances. Adaptation measures should be required to be implemented at the time	Details of proposed measures to manage flood risk are provided in Volume 3, Chapter 3: Hydrology and flood risk and Volume 3, Annex 2.3: Flood risk assessment of the ES and the Outline Operational Drainage Management Plan (document reference J10). The design of such measures has been based on the latest climate change allowances from the Environment Agency (EA, 2017). The assessment of climate risk provided in this chapter is based on the latest climate

Summary of NPS provision	How and where considered in the ES
of construction where necessary and appropriate to do so.	change projections, as set out in **paragraphs 1.6.2.4** to **1.6.2.8**. Commitments to reduce the potential consequences of identified climate risks (including design considerations) are detailed within Volume 4, Annex 1.2: Climate change risk assessment of the ES.
GHG assessments should include 'A whole life GHG assessment showing construction, operational and decommissioning GHG impacts, including impacts from land use change…Where there are residual emissions, the level of emissions and the impact of those on national and international efforts to limit climate change, both alone and where relevant in combination with other developments at a regional or national level, or sector level, if sectoral targets are developed' (paragraph 5.3.4 of NPS EN-1).	This chapter provides an assessment of the construction, operation and maintenance, and decommissioning emissions associated with the Transmission Assets, at **sections 1.11.2, 1.11.3** and **1.11.5**, as well as the overall net whole life emissions **section 1.11.5**. Emissions associated with the Transmission Assets are contextualised within the UK carbon budgets at **section 1.11.5**. **Section 1.13** details the cumulative impact of the Transmission Assets on climate change, in combination with the Generation Assets. The assessment is supported by Volume 4, Annex 1.1: Greenhouse gas assessment of the ES.
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 of NPS EN-1).	This chapter provides an assessment of the construction, operation and maintenance, and decommissioning emissions associated with the Transmission Assets, at **sections 1.11.2, 1.11.3** and **1.11.5**, as well as the overall net whole life emissions **section 1.11.5**. This assessment is supported by Volume 4, Annex 1.1: Greenhouse gas assessment of the ES. Mitigation measures (commitments) to reduce emissions associated with the Transmission Assets, particularly by embodied carbon reductions are detailed at **section 1.8**.
Applicants should look for opportunities within the proposed development to embed nature-based or technological solutions to mitigate or offset the emissions of construction and decommissioning (paragraph 5.3.6 of NPS EN-1).	The development of the outline design at the onshore substations has taken an integrated approach, considering hydrology, flood risk, landscape and biodiversity and this is reflected in the Outline Operational Drainage Management Plan (document reference J10), Outline Landscape Management Plan (document reference J2) and Onshore Biodiversity Benefit Statement (document reference J11).
Steps taken to minimise and offset emissions should be set out in a GHG Reduction Strategy, secured under the Development Consent Order. The GHG Reduction Strategy should consider the creation and preservation of carbon stores and sinks including through woodland creation, hedgerow creation and restoration, peatland restoration and through other natural habitats (paragraph 5.3.7 of NPS EN-1).	The Applicants are committed to exploring options to reduce construction related emissions. Mitigation measures (commitments) to reduce emissions associated with the Transmission Assets, particularly by embodied carbon reductions are detailed at **section 1.8**, and include the submission of a Greenhouse gas (GHG) reduction strategy (document reference J4) (see also CoT42).
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 (paragraph 5.3.8 of NPS EN-1).	This chapter considers the GHG emissions for the construction, operation and maintenance, and decommissioning stages of the Transmission Assets (**section 1.11.2**), as well as the overall net whole life emissions (**section 1.11.5**). This assessment is supported by Volume 4, Annex 1.1: Greenhouse gas assessment of the ES.

Summary of NPS provision	How and where considered in the ES
The Secretary of State should be content that the applicant has taken all reasonable steps to reduce the GHG emissions of the construction and decommissioning stage of the development (paragraph 5.3.9 of NPS EN-1).	The Applicants are committed to exploring options to reduce construction related emissions. Mitigation measures (commitments) to reduce emissions associated with the Transmission Assets, particularly by embodied carbon reductions are detailed at **section 1.8,** and include the submission of a Greenhouse gas (GHG) reduction strategy (document reference J4) (see also CoT42).
The Secretary of State should 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. However, in light of the vital role energy infrastructure plays in the process of economy wide decarbonisation, the Secretary of State must accept that there are likely to be some residual emissions from construction and decommissioning of energy infrastructure (paragraph 5.3.10 of NPS EN-1).	The design of the Transmission Assets has incorporated nature-based solutions, where practicable, such as in the development of biodiversity benefit and mitigation areas and in the outline design of the onshore substations, which has taken into account hydrology, flood risk, landscape and biodiversity considerations. See the Outline Operational Drainage Management Plan (document reference J10), Outline Landscape Management Plan (document reference J2) and Onshore Biodiversity Benefit Statement (document reference J11). The purpose of the Transmission Assets is to provide a connection to the UK Grid for two offshore wind farms. The cumulative climate change effects of the Transmission Assets with the Generation Assets is provided in **section 1.13**. This demonstrates that whilst some construction phase emissions are unavoidable, the overall effect of the Transmission Assets and Generation Assets together would be significant beneficial.
Operational GHG emissions are a significant adverse impact from some types of energy infrastructure which cannot be totally avoided. Operational emissions will be addressed in a managed, economy-wide manner, to ensure consistency with carbon budgets, net zero and our international climate commitments (paragraphs 5.3.11 and 5.3.12 of NPS EN-1).	
NPS EN-3 (DESNZ, 2024b)	
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.	Table 2.1 of Volume 1, Chapter 2: Policy and legislation context provide details of the need and policy context for the Transmission Assets.
While offshore wind farms will not be affected by flooding, applicants should demonstrate that any necessary land-side infrastructure (such as cabling and onshore substations) will be appropriately resilient to climate-change induced weather phenomena (paragraph 2.4.8 of NPS EN-3).	This chapter provides an assessment of climate risk and resilience for the Transmission Assets - **paragraphs 1.11.4.1** to **1.11.4.10** assess the impact of climate change on the Transmission Assets during the operation and maintenance and decommissioning phases. Further details are provided within Volume 4, Annex 1.2: Climate change risk assessment of the ES. Consideration of onshore flood risk has been addressed within Volume 3, Chapter 2: Hydrology and flood risk of the ES, Volume 3, Annex 2.3: Flood risk assessment of the ES and the Outline Operational Drainage Management Plan (document reference J10).
NPS EN-5 (DESNZ, 2024c)	
Applicants must consider how the development is vulnerable to, and how it has been designed to be resilient to the increased risks of flooding, wind and storm	This chapter provides an assessment of climate risk for the relevant elements of the Transmission Assets **paragraphs 1.11.4.1** to **1.11.4.10** assess the impact of climate change on the Transmission Assets during the operation and

Summary of NPS provision	How and where considered in the ES
events, heightened temperatures, and subsidence resulting from climate change (paragraph 2.3.2 of NPS EN-5).	maintenance and decommissioning phases. Details of this are provided within Volume 4, Annex 1.2: Climate change risk assessment of the ES. Consideration of onshore flood risk has been addressed within Volume 3, Chapter 2: Hydrology and flood risk of the ES, Volume 3, Annex 2.3: Flood risk assessment of the ES and the Outline Operational Drainage Management Plan (document reference J10).
Section 4.10 of EN-1 advises that the resilience of the project to the effects of climate change must be assessed (paragraph 2.3.3 of NPS EN-5).	This chapter provides a climate change risk assessment for the relevant elements of the Transmission Assets - **paragraphs 1.11.4.1** to **1.11.4.10** assess the impact of climate change on the Transmission Assets during the operation and maintenance and decommissioning phases. Further details are provided within Volume 4, Annex 1.2: Climate change risk assessment of the ES. Volume 4, Annex 1.2: Climate change risk assessment of the ES considers the maximum climate change scenario, informed by climate projections using the representative concentration pathway (RCP) 8.5, a high-emissions scenario assuming 'business as usual' growth globally with little additional mitigation. This represents a maximum credible scenario. The chapter has been prepared taking into account the latest guidance available from IEMA. Consideration of onshore flood risk has been addressed within Volume 3, Chapter 2: Hydrology and flood risk of the ES, Volume 3, Annex 2.3: Flood risk assessment of the ES and the Outline Operational Drainage Management Plan (document reference J10).

The National Planning Policy Framework

1.2.2.5 The National Planning Policy Framework (NPPF) was published in 2012 and updated in 2018, 2019, 2021 and 2023 (Department for Levelling Up, Housing and Communities, 2023). The NPPF sets out the Government's planning policies for England.

1.2.2.6 The Government has published proposed reforms to the NPPF for consultation on 30 July 2024, with the consultation period ending on 24 September 2024 (Ministry of Housing, Communities and Local Government, 2024). Following consultation, the NPPF will be updated.

1.2.2.7 **Table 1.2** sets out a summary of the NPPF policies relevant to this chapter.

Table 1.2: Summary of NPPF requirements relevant to this chapter

Policy	Key provisions	How and where considered in the ES
Chapter 14. Meeting the challenge of climate change, flooding and coastal change Paragraph 157 and 159.	The planning system should support the transition to a low carbon future in a changing climate. New development should be planned for in ways that: avoid increased vulnerability to the range of impacts arising from climate change… and can help to reduce greenhouse gas emissions.	This chapter provides an assessment of the construction, operation and maintenance, and decommissioning emissions associated with the Transmission Assets at **sections 1.11.2, 1.11.3** and **1.11.5**, as well as the overall net whole life emissions **section 1.11.5**. This assessment is supported by Volume 4, Annex 1.1: Greenhouse gas assessment of the ES. Additionally, this chapter provides an assessment of climate risk and resilience for the Transmission Assets - paragraphs **1.11.4.1** to **1.11.4.10** assess the impact of climate change on the Transmission Assets during the operation and maintenance and decommissioning phases. Further details are provided within Volume 4, Annex 1.2: Climate change risk assessment of the ES.

1.2.2.8 The consultation draft includes similar provisions as the designated NPPF. The consultation draft NPPF has been reviewed and there are no material updates for climate change.

1.2.2.9 The Planning Practice Guidance (Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government, 2023) supports the NPPF and provides guidance across a range of topic areas, including climate change. It recommends the consideration of future climate risks and promotes the implementation of suitable adaptation and mitigation strategies to manage any climate risk.

Marine policy

UK Marine Policy Statement

1.2.2.10 The UK Marine Policy Statement (HM Government, 2011) outlines the need to identify how energy infrastructure (including offshore wind and the necessary infrastructure that accompanies it, such as substations) will *'contribute to delivery of national targets and priorities, including legally binding commitments entered into under the Renewable Energy Directive (Directive 2009/28/EC) and our domestic binding target to reduce greenhouse gas emissions by 80% by 2050. This will include taking account of… generation and distribution infrastructure'.*

North West Inshore and North West Offshore Marine Plans

1.2.2.11 **Table 1.3** sets out a summary of the specific policies set out in North West Inshore and North West Offshore Marine Plan (HM Government, 2021) relevant to this chapter.

Table 1.3: Summary of inshore and offshore marine plan policies relevant to this chapter

Policy	Key provisions	How and where considered in the ES
NW-CC-2	Proposals should demonstrate for the lifetime of the project that they are resilient to the impacts of climate change and coastal change.	This chapter provides an assessment of climate risk and resilience of the Transmission Assets - paragraphs **1.11.4.1** to **1.11.4.10** assess the impact of climate change on the Transmission Assets during the operation and maintenance and decommissioning phases. Further details are provided within Volume 4, Annex 1.2: Climate change risk assessment of the ES.
NW-AIR-1	Proposals must assess their direct and indirect emissions of GHGs. Where proposals are likely to result in increased emissions of GHGs, it must be demonstrated that they will be avoided, minimised, and mitigated.	This chapter provides an assessment of CO_2e emissions and other relevant GHGs resultant from the Transmission Assets in **sections 1.11.2, 1.11.3** and **1.11.5**. This assessment is supported by Volume 4, Annex 1.1: Greenhouse gas assessment of the ES. Mitigation measures (commitments) to reduce emissions associated with the Transmission Assets, particularly by embodied carbon reductions, are detailed at **section 1.8**.

Local planning policy

1.2.2.12 The onshore and intertidal elements of the Transmission Assets are located within the administrative areas of Fylde Council, Blackpool Council, South Ribble Borough Council and Preston City Council (and Lancashire County Council at the County level).

1.2.2.13 The relevant local planning policies applicable to climate change based on the extent of the study areas for this assessment are summarised in **Table 1.4**.

Table 1.4: Summary of local planning policy relevant to climate change

Policy	Key provisions	How and where considered in the ES
Fylde Local Plan to 2032 (incorporating Partial Review) (Fylde Council, 2021)		
Strategic Objective 1: To create sustainable communities	The Local Plan requires new developments to *'follow sustainable design principles and incorporate sustainable building practices by reducing carbon emissions, maximising water and waste efficiency and ensuring that they are resilient to the effects of climate change'*.	Mitigation measures (Commitments) to reduce emissions associated with the Transmission Assets, particularly by embodied carbon reductions, are detailed at **section 1.8**. This chapter provides a climate change risk assessment for the relevant elements of the Transmission Assets - paragraphs **1.11.4.1** to **1.11.4.10** assess the impact of climate change on the Transmission Assets during the operation and maintenance and decommissioning phases. Details of this are provided within Volume 4, Annex 1.2: Climate change risk assessment of the ES. Consideration of onshore flood risk has been addressed within Volume 3, Chapter 2: Hydrology and flood risk of the ES, Volume 3, Annex 2.3: Flood risk assessment of the ES and the Outline Operational Drainage Management Plan (document reference J10).
Strategic Objective 2: To maintain, improve and enhance the environment	The Local Plan promotes renewable and low carbon energy in order to reduce and mitigate carbon emissions within the Borough.	This chapter provides an assessment of the construction, operation and maintenance and decommissioning emissions associated with the Transmission Assets, at **sections 1.11.2, 1.11.3** and **1.11.5**. Emissions associated with the Transmission Assets are contextualised within the UK carbon budgets at **section 1.11.5**. Mitigation measures (Commitments) to reduce emissions associated with the Transmission Assets, particularly by embodied carbon reductions, are detailed at **section 1.8**.
Blackpool Local Plan, Part 1: Core Strategy (2012-2027) (Blackpool Council, 2016)		
Goal 1: Sustainable regeneration, diversification and growth	Key objectives include addressing climate change by *'managing flood risk, protecting water quality, reducing energy use and encouraging renewable energy sources'*.	The Transmission Assets is a renewable energy project. This chapter provides an assessment of climate risk and resilience for the relevant elements of the Transmission Assets - paragraphs **1.11.4.1** to **1.11.4.10** assess the impact of climate change on the Transmission Assets during the operation and maintenance and decommissioning phases. Consideration of onshore flood risk has been addressed within Volume 3, Chapter 2: Hydrology and flood risk of the ES, Volume 3, Annex 2.3: Flood risk assessment of the ES and the Outline Operational Drainage Management Plan (document reference J10).

Policy	Key provisions	How and where considered in the ES
Blackpool's Climate Emergency Action Plan (Blackpool Council, 2021)		
n/a	Blackpool Council have declared a climate emergency and have set a target to make Blackpool Council net zero by 2030 and to work towards achieving the same across the whole town.	The Transmission Assets is a renewable energy project. Emissions associated with the Transmission Assets are contextualised within the UK carbon budgets at **section 1.11.5**.
n/a	Key actions to achieve this relate to the power and heat network, with new renewable power schemes promoted.	
South Ribble Borough Council Local Plan 2012-2026 (South Ribble Borough Council, 2015)		
Vision for central Lancashire	The Local Plan sets out the vision for the provision of energy from sustainable sources, including mitigation measures and, wherever possible, adaptation to climate change.	This chapter provides an assessment of the construction, operation and decommissioning emissions associated with the Transmission Assets, at **sections 1.11.2, 1.11.3** and **1.11.5**. Mitigation measures (Commitments) to reduce emissions associated with the Transmission Assets, particularly by embodied carbon reductions, are detailed at **section 1.8**. This chapter also provides a climate change risk assessment for the relevant elements of the Transmission Assets - paragraphs **1.11.4.1** to **1.11.4.10** assess the impact of climate change on the Transmission Assets during the operation and maintenance and decommissioning phases. Details of this are provided within Volume 4, Annex 1.2: Climate change risk assessment of the ES.
Core Strategy Objectives	To reduce energy use and carbon dioxide emissions in new developments, in addition to encouraging the use and generation of energy from renewable and low carbon sources.	This chapter provides an assessment of the construction, operation and maintenance and decommissioning emissions associated with the Transmission Assets, at **sections 1.11.2, 1.11.3** and **1.11.5**. Emissions associated with the Transmission Assets are contextualised within the UK carbon budgets at **section 1.11.5**. Mitigation measures (Commitments) to reduce emissions associated with the Transmission Assets, particularly by embodied carbon reductions, are detailed at **section 1.8**.
South Ribble Climate Emergency Action Plan (South Ribble Borough Council, 2021)		
n/a	In 2019, South Ribble Borough Council declared a climate emergency, pledging to make the Borough carbon neutral by 2030.	The Transmission Assets is a renewable energy project. Emissions associated with the Transmission Assets are contextualised within the UK carbon budgets at **section 1.11.5**.

Policy	Key provisions	How and where considered in the ES
	The Plan outlines actions to promote the generation of renewable energy, in addition to enhancing climate risk resilience.	This chapter also provides a climate change risk assessment for the relevant elements of the Transmission Assets - paragraphs **1.11.4.1** to **1.11.4.10** assess the impact of climate change on the Transmission Assets during the operation and maintenance and decommissioning phases. Details of this are provided within Volume 4, Annex 1.2: Climate change risk assessment of the ES.
Preston Local Plan 2012-2026 (Preston City Council, 2015)		
Core Strategy Objectives	The Preston Local Plan aligns with the Central Lancashire Local Development Framework. Key core strategy objectives for tackling climate change include: • SO22: To encourage the generation and use of energy from renewable and low carbon sources. • SO23: To manage flood risk and the impacts of flooding.	The Transmission Assets is a renewable energy project. Emissions associated with the Transmission Assets are contextualised within the UK carbon budgets at **section 1.11.5**. This chapter also provides a climate change risk assessment for the relevant elements of the Transmission Assets - paragraphs **1.11.4.1** to **1.11.4.10** assess the impact of climate change on the Transmission Assets during the operation and maintenance and decommissioning phases. Details of this are provided within Volume 4, Annex 1.2: Climate change risk assessment of the ES. Consideration of onshore flood risk has been addressed within Volume 3, Chapter 2: Hydrology and flood risk of the ES, Volume 3, Annex 2.3: Flood risk assessment of the ES and the Outline Operational Drainage Management Plan (document reference J10).
Policy 28: Renewable and low carbon energy schemes	*'Proposals for renewable and low carbon energy schemes will be supported and planning permission granted'* where there will be no unacceptable impact on environmental, social and economic receptors.	Each technical chapter within the ES details impacts of the Transmission Assets on their respective receptors. Likely significant effects and where relevant, mitigation measures are identified. This chapter identifies the impacts of the Transmission Assets on and from climate change in **section 1.11.** Mitigation measures (Commitments) to reduce emissions associated with the Transmission Assets, particularly by embodied carbon reductions, are detailed at **section 1.8**.
Preston City Council Interim Climate Action Statement (Preston City Council, 2021)		
n/a	Preston City Council declared a climate emergency in April 2019. The Council has targeted net zero carbon emissions by 2030. A Climate Action Plan will be published which will detail the proposed pathway to net zero carbon.	Emissions associated with the Transmission Assets are contextualised within the UK carbon budgets at **section 1.11.5**. This chapter also provides a climate change risk assessment for the relevant elements of the Transmission Assets - paragraphs **1.11.4.1** to **1.11.4.10** assess the impact of

Policy	Key provisions	How and where considered in the ES
		climate change on the Transmission Assets during the operation and maintenance and decommissioning phases. Details of this are provided within Volume 4, Annex 1.2: Climate change risk assessment of the ES.
Lancashire County Council Environment and Climate Strategy, 2023-2025 (Lancashire County Council, undated)		
Vision	Lancashire will reduce emissions by enhancing our services and operations. We will be better prepared for the impacts of climate change, building resilience into our services, communities and businesses.	Emissions associated with the Transmission Assets are contextualised within the UK carbon budgets at **section 1.11.5**. Mitigation measures (Commitments) to reduce emissions associated with the Transmission Assets, particularly by embodied carbon reductions, are detailed at **section 1.8.**

1.2.3 Relevant guidance

1.2.3.1 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).

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

1.2.3.3 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), 2024); and
- PAS 2080 – Carbon Management in Buildings and Infrastructure (The British Standards Institution (BSI), 2023).

1.3 Consultation

1.3.1 Scoping

1.3.1.1 On 28 October 2022, the Applicants submitted a Scoping Report to the Planning Inspectorate, which described the scope and methodology for the technical studies being undertaken to provide an assessment of any likely significant effects for the construction, operation and maintenance and decommissioning phases of the Transmission Assets.

1.3.1.2 Following consultation with the appropriate statutory bodies, the Planning Inspectorate (on behalf of the Secretary of State) provided a Scoping Opinion on 8 December 2022.

1.3.2 Statutory consultation responses

1.3.2.1 The preliminary findings of the EIA process were published in the Preliminary Environmental Information Report (PEIR) in October 2023. The PEIR was prepared to provide the basis for formal consultation under the Planning Act 2008. This included consultation with statutory and non-statutory bodies under section 42 and 47 of the Planning Act 2008, as presented in **Table 1.5**.

1.3.3 Summary of consultation responses received

1.3.3.1 A summary of the key items raised specific to climate change is presented in **Table 1.5**, together with how these have been considered in the production of this chapter. It should however be noted that formal responses are provided for all consultation responses received and can be accessed in the Consultation Report (document reference E1).

Table 1.5: Summary of key consultation comments raised during consultation activities undertaken for the Transmission Assets relevant to climate change

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
08 December 2022	Scoping Opinion (Planning Inspectorate)	With regards to the assessment of climate risk, *'the Inspectorate considers that consideration of construction stage effects can be scoped out', 'the assessment of decommissioning stage effects should take into account the impacts of climate change, including increases in wave height and wind speed'*.	The vulnerability of the Transmission Assets during the operation and maintenance and decommissioning phases has been assessed in **section 1.11.4** and is supported by Volume 4, Annex 1.2: Climate change risk assessment of the ES.
08 December 2022	Scoping Opinion (Planning Inspectorate)	*'In-combination climate change effects are proposed to be scoped out of the Climate Change aspect chapter as they will be addressed individually within each applicable ES chapter. The Inspectorate is content with this approach. The ES should cross-reference other relevant Chapters where this is assessed in for clarity'.*	In-combination climate change effects are identified and assessed as relevant within this chapter, at **section 1.15**.
08 December 2022	Scoping Opinion (Planning Inspectorate)	The cumulative impact of local development projects may *'have an influence on the vulnerability of the proposed Development to climate change, e.g. influencing flooding risk, and should therefore be considered in that context'*.	The vulnerability of the Transmission Assets to climate change is assessed in **section 1.11.4** and is supported by Volume 4, Annex 1.2: Climate change risk assessment of the ES. The cumulative effects assessment is included at **section 1.13**. The cumulative impact with other projects on the vulnerability of the Transmission Assets to climate change is limited to impact on flood risk. Given that all other projects will be required to complete a flood risk assessment and drainage strategy, accounting for increased precipitation as a result of climate change, there are not anticipated to be any significant cumulative effects resulting from increased vulnerability to climate change. Further, a high sensitivity worst case climate projection scenario has been used to determine a conservative precautionary case for future risks from climate change. This

Date	Consultee and type of response	Comment raised	Response to comment raised and/or where considered in this chapter
			will incorporate any uncertainty in climate fluctuations that may arise as a result of local development projects.
23 November 2023	Statutory consultation response (Natural England)	*'Natural England advises that either further information is provided to demonstrate the extent of deep peat in the area of the cable route, or that the proposed developments are amended to avoid any work within these particular areas".* *"Natural England do not support the principle of developing on peat. Peat is an irreplaceable asset that once gone is lost forever and can never be restored to sequester carbon which is difficult to justify in a climate emergency'.*	Surveys carried out in 2024 did not identify any significant peat carbon storage to be impacted by the Transmission Assets and as such no significant loss of carbon stores. Refer to section 1.4 of Volume 3, Annex 5.4 Geoarchaeological desk based assessment report of the ES and Section 6.7 of Volume 3, Chapter 6: Land use and recreation of the ES.
22 November 2023	Statutory consultation response (National Infrastructure Team, Environment Agency)	*'Consider local opportunities for offsetting GHG emissions. Engage with local partners who could support with some of this'.*	Offsetting has not been considered as part of the climate change chapter, as this is a last resort when considering GHG reduction opportunities and is not considered to be required for this project as an overall positive contribution to climate change is anticipated (when considered together with the Generation Assets – see **section 1.13**). This chapter has considered a maximum design scenario and presents a conservative assessment of GHG emissions from construction, operation and decommissioning, at **sections 1.11.2, 1.11.3** and **1.11.5**. **Section 1.8** outlines how the Applicants are committed to exploring options to reduce construction related emissions.

1.4 Study area

1.4.1.1 GHG emissions have a global (international) effect rather than directly affecting any specific local receptor. The impact of GHG emissions arising due to the Transmission Assets on the global atmospheric concentration of the relevant GHGs, expressed in CO_2-equivalents (CO_2e), is therefore considered within this assessment.

1.4.1.2 The Transmission Assets' climate change study area is defined as the onshore, intertidal and offshore components of the Transmission Assets (as defined by the Transmission Assets Onshore Infrastructure Area, Intertidal Infrastructure Area and Offshore Permanent Infrastructure Area) alongside the global atmosphere, based on established IEMA guidance (IEMA, 2022). The Transmission Assets Order Limits are shown on Figure 1.1 (see Volume 4, Figures).

1.4.1.3 The climate change risk study area also covers the Transmission Assets Order Limits, as shown in Figure 1.1 (see Volume 4, Figures). The assessment of the onshore elements of the Transmission Assets covers two 25 km grid cells based on the UK Climate Projections 2018 (UKCP18) probabilistic projections (Met Office Hadley Centre (MOHC), 2021).

1.4.1.4 The areas identified in Volume 1, Chapter 3: Project description of the ES for biodiversity benefit, enhancement and/or mitigation are excluded from the climate change study area. This is because any planting associated with improving habitat quality is not considered to result in a material change in GHG emissions during the construction, operation and maintenance, or decommissioning phases. Such areas have not been considered further.

1.4.1.5 With regards to the assessment of cumulative impacts, 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 impacts due to other specific local development projects are not considered individually but are taken into account when considering the impact of the Transmission Assets, and probabilistic projections used in the climate change risk assessment (CCRA) (Volume 4, Annex 1.2: Climate change risk assessment of the ES). However, the impacts resulting from the Generation Assets are considered, in order to account for the potential impact of both the generation and transmission elements combined. Therefore, the cumulative study area incorporates the Transmission Assets Order Limits, alongside the Order Limits for each of the Generation Assets.

1.5 Baseline methodology

1.5.1 Methodology for baseline studies

Desk studies

1.5.1.1 A comprehensive desk-based review was undertaken to inform the baseline for climate change. The existing studies and datasets referred to as part of the desk-based review are summarised in **Table 1.6**. Desk studies were

undertaken to determine the GHG emissions likely to arise from the Transmission Assets, in addition to the impact of climate change on the Transmission Assets and on its other environmental impacts (i.e., in-combination climate impacts).

1.5.1.2 To determine the baseline environment for the GHG emissions assessment, information has been sourced and cross referenced from Volume 2, Chapter 2: Benthic subtidal and intertidal ecology and Volume 3, Chapter 6: Land use and recreation of the ES. The baseline environment is defined as areas that would be occupied by the Transmission Assets throughout the construction, operation and maintenance and decommissioning phases.

1.5.1.3 To determine the baseline climate environment to inform both the climate change risk assessment and assessment of in-combination climate impacts, onshore climate conditions have been sourced from the Met Office observed data for Squires Gate climate station, Blackpool. The observational data from Squires Gate climate station has been collected and averaged over 30 years from 1981 to 2010 and reviewed against regional observational data averaged over the same reporting period (Met Office, 2020).

1.5.1.4 Baseline offshore climatic conditions have been sourced from observational data collected within the UK Offshore Energy Strategic Environmental Assessment (BEIS, 2022a) and Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Reporting of the physical science (IPCC, 2021).

Table 1.6: Summary of desk study sources

Title	Source	Year	Author
UK Government GHG Conversion Factors for Company Reporting	Defra	2024	DESNZ and Defra
Provisional Agricultural Land Classification (ALC) England	Natural England	2019	Natural England
UK Climate Averages	Met Office	2020	Met Office
UK Offshore Energy Strategic Environmental Assessment: Appendix 1F: Climate & Meteorology	BEIS	2022	BEIS
Climate Change 2021: The Physical Science Basis	IPCC	2021	IPCC

1.6 Baseline environment

1.6.1 Desk study

1.6.1.1 Information on climate change within the study area has been collected through a comprehensive review of existing studies and datasets. These are summarised in **Table 1.6.**

Greenhouse gas emissions assessment baseline environment

1.6.1.2 The current baseline for the onshore elements of the Transmission Assets primarily comprises agricultural land. This land has been broadly categorised as Grades 2, 3 and 4 agricultural land, with the presence of peat or peaty

soils likely, based on available agricultural land classification mapping (see Volume 3, Annex 6.1: Published agricultural land classification and soils data of the ES). With regard to the assessment of GHG emissions, land with high carbon stock such as woodland and peat is of most relevance. As detailed within the baseline section (section 6.7) of Chapter 6: Land use and recreation of the ES, there was potential for peat to the east and west of Huck Lane, however, surveys conducted in 2024 conclude that the potential peaty land is categorised as organic carbon and not peat. Furthermore the Volume 3, Annex 5.4: Geoarchaeological desk based assessment report of the ES has stipulated that any buried peat would be below 2 m and as such, would not be disturbed by construction activity.

1.6.1.3 When considering the current baseline for the offshore elements of the Transmission Assets, the baseline consists of various subtidal habitats of mixed sediments comprising sand and gravels, and intertidal mudflats. These habitats support diverse benthic sediment-based communities. Such environments are detailed within Volume 2, Chapter 2: Benthic subtidal and intertidal ecology of the ES.

Climate change risk assessment baseline environment

1.6.1.4 A description of the onshore and offshore baseline can be found in Volume 4, Annex 1.2: Climate change risk assessment of the ES. Key relevant information concerning the onshore and offshore baseline is summarised below.

Onshore baseline environment

1.6.1.5 North West England experiences a temperate climate, with annual average maximum and minimum temperatures of 13.11 °C and 6.66 °C recorded at the Squires Gate climate station respectively (Met Office, 2020). During the 1981 to 2010 baseline period, average maximum temperatures reached 19.62 °C in July and minimum temperatures fell to an average of 1.67 °C in February. This is consistent with regional climate patterns for North West England and North Wales. In the summer months, regional temperatures often range between 19.09 °C and 9.07 °C; and in the winter months, regional temperatures range between 6.42 °C and 0.94 °C. In recent years, temperature fluctuations have resulted in extreme high temperatures above 30 °C in the summer months.

1.6.1.6 Precipitation recorded at the Squires Gate climate station is lower than that reported for the regional annual total of 1,304.55 mm, at 882.68 mm a year. However, regional precipitation in North Wales and North West England exceeds the UK annual average, which totals 1,142.04 mm. Therefore, North West England can be considered as a region that is exposed to high rainfall in comparison to the rest of the UK.

1.6.1.7 Regional annual average wind speeds in North West England and North Wales regions are marginally higher than the annual average for the UK, equalling 9.52 knots (kn), and 9.38 kn, respectively. Moreover, as the selected onshore elements of the Transmission Assets are adjacent to the

Irish Sea coastline, it can be predicted that the area will be susceptible to higher wind speeds throughout the year due to its coastal location.

Offshore baseline environment

1.6.1.8 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, 2022a).

1.6.1.9 Precipitation generally falls 18 days per month during the winter, and 10 to 15 days per month during the summer. Rainfall intensity and duration varies greatly from day to day (BEIS, 2022a).

1.6.1.10 Higher wind speeds can be expected offshore and in intertidal areas in comparison with the onshore elements of the Transmission Assets Order Limits due to the lack of obstructions (both man-made and natural) in open water. Wind conditions are generally westerly and south westerly throughout the year. During the winter, winds occasionally exceed 14 m/s (with 20% probability) 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% (BEIS, 2022a).

1.6.1.11 Mean sea level is a crucial element of climate change-related risks for wind farms – global mean sea level rose by 0.2 m between 1901 and 2018, and continues to rise (IPCC, 2021). Land adjacent to the coast and estuaries within Lancashire has been identified as vulnerable to coastal flooding, despite the protection of current sea and tidal defences (Environment Agency, 2022).

1.6.2 Future baseline conditions

1.6.2.1 Consideration of the future baseline conditions in the absence of the Transmission Assets has been carried out and is described within this section.

GHG emissions assessment future baseline

1.6.2.2 In respect of the Baseline the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 requires the ES to include '*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*'. Each chapter of the ES provides an outline of the likely future baseline conditions in the absence of the Transmission Assets.

1.6.2.3 The future baseline GHG emissions for existing land use without the Transmission Assets are likely to remain similar to the current baseline.

Climate change risk assessment future baseline

1.6.2.4 In the near future, roughly within the next few years to a decade, variations in average temperature and precipitation are likely to be the most visible in terms of year-to-year changes in climate. In subsequent decades, within the

operating lifetime of the Transmission Assets, anthropogenic climatic changes are expected to become more apparent.

1.6.2.5 The Met Office Hadley Centre (MOHC) publishes both probabilistic climate change projections and downscaled global circulation model outputs for the UK at various spatial scales. This is called the UKCP18 dataset, first published in November 2018 and at v2.9.0 (MOHC, 2023) at the time of writing. The projections are based on representative concentration pathway (RCP) scenarios used by the IPCC. The RCP scenarios (four scenarios presented in the IPCC fifth Assessment report which are included within the UKCP18 database) describe different climatic futures, all of which are considered possible depending on the volume of GHGs emitted. These provide the basis for future assessments of climate change and possible response strategies, thereby giving a low to high range in potential global GHG reduction initiatives and resulting rate of climatic effects over a given period.

1.6.2.6 The probabilistic projections published at a 25 km grid cell scale are considered the most useful for this assessment when considering the onshore elements of the Transmission Assets, being designed to show a range of projection values that reflect uncertainty in modelled outcomes. The CP18 Overview Report (MOHC, 2018a) and supporting factsheets (MOHC, 2018b) for the wider regional and UK context have also been drawn upon.

1.6.2.7 At the end of the operational lifetime of the Generation Assets, the Transmission Assets will be decommissioned. For the purposes of this assessment, the Transmission Assets are expected to have an initial 35-year operating lifetime and become fully operational by 2030, but as a key piece of energy infrastructure could also operate in the longer term (and the design life of the Transmission Assets would support this). Therefore, climate projections for the mid- and late century have been considered: average conditions during 2040 to 2069 and 2070 to 2099.

1.6.2.8 Probabilistic local climate projections consistent with those referenced above and used to illustrate future possible onshore climate trends are not available for offshore regions. As such, the results of marine climate projections as set out within the UKCP18 Marine Report (Palmer *et al*. 2018) and interrogated within the UK Climate Risk Independent Assessment (CCRA3), Chapter 4: Infrastructure (Jaroszweski *et al.* 2021) have been used to examine future trends for wind speed, wave height and sea levels. The projections are based on RCP 8.5, with data largely available for the end of the 21st century. Whilst this is outside of the initial lifetime of the Transmission Assets, these projections display climate trends that will begin to be felt throughout this century.

1.6.2.9 Further information is presented within Volume 4, Annex 1.2: Climate change risk assessment of the ES.

1.6.3 Key receptors

1.6.3.1 **Table 1.7** identifies the receptors taken forward into the assessment.

Table 1.7: Key receptors taken forward to assessment

Receptor	Description
Global atmospheric mass of GHGs	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.
Offshore export cables	As described within Volume 1, Chapter 3: Project description of the ES.
Onshore export cables and 400 kV grid connection cables	
Onshore substations	
Sediment transport pathways	Described within Volume 2, Chapter 1: Physical processes of the ES.
Onshore ecology and habitats	Described within Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES.
Onshore and intertidal ornithology	Described within Volume 3, Chapter 4: Onshore ecology and nature conservation of the ES.
Human receptors impacted by noise and vibration	Described within Volume 3, Chapter 8: Noise and vibration of the ES.
Landscape character	Described within Volume 3, Chapter 10: Landscape and visual resources of the ES.

1.7 Scope of the assessment

1.7.1.1 The scope of the ES has been developed in consultation with relevant statutory and non-statutory consultees as detailed in **Table 1.5**, in addition to relevant policy and guidance. This assessment of climate change considers both the effect of GHG emissions caused directly or indirectly by the Transmission Assets, which have the potential to contribute to climate change (e.g., emissions arising from the manufacturing and installation of the Transmission Assets) and the potential effect of changes in climate on the Transmission Assets and other identified environmental impacts (in-combination climate impacts – where future climate change may exacerbate or diminish the effect of an existing environmental impact on the project).

1.7.1.2 Taking into account the scoping and consultation process, **Table 1.8** summarises the potential effects considered as part of this assessment.

Table 1.8: Impacts considered within this assessment

Activity	Impacts scoped into the assessment
Construction phase	
Manufacturing and installation of the Transmission Assets.	GHG emissions arising from such activity would contribute to global GHG emissions concentrations and climate change.
Installation of the Transmission Assets.	Land use change - GHG emissions arising from land use change would contribute to global GHG emissions concentrations and climate change.
Operation and maintenance phase	
Consumption of materials and activities required to facilitate the operation and maintenance phase.	GHG emissions arising from such activity would contribute to global GHG emissions concentrations and climate change.
Operation and maintenance of the Transmission Assets.	Land use change - GHG emissions arising from land use change would contribute to global GHG emissions concentrations and climate change.
	Effect of projected future climate change on the Transmission Assets (climate risk).
	Effect of projected future climate change on the vulnerability of identified receptors, which could modify its other environmental impacts (i.e., in-combination climate change impacts).
Decommissioning	
Decommissioning activities, such as use of plant, fuel and vessel use, and the recovery (or disposal) of materials.	GHG emissions arising from such activity would contribute to global GHG emissions concentrations and climate change.
Decommissioning of the Transmission Assets.	Land use change - GHG emissions arising from land use change would contribute to global GHG emissions concentrations and climate change.
	Effect of projected future climate change on the Transmission Assets (climate risk).
	Effect of projected future climate change on the vulnerability of identified receptors (i.e., in-combination climate change impacts).

1.7.1.3 Impacts that are not likely to result in significant effects have been scoped out of the assessment. A summary of the impacts scoped out, together with justification for scoping them out and whether the approach has been agreed with key stakeholders through either scoping or consultation, is presented in **Table 1.9.**

Table 1.9: Impacts scoped out of the assessment

Impact	Justification
The impact of the effects of climate change on the Transmission Assets' construction activities.	Due to the length of the overall construction programme (sequential site preparation and construction scenario of up to 75 months (MDS), with construction anticipated to commence in 2027), variations in climatic parameters would be minimal across the relevant construction period. Construction work practices are adapted to existing climate conditions and weather in the UK and are anticipated to evolve with time and climatic variations. As such, the effects of climate change on construction activities is not considered further. Such impacts are assessed only for the operation and maintenance, and decommissioning phases only. The Planning Inspectorate confirmed this approach in its Scoping Opinion (see **Table 1.5**).

1.8 Measures adopted as part of the Transmission Assets (Commitments)

1.8.1.1 For the purposes of the EIA process, the term 'measures adopted as part of the Transmission Assets' is used to include the following two types of mitigation measures (adapted from IEMA, 2016). These measures are set out in Volume 1, Annex 5.3: Commitments Register of the ES.

- Embedded mitigation. This includes the following.
  - Primary (inherent) mitigation - measures included as part of the project design. IEMA describes these as 'modifications to the location or design of the development made during the pre-application phase that are an inherent part of the project and do not require additional action to be taken'. This includes modifications arising through the iterative design process. These measures will be secured through the consent itself through the description of the project and the parameters secured in the DCO and/or marine licences. For example, a reduction in footprint or height.
  - Tertiary (inexorable) mitigation. IEMA describes these as '*actions that would occur with or without input from the EIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects*'. It may be helpful to secure such measures through a Code of Construction Practice or similar.
- Secondary (foreseeable) mitigation. IEMA describes these as '*actions that will require further activity in order to achieve the anticipated outcome'*. These include measures required to reduce the significance of environmental effects (such as lighting limits) and may be secured through environmental management plans.

1.8.1.2 In addition, where relevant, measures have been identified that may result in enhancement of environmental conditions. Such measures are clearly identified within Volume 1, Annex 5.3: Commitments Register of the ES. The measures relevant to this chapter are summarised in **Table 1.10**.

1.8.1.3 Embedded measures that will form part of the final design (and/or are established legislative requirements/good practice) have been taken into account as part of the initial assessment presented in **section 1.11** below (i.e., the initial determination of impact magnitude and significance of effects assumes implementation of these measures). This ensures that the measures to which the Applicants are committed are taken into account in the assessment of effects.

1.8.1.4 Where an assessment identifies likely significant adverse effects, further or secondary mitigation measures may be applied. These are measures that could further prevent, reduce and, where possible, offset these effects. They are defined by IEMA as actions that will require further activity in order to achieve the anticipated outcome and may be imposed as part of the planning consent, or through inclusion in the ES (referred to as secondary mitigation measures in IEMA (2016) guidance). For further or secondary measures both pre-mitigation and residual effects are presented.

Table 1.10: Measures (Commitments) adopted as part of the Transmission Assets

Commitment number	Measure adopted	How the measure will be secured
Embedded measures		
CoT11	An Outline Operational Drainage Management Plan for the substation site(s) has been prepared and submitted with the application for development consent. The Plan will include measures to ensure that existing land drainage is reinstated and/or maintained. This will include measures to limit discharge rates and attenuate flows to maintain greenfield runoff rates at the onshore substations. It will also include measures to control surface water runoff, including measures to prevent flooding of the working areas or offsite and to ensure any runoff is treated appropriately. Detailed Operational Drainage Management Plan(s) will be developed in accordance with the Outline Operational Drainage Management Plan and in line with the latest relevant drainage guidance notes in consultation with the Environment Agency and the Lead Local Flood Authority (Lancashire County Council).	DCO Schedules 2A & 2B, Requirement 20 (Outline Operational Drainage Management Plan)
CoT35	An Outline Code of Construction Practice (CoCP) has been prepared and submitted with the application for development consent. Detailed CoCP(s) will be developed in accordance with the Outline CoCP. The Outline CoCP includes measures to maintain and address: - flood protection and control measures; - water environment and drainage; - pollution prevention; - geology and ground conditions; - ecology and nature conservation (including protected species and invasive species); - historic environment; - soil management; - traffic and transport; - noise management measures; - air quality and dust management; - landscape and visual; - recreation; and - bentonite breakout.	DCO Schedules 2A & 2B, Requirement 8 (Code of Construction Practice)

Commitment number	Measure adopted	How the measure will be secured
CoT36	An Onshore Decommissioning Plan will be developed prior to decommissioning. The Onshore Decommissioning Plan(s) will include provisions for the removal of all onshore above ground infrastructure and the decommissioning of below ground infrastructure (if and where relevant and practicable), and details relevant to flood risk, pollution prevention and avoidance of ground disturbance. The Onshore Decommissioning Plan(s) will be in line with the latest relevant available guidance.	DCO Schedules 2A & 2B, Requirement 22 (Onshore decommissioning)
CoT49	Construction Method Statement(s) (CMSs) including Offshore Cable Specification and Installation Plan(s), will be produced and implemented prior to construction. These will contain: - details of cable installation and methodology; and - details of foundation installation methodology covering scour protection and the deposition of material arising from drilling, dredging, and/or sandwave clearance.	DCO Schedule 14 (Marine Licence 1: Morgan Offshore Wind Project Transmission Assets) Part 2 – Condition 18(1)(e) (Pre-construction plans and documentation) and DCO Schedule 15 (Marine Licence 2: Morecambe Offshore Windfarm Transmission Assets), Part 2 - Condition 18(1)(e) (Pre-construction plans and documentation)
CoT71	An Outline Offshore Operation and Maintenance Plan has been prepared and submitted as part of the application for development consent. Detailed Offshore Operation and Maintenance Plan(s) will be produced prior to entering the operation and maintenance phase.	DCO Schedule 14 (Marine Licence 1: Morgan Offshore Wind Project Transmission Assets) Part 2 – Condition 11(3) (Maintenance of the authorised scheme) and DCO Schedule 15 (Marine Licence 2: Morecambe Offshore Windfarm Transmission Assets), Part 2 – Condition 11(3) (Maintenance of the authorised scheme)
Secondary measures		
CoT42	A Greenhouse Gas (GHG) Reduction Strategy has been prepared and submitted with the application for development consent. The GHG Reduction Strategy outlines options to reduce construction-related emissions.	n/a

1.9 Key parameters for assessment

1.9.1 Maximum design scenario

1.9.1.1 The maximum design scenarios identified in **Table 1.11** 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 ES. 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.

1.9.1.2 If the Transmission Assets were to be constructed sequentially or concurrently, it is not anticipated that there would be any additional impacts to those assessed within this ES Chapter. Therefore, the assessment of effects in **section 1.11** using the MDS in **Table 1.11** will be applicable to both the concurrent and sequential construction scenarios.

Table 1.11: Maximum design scenario considered for the assessment of impacts

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
The impact of GHG emissions arising from the manufacturing and installation of the Transmission Assets.	✓	×	×	**Construction phase** • The greatest number of transport vehicles and vessels for the installation of the Transmission Assets (total 12 no. tug/anchor handlers, 48 no. cable lay installation and support vessels, 30 no. guard vessels, 6 no. survey vessels, 20 no. seabed preparation vessels, 148 no. crew transfer vessels, 22 no. cable protection Installation vessels, 20 no. helicopters, 356,408 no. heavy goods vehicles (HGVs), 898,127 no. light vehicles (LVs)). • The greatest area of onshore substations – 223,500 m^2 total permanent footprint (including landscape planting, access, drainage and attenuation), this includes up to 28 buildings. Largest building up to 80 m in width, 140 m in length. • The maximum area of cable route (484 km x 350 mm offshore export cables (6 no.), 306 km x 300 mm onshore export cables (18 no.), 156 km x 300 mm 400 kV grid connection cable (12 no.)). • The maximum volume of cable protection (596,540 m^3). • The maximum area of joint bays and link boxes (25 m x 10 m x 4 m (170 no.), and 2 m x 5 m x 2 m (170 no.), respectively). • The maximum number of transition joint bays (6 no.). • The maximum area of direct pipe at landfall (1,500 m x 1.27 m maximum pipe diameter x 35 mm x 6 no. pipelines). • The maximum area of direct pipe for the crossing under Blackpool Airport (1,400 m x 1.5 m maximum pipe diameter x 35 mm x 6 no. pipelines). • The maximum area of direct pipe for the Ribble crossing (650 m x 1.57 m maximum pipe diameter x 35 mm x 4 no. pipelines). • The maximum area of Horizontal Directional Drilling (HDD) for the crossing under existing infrastructure and obstacles such as roads, railways and rivers (6,225 m x 0.315 m maximum duct diameter x	The greatest number and size of structures and maximum length of the export cables will result in the greatest consumption of fuel and materials, representing the greatest potential for GHG emissions. Construction duration does not affect the assessment, as this is based on quantities and emissions rather than duration of activities.

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				29 mm x 2 to 6 no. pipelines).	
The impact of GHG emissions arising from the consumption of materials and activities required to facilitate the operation and maintenance of the Transmission Assets.	×	✓	×	**Operation and maintenance phase** • The greatest number of maintenance vehicles and machinery across the lifetime of the Transmission Assets (42 no. per year crew transfer vessels, 3 no. jack-up vessels, 4 no. per year cable repair vessels, 20 no. per year other vessels, 8 no. excavators, 16 no. helicopters, 12 no. per year inspection drones).	The greatest number and size of structures and maximum length of the export cables will result in the greatest consumption of fuel and materials representing the greatest potential for GHG emissions.
The impact of GHG emissions arising from land use change during the construction, operation and maintenance and decommissioning phases.	✓	✓	✓	**Construction, operation and maintenance and decommissioning phases** • The greatest permanent footprint of the onshore substations is 223,500 m^2 (including landscaping, planting and drainage). This includes up to 28 buildings. Largest building up to 80 m in width, 140 m in length. • The maximum area of cable route (484 km x 350 mm offshore export cables (6 no.), 306 km x 300 mm onshore export cables (18 no.), 156 km x 300 mm 400 kV grid connection cable (12 no.)). • The maximum volume of cable protection (596,540 m^3). • The maximum area of joint bays and link boxes (25 m x 10 m x 4 m (170 no.), and 2 m x 5 m x 2 m (170 no.), respectively). • The maximum number of transition joint bays (6 no.). • The maximum area of direct pipe at landfall (1,500 m x 1.27 m maximum pipe diameter x 35 mm x 6 no. pipelines). • The maximum area of direct pipe for the crossing under Blackpool Airport (1,400 m x 1.5 m maximum pipe diameter x 35 mm x 6 no. pipelines). • The maximum area of direct pipe for the Ribble crossing (650 m x 1.57 m maximum pipe diameter x 35 mm x 4 no. pipelines). • The maximum area of HDD for the crossing under existing	GHG emissions arising from land use change during the construction, operation and maintenance and decommissioning phases will be considered as part of the overall GHG impact of the Transmission Assets. Construction duration does not affect the assessment, as this is based on quantities and emissions rather than duration of activities.

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				infrastructure and obstacles such as roads, railways and rivers (6,225 m x 0.315 m maximum duct diameter x 29 mm x 2 to 6 no. pipelines).	
The impact of GHG emissions arising from decommissioning works (e.g., plant, fuel and vessel use) and the recovery (or disposal) of materials.	×	×	✓	**Decommissioning phase** • Greatest number of transport vehicles and vessels for the installation of the Transmission Assets – the decommissioning sequence will generally be the reverse of the construction sequence and will involve similar types and numbers of vessels and equipment (total 12 no. tug/anchor handlers, 46 no. cable lay installation and support vessels, 30 no. guard vessels, 6 no. survey vessels, 20 no. seabed preparation vessels, 148 no. crew transfer vessels, 22 no. cable protection Installation vessels, 20 no. helicopters, 356,408 no. HGVs, 898,127 no. LVs). • The greatest area of onshore substations is 223,500 m^2 including landscaping, planting and drainage). This includes up to 28 buildings. Largest building up to 80 m in width, 140 m in length. • The maximum area of cable route (484 km x 350 mm offshore export cables (6 no.), 306 km x 300 mm onshore export cables (18 no.), 156 km x 300 mm 400 kV grid connection cable (12 no.)). • The maximum volume of cable protection (596,540 m^3). • The maximum area of joint bays and link boxes (25 m x 10 m x 4 m (170 no.), and 2 m x 5 m x 2 m (170 no.), respectively). • The maximum number of transition joint bays (6 no.). • The maximum area of direct pipe at landfall (1,500 m x 1.27 m maximum pipe diameter x 35 mm x 6 no. pipelines). • The maximum area of direct pipe for the crossing under Blackpool Airport (1,400 m x 1.5 m maximum pipe diameter x 35 mm x 6 no. pipelines). • The maximum area of direct pipe for the Ribble crossing (650 m x 1.57 m maximum pipe diameter x 35 mm x 4 no. pipelines). • The maximum area of HDD for the crossing under existing	GHG emissions arising from decommissioning works (e.g., plant, fuel and vessel use) and the recovery (or disposal) of materials would contribute to the lifecycle total and net GHG balance of the Transmission Assets.

Impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				infrastructure and obstacles such as roads, railways and rivers (6,225 m x 0.315 m maximum duct diameter x 29 mm x 2 to 6 no. pipelines).	
The impact of climate change on the Transmission Assets	×	✓	✓	**Operation and maintenance phase** • 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 operation and maintenance activities. **Decommissioning phase** • Consistently heightened wave heights, increased wind speeds and increased frequency of extreme events such as floods and storms may lead to heightened risk to teams involved in decommissioning activities.	Onshore elements of the Transmission Assets will include industrial type buildings (such as the onshore substations), containing electrical equipment (largely self-operating) and buried cabling which are in a low-risk category with no vulnerable site users. The main climate risk to the onshore elements of the Transmission Assets is flooding, which will be assessed including appropriate allowances for changes in rainfall intensity and coastal change due to climate change in Volume 3, Chapter 2: Hydrology and flood risk of the ES. The main non-flooding risk would be increased cooling demand for the equipment because of climate change including global temperature increases and increased risk of heatwave (MOHC, 2018a). Regarding the offshore elements of the Transmission Assets, there is anticipated to be no risk to the buried cabling.

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

1.10 Assessment methodology

1.10.1 Overview

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

- IEMA Guidance on Climate Change Adaptation and Resilience (IEMA, 2020); and
- IEMA Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (IEMA, 2022).

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

- local planning policies;
- national climate change policies; and
- international climate change legislation and policy.

1.10.1.3 In order to undertake a climate change impact assessment, information gathered in Volume 4, Annex 1.1: Greenhouse gas assessment of the ES and Annex 1.2: Climate change risk assessment of the ES has been utilised. This information is sourced from primary calculations and secondary sources to calculate the effect of the Transmission Assets on and from climate change.

1.10.1.4 The approach to determining the significance of effects is a two-stage process that involves defining the magnitude of the impact and the sensitivity of the receptor. This section describes the criteria applied in this chapter to assign values to the magnitude of impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on relevant guidance, including the Design Manual for Roads and Bridges (DMRB) methodology (Highways England *et al.,* 2020) where appropriate as described in further detail in Volume 1, Chapter 5: Environmental assessment methodology of the ES.

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

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

1.10.1.6 The assessment methodology for each of these categories is set out below, with the impact assessment criteria for the effect of the Transmission Assets on climate change defined at **paragraphs 1.10.2.1** to **1.10.2.15**, and the assessment criteria for the effect from climatic changes on the Transmission Assets at **paragraphs 1.10.3.1** to **1.10.3.7**.

1.10.1.7 The assessment of in-combination climate impacts applies the significance criteria developed by the relevant environmental topics, as detailed within each technical chapter of the ES. A reasoned judgement is taken regarding change to the sensitivity of receptors and magnitude of effect. This is set out in **section 1.10.4.**

1.10.2 GHG emissions assessment methodology

1.10.2.1 GHG emissions have been estimated by applying published factors (**paragraph 1.10.2.2**) to activities in the baseline and to those required for the Transmission 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_2-equivalent global warming potential (GWP). This is denoted by CO_2e units in emissions factors and calculation results. GWPs used are typically the 100-year factors in the IPCC Fifth Assessment Report (IPCC, 2013) or as otherwise defined for national reporting under the United Nations Framework Convention on Climate Change (UNFCCC).

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

- Inventory of Carbon and Energy database (Jones and Hammond, 2019);
- UK Government GHG Conversion Factors for Company Reporting (DESNZ and Defra, 2024); and
- the Greenhouse Gas Protocol suite of documents (WRI and WBCSD, 2004).

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

- scope 1 emissions: direct GHG emissions from sources owned or controlled by the company (e.g., from combustion of fuel at an installation);
- scope 2 emissions: caused indirectly by consumption of purchased energy (e.g., from generating electricity supplied through the UK Grid to an installation); and
- 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).

1.10.2.4 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 Transmission Assets. These emissions are not separated out by defined scopes (scopes 1, 2 or 3) in the assessment.

1.10.2.5 The assessment has considered the GHG emissions arising from the Transmission Assets. Emissions resulting from the manufacturing and construction of the Transmission Assets (including the onshore substations, cabling etc) have been calculated via published benchmark carbon intensities and published life-cycle assessment (LCA) literature regarding substation technology.

1.10.2.6 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 Transmission Assets have been evaluated where possible when determining the significance of effects.

Receptor sensitivity/value

1.10.2.7 GHG emissions have a global impact 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), as defined within IEMA's guide to 'Assessing Greenhouse Gas Emissions and Evaluating their Significance' (IEMA, 2022).

Magnitude of impact

1.10.2.8 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. Therefore, the magnitude of impact is reported numerically. Where a quantifiable figure is not possible this is expressed qualitatively.

Significance of effect

1.10.2.9 The significance of the effect upon climate change has been determined by taking into account the sensitivity of the receptor and the magnitude of the impact.

1.10.2.10 In all cases, the evaluation of receptor sensitivity, impact magnitude and significance of effect has been informed by professional judgement and is underpinned by narrative to explain the conclusions reached.

1.10.2.11 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.

1.10.2.12 Taking the guidance into account, the following have been considered in contextualising the Transmission Assets' emissions:

- The magnitude of net GHG emissions as a percentage of national and local carbon budgets (where feasible).
- Whether the Transmission Assets contribute to, and are 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 to the Paris Agreement (BEIS, 2022b)).

1.10.2.13 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).

- Major adverse: 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: 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: impacts would be reduced through measures that go well beyond existing and emerging policy requirements and good practice design standards for projects of this type.
- Negligible: 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: impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline.

1.10.2.14 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.

1.10.2.15 GHG emissions associated with a project are often reported as a whole life figure (net emissions) that takes account of all life stages. The net whole life figure is the key element for determining the Transmission Assets' whole life impact on climate change. In addition, it is key to determining its impact within the context of the Generation Assets during their operational phase, allowing the consideration of avoided emissions that the Transmission Assets enable (avoided emissions refer to those emissions that have been 'avoided' by using a specific product or service, compared to a scenario where the product or service had not been used).

1.10.2.16 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 a project, alongside the sections that assess construction, operation and maintenance, and decommissioning effects in isolation. As such, this chapter details the assessment of effects from the construction, operation and maintenance, and decommissioning phases individually, before assessing the net whole life GHG emissions (both from the Transmission Assets alone (**section 1.11.5**), and alongside the Generation Assets within the assessment of cumulative effects (**section 1.13**)).

1.10.3 Climate change risk assessment methodology

1.10.3.1 Potential climatic conditions during the 2040 to 2069 and 2070 to 2099 time periods for the onshore elements of the Transmission Assets have been considered based on the MOHC UKCP18 probabilistic projections (MOHC, 2023). Projections for the global emissions RCP 8.5 have been used as a worst case approach, as this is a high emissions scenario assuming 'business as usual' growth globally with little additional mitigation to combat climate change. Baseline offshore climatic conditions have been sourced from observational data collated within the UK Offshore Energy Strategic Environmental Assessment (BEIS, 2022a) and IPCC Sixth Assessment Reporting of the physical science (IPCC, 2021).

1.10.3.2 Further detail of the approach and data input is given in Volume 4, Annex 1.2: Climate change risk assessment of the ES.

1.10.3.3 An initial screening exercise has been undertaken, which has identified the relevant climate change risks on the Transmission Assets. A high level assessment of such risks has been undertaken, considering the hazard, potential severity of impact on the Transmission Assets and its users, probability of that impact, and level of influence the design can have on the risk.

Impact assessment criteria

1.10.3.4 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'*.

1.10.3.5 The CCRA differs from many other EIA topics in that it considers how the resilience of a development is affected by an external factor (climate change) and not specifically how potential environmental receptors are affected by a development's impacts. Consequentially, the CCRA cannot 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.

1.10.3.6 As set out in the CCRA (Volume 4, Annex 1.2 of the ES), a risk assessment has been undertaken, considering the hazard, potential severity of impact on

the Transmission Assets (including their sensitivity and vulnerability), probability of that impact, and level of influence the Transmission 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 significant adverse or beneficial effect in EIA terms. By considering measures adopted as part of the Transmission Assets, professional judgement has been used in determining whether impacts are likely to result in significant adverse or beneficial effects.

1.10.3.7 The criteria for defining severity, probability and influence in this chapter are outlined in **Table 1.12** below.

Table 1.12: 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 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.

1.10.4 In-combination climate impact assessment methodology

1.10.4.1 IEMA guidance (2020) defines an in-combination climate impact as *'when a projected future climate impact (e.g., increase in temperatures) interacts with an effect identified by another topic and exacerbates its impact'*.

1.10.4.2 The in-combination climate impact assessment has been informed by the potential climatic conditions during the 2040 to 2069 and 2070 to 2099 time periods for the onshore elements of the Transmission Assets based on the MOHC UKCP18 probabilistic projections (MOHC, 2023), consistent with **paragraph 1.10.3.1**. Projections for the global emissions RCP 8.5 have been used as a worst case approach, as this is a high-emissions scenario assuming 'business as usual' growth globally with little additional mitigation to combat climate change. Baseline offshore climatic conditions have been

sourced from observational data collated within the UK Offshore Energy Strategic Environmental Assessment (BEIS, 2022a) and IPCC Sixth Assessment Reporting of the physical science (IPCC, 2021).

1.10.4.3 An initial screening exercise for each environmental topic has been undertaken which identifies impacts reported within the technical chapters making up the ES and considers whether projected climate conditions will alter the sensitivity of receptors or magnitude of impact resulting in a change in significance. The significance of any effect has been re-assessed using the standard methodologies for each relevant environment topic.

1.10.4.4 Consideration has also been given to whether any new effects will arise as a result of the Transmission Assets under future projected climate conditions.

1.10.4.5 The assessment of in-combination climate impacts has considered the measures adopted as part of the Transmission Assets (embedded mitigation) in determining whether projected climate change affects effects on sensitive receptors. Should an effect remain significant following the above-described assessment of in-combination climate impacts, further (secondary) mitigation has been presented where relevant.

Impact assessment criteria

1.10.4.6 The in-combination climate impact assessment applies the significance criteria developed by the relevant environmental topics and detailed within each technical chapter of the ES.

1.10.5 Assumptions and limitations of the assessment

1.10.5.1 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 they occur) 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 Transmission Assets.

1.10.5.2 Additionally, due to the early stage in the development design, the design of the Transmission Assets has not yet been fully specified. Thus, there is a degree of uncertainty regarding the construction stage GHG emissions resulting from the manufacturing and construction of the Transmission Assets. The assessment has sought to limit the impact this may have by assessing a maximum design scenario (which will result in a conservative or worst case assessment).

1.10.5.3 Detailed LCA information is not yet available for all items specific to electricity transmission infrastructure. As such, where not available, a conservative estimate of construction materials or fuels has been scaled by relevant emissions factors. Where used to calculate the embodied carbon associated with materials, emissions factors do not account for emissions associated

with the manufacture of products, and as such may underestimate embodied carbon emissions.

1.10.5.4 When assessing climate risks, uncertainty arises from both modelling uncertainty and natural variability in the potential magnitude of future changes in climate. Therefore, a high magnitude of change scenario and the high end of probabilistic projections have been used, to provide a precautionary worst case approach. This is further discussed in Volume 4, Annex 1.2: Climate change risk assessment of the ES.

1.10.5.5 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 assessment of the effects of the Transmission Assets.

1.11 Assessment of effects

1.11.1 Introduction

1.11.1.1 The impacts arising from of the construction, operation and maintenance, and decommissioning phases of the Transmission Assets are listed in **Table 1.11**, along with the maximum design scenario against which each impact has been assessed.

1.11.1.2 A description of the likely effect on receptors caused by each identified impact is given below.

1.11.1.3 The assessment of effects relating to climate change is divided into the effects of GHG emissions on climate change and the effects of climate change risk.

1.11.2 GHG emissions

1.11.2.1 As set out in **paragraph 1.11.1** and Volume 4, Annex 1.1: Greenhouse gas assessment of the ES, the LCA of embodied carbon is divided into three stages.

Construction phase

1.11.2.2 This section considers the embodied carbon emissions associated with the consumption of materials and fuel required to construct the Transmission Assets (onshore and offshore elements). This has included consideration of the maximum length of the onshore and offshore cables, and maximum size for the onshore substations representing the greatest potential for GHG emissions from the construction and installation of the Transmission Assets as a conservative estimate of impact. The following items are considered within this assessment:

- offshore export cables (including cable protection);
- helicopter and vessel movements;

- landfall (trenchless installation and transition joint bays);
- onshore export cables (including joint bays, link boxes, crossings and trenchless techniques, works between the transition joint bays within Blackpool Airport to Queensway (B5261));
- onshore substations;
- 400 kV grid connection cables (including joint bays, link boxes, crossings and trenchless techniques, River Ribble Crossing); and
- onshore vehicles movements.

1.11.2.3 A combined approach has been undertaken to calculate embodied carbon, informed in part by LCA data but also by relevant emissions factors scaled by conservative estimates of construction materials or fuels.

1.11.2.4 The potential impact of the onshore substations has been estimated using an intensity for the manufacturing GWP of 2,190 $kgCO_2e$ per MW (ABB, 2003). This was scaled by the nominal capacities for the Generation Assets, totalling approximately 1,980 MW, to give an estimated embodied carbon value of 4,336 tCO_2e. It has been assumed that this intensity accounts for all onshore substation elements.

1.11.2.5 At this stage of design, material estimates have some uncertainty in terms of their quantities and specific products to be used in the final design. As such, a published benchmark (Royal Institute of Chartered Surveyors (RICS), 2012) has also been used to estimate emissions associated with the onshore substation buildings.

1.11.2.6 The benchmark data is expressed in $kgCO_2e/m^2$ of floorspace as an intensity, which was scaled by the total floor area for all onshore substation buildings. Since PEIR, the assumed building floor area has been refined resulting in a smaller footprint. When using the RICS (2012) intensity for other industrial/utilities/specialist uses, this results in estimated embodied carbon emissions of 16,732 tCO_2e for the onshore substations.

1.11.2.7 Material quantities associated with the offshore export cables, onshore export cables and 400 kV grid connection cables have been scaled by the relevant materials emissions factor as reported within the Inventory of Carbon and Energy database (Jones and Hammond, 2019). Material quantities of copper and lead for cables associated with the onshore export cable corridor and 400kV grid connection cable corridor were estimated based on the total length of each cable. Lead and copper emissions factors were then scaled by the calculated material quantities to give an estimated embodied carbon value of 60,012 tCO_2e. Emissions associated with onshore export cable and 400 kV grid connection cable ducts were estimated based on the duct dimensions and scaled by the relevant material intensity factor (Jones and Hammond, 2019). Total emissions were estimated at 9,061 tCO_2e.

1.11.2.8 Material quantities associated with the offshore export cable protection were scaled by the relevant material intensity factor (Jones and Hammond, 2019). Total emissions were estimated at 11,808 tCO_2e.

1.11.2.9 Material quantities associated with the construction of joint bays, transition joint bays and link boxes were estimated based their dimensions and scaled

by the relevant material intensity factor (Jones and Hammond, 2019). Total emissions were estimated at 4,185 tCO_2e.

1.11.2.10 Material quantities associated with the trenchless cable installation at landfall, Blackpool Airport crossing, Ribble crossing, and additional onshore cable crossings associated with crossing existing roads, railways and rivers, were estimated based on the pipeline dimensions and scaled by the relevant material intensity factor (Jones and Hammond, 2019). Total emissions were estimated at 72,495 tCO_2e.

1.11.2.11 Emissions associated with fuel combustion from vessel, helicopter, heavy and light goods vehicle movements 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 51,318 tCO_2e during the construction phase.

1.11.2.12 Embodied carbon associated with the material consumption for the construction of the haul roads has not been assessed quantitatively. It is anticipated that the haul roads will use recycled materials, such as recycled aggregates, and will be decommissioned at the end of the construction phase with materials recycled. As such, resultant emissions are likely to be negligible and immaterial and have not been assessed further.

1.11.2.13 The estimated GHG emissions arising from the consumption of materials to construct the Transmission Assets are presented in **Table 1.13**.

Table 1.13: Estimated construction stage Transmission Assets GHG emissions

LCA Stage	Item	Transmission Assets emissions (tCO_2e)
A1-A5	Offshore export cables	30,704
	Offshore export cable protection	11,808
	Landfall (trenchless installation)	26,501
	Onshore substation plant	4,336
	Onshore substation housing buildings	16,732
	Onshore export cable corridor (incl. the associated cable ducting, cable crossings, joint bays, and link boxes)	63,005
	400 kV grid connection cable corridor (incl. the associated cable ducting, cable crossings, joint bays, and link boxes)	24,593
	Transition joint bays	949
	Helicopter movements	16
	Vessel movements	6,006
	Traffic movements	45,296
	Total	**229,947**

Sensitivity of the receptor

1.11.2.14 In accordance with **paragraph 1.10.2.7**, the receptor (global climate) is considered to be of high sensitivity, as it is highly vulnerable, of low recoverability and high value.

Magnitude of impact

1.11.2.15 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 indirectly. The magnitude is therefore, considered to be 229,947 tCO_2e for the construction period.

Significance of the effect

1.11.2.16 Overall, the sensitivity of the receptor is considered to be **high** and the magnitude of the impact is assessed as **229,947 tCO_2e**. The effect will, therefore, be **moderate adverse**, which is significant. As set out in **section 1.1**, this assessment relates to the Transmission Assets alone as the Generation Assets will be consented separately. However, given their purpose, the Transmission Assets would never operate in isolation. As such, the cumulative impacts of the Transmission Assets with the Generation Assets have been assessed and are presented in **section 1.13**.

Further mitigation and residual effect

1.11.2.17 A moderate adverse effect is predicted for GHG emissions produced as a result of construction activity associated with the Transmission Assets. This is significant in EIA terms. In order to mitigate this effect, the Applicants are committed to exploring options to reduce construction-related emissions. A Greenhouse Gas (GHG) Reduction Strategy has been prepared and submitted with the application for development consent (document reference J4). The GHG Reduction Strategy outlines options to reduce construction-related emissions (CoT42 within **Table 1.10**).

1.11.2.18 With these commitments to look at opportunities to reduce construction-related emissions, the impact magnitude is predicted to reduce, and the residual effect is likely to be **minor adverse**, which is not significant in EIA terms.

Operation and maintenance phase

1.11.2.19 Emissions during the operation and maintenance phase of the Transmission Assets refer to activities contributing to maintenance of the assets. Maintenance can be divided into preventative maintenance and corrective maintenance, and are fully detailed in Volume 1, Chapter 3: Project description of the ES.

- Preventative maintenance includes the proactive repair to, or replacement of, known wear components based on routine inspections or monitoring systems.

- Corrective maintenance includes the reactive repair or replacement of failed or damaged components.

1.11.2.20 The maintenance activities for the Transmission Assets largely involve inspection, remote monitoring, repainting, removal of marine growth, reburial of cables and geophysical surveys. Emissions associated with such activities are negligible and immaterial and, as such, have not been assessed further.

1.11.2.21 Emissions associated with the operational vessel and helicopter movements have been captured, alongside emissions associated with the embodied carbon of cables, and onshore substation material replacements over the Transmission Assets' assumed 35-year lifetime. Conservative assumptions for material replacement rates have been used to provide a maximum design scenario. The methodology to calculate emissions associated with such maintenance activities follows the methodology set out in **paragraphs 1.11.2.2 to 1.11.2.12**.

1.11.2.22 The estimated GHG emissions arising from the consumption of materials and activities required to facilitate the operation and maintenance of the Transmission Assets are presented in **Table 1.14**.

Table 1.14: Estimated operation and maintenance stage GHG emissions

LCA Stage	Item	Transmission Assets emissions (tCO_2e)
B1-B5	Export cable replacement	7,283
	Vessel movements	69,117
	Helicopter movements	456
	Total	**76,856**

Sensitivity of the receptor

1.11.2.23 In accordance with **paragraph 1.10.2.7**, the receptor (global climate) is considered to be of high sensitivity, as it is highly vulnerable, of low recoverability and high value.

Magnitude of impact

1.11.2.24 The impact is predicted to be of international spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is considered to be 76,856 tCO_2e**.**

Significance of the effect

1.11.2.25 Overall, the sensitivity of the receptor is considered to be **high** and the magnitude of the impact is assessed as **76,856 tCO_2e**. The effect will, therefore, be of **minor adverse**, which is not significant in EIA terms. As set out in **section 1.1**, this assessment relates to the Transmission Assets alone as the Generation Assets will be consented separately. However, given their purpose, the Transmission Assets would never operate in isolation. As such,

the cumulative impacts of the Transmission Assets with the Generation Assets have been assessed and are presented in **section 1.13**.

Decommissioning phase

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

1.11.2.27 It is anticipated that the offshore and onshore export cables will be left *in situ* or removed via joint bays. No new excavation is anticipated. The remaining elements will be dismantled and removed for recycling and disposal if it is feasible with minimal environmental disturbance. The components of the onshore substations are considered to be highly recyclable. When disposing of such elements, recycling is the preferred solution. This not only prevents the materials from being sent to landfill, but also reduces the need for the extraction of primary materials. Material which cannot be recycled might be incinerated or used to produce energy from waste. 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.

1.11.2.28 Carbon emissions associated with use of plant and fuel is expected to have achieved good levels of decarbonisation at the decommissioning phase of the Transmission Assets. As such, the below quantified emissions are anticipated to be a worst case estimate.

1.11.2.29 The estimated GHG emissions arising from the consumption of fuel required to facilitate the decommissioning of the Transmission Assets are presented in **Table 1.15**. As comprehensive transport movements and plant use are not yet available for the decommissioning phase, movements associated with the construction phase have been applied to provide a conservative estimate of decommissioning activities.

1.11.2.30 Further detailed consideration can be found in Volume 4, Annex 1.1: Greenhouse gas assessment of the ES.

Table 1.15: Estimated decommissioning stage GHG emissions

LCA Stage	Item	Transmission Assets emissions (tCO_2e)
C1-C4	Vessel and traffic movements	51,318
Total		**51,318**

Sensitivity of the receptor

1.11.2.31 In accordance with **paragraph 1.10.2.7**, the receptor (global climate) is considered to be of high sensitivity, as it is highly vulnerable, of low recoverability and high value.

Magnitude of impact

1.11.2.1 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 indirectly. The magnitude is therefore, assessed to be 51,318 tCO_2e.

Significance of the effect

1.11.2.2 Overall, the sensitivity of the receptor is considered to be **high** and the magnitude of the impact is assessed to be **51,318 tCO_2e**. The effect will, therefore, be of **minor adverse** effect, which is not significant in EIA terms. As set out in **section 1.1**, this assessment relates to the Transmission Assets alone as the Generation Assets will be consented separately. However, given their purpose, the Transmission Assets would never operate in isolation. As such, the cumulative impacts of the Transmission Assets with the Generation Assets have been assessed and are presented in **section 1.13**.

1.11.3 GHG emissions arising from land use change

Construction, operation and maintenance, and decommissioning phases

Sensitivity of the receptor

1.11.3.1 In accordance with **paragraph 1.10.2.7**, the receptor (global climate) is considered to be of high sensitivity, as it is highly vulnerable, of low recoverability and high value.

Magnitude of impact

1.11.3.2 Onshore and offshore habitat and land use within the Transmission Assets Onshore Infrastructure Area, Intertidal Infrastructure Area and Offshore Permanent Infrastructure Area would be impacted for the duration of construction (excavation for foundations, buildings, construction of access roads, installation of onshore and offshore cables and construction compounds) and in some cases operation and maintenance phase primarily for onshore substations. Further detail is provided within Volume 4, Annex 1.1: Greenhouse gas assessment of the ES.

1.11.3.3 However, through the onshore land restoration works to be undertaken following the completion of the onshore export cable and 400 kV grid connection cable installation, and the decommissioning process, it is anticipated that the existing onshore baseline environment, which is not currently believed to be a significant carbon store, would be restored.

1.11.3.4 Similarly, while the decommissioning process offshore may result in all offshore cables and any offshore cable protection left *in situ* (preferred option), or there may be a scenario where they might be retrieved, given no carbon stores are directly affected by the Transmission Assets, the change concerning carbon storage value would be minimal.

1.11.3.5 As such, the magnitude of change in a tCO_2e owing to land use and sea bed change across the whole life of the Transmission Assets is considered to be **negligible**.

Significance of the effect

1.11.3.6 Overall, the sensitivity of the receptor is **high** and the magnitude of the impact is **negligible**. The effect will, therefore, be **negligible**, which is not significant.

1.11.4 Climate change risk

1.11.4.1 The risks identified in Volume 4, Annex 1.2: Climate change risk assessment of the ES, are summarised in this section in relating to their impact upon the operation and maintenance and decommissioning phases of the Transmission Assets, in accordance with the following assessment criteria (as detailed in **Table 1.12**):

- severity of the impacts;
- probability of the potential impacts; and
- influence factor.

1.11.4.2 Consistently heightened temperatures, changes to rainfall patterns, 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 operation and maintenance activities. It is noted, however, that onshore substations include built-in safety measures, including monitoring, to prevent this happening and therefore the likelihood is very low.

1.11.4.3 Volume 4, Annex 1.2: Climate change risk assessment of the ES details the potential climatic changes in the coming decades and considers the potential consequences for the Transmission Assets in a risk assessment format. The most significant risk from climate change to the Transmission Assets is likely to arise from flooding. This is assessed separately in detail in Volume 3, Chapter 2: Hydrology and flood risk of the ES and appropriate flood management and resilience measures have been taken into account. No further consideration is presented in this assessment.

1.11.4.4 The risk assessment in Volume 4, Annex 1.2: Climate change risk assessment of the ES considers in its scoring the level of influence the design of the operation and maintenance and decommissioning activities can have upon the remaining risks, in addition to its severity and probability. Those risks over which the Applicants have little or no influence are therefore not typically likely to result in significant effects, save where the severity and/or probability are highest.

Operation and maintenance phase

1.11.4.5 With the exception of flood risk, the greatest risks to the operation of onshore elements of the Transmission Assets due to climate change have been identified as those arising from high temperatures affecting operational

equipment and storms affecting power transmission or building/structure damage.

1.11.4.6 The greatest risks to the operation of offshore elements of the Transmission Assets due to climate change have been identified as those arising from high temperatures and ocean acidification affecting operational equipment (i.e., submerged export cables).

1.11.4.7 When accounting for measures adopted as part of the Transmission Assets (embedded mitigation, see **Table 1.10**) in determining the significance of each identified risk, the CCRA concluded that the effect of climate change on the operation and maintenance of the Transmission Assets is **negligible** with no risk score exceeding 4, which is not significant in EIA terms.

Decommissioning phase

1.11.4.8 There are a few risks identified as being associated with the decommissioning of the onshore elements of the Transmission Assets. These are largely associated with increased temperatures and severity of storm events impacting worker safety during decommissioning activities.

1.11.4.9 No risks have been identified associated with the decommissioning of the offshore elements of the Transmission Assets, given all offshore export cables will be left *in situ* at decommissioning. Therefore, there are not anticipated to be any offshore decommissioning works associated with the Transmission Assets.

1.11.4.10 When accounting for measures adopted as part of the Transmission Assets (embedded mitigation) in determining the significance of each identified risk, the CCRA concluded that the effect of climate change on the decommissioning of the Transmission Assets is **negligible** with no risk score exceeding 4, which is not significant in EIA terms.

1.11.5 Net whole life GHG emissions and context

1.11.5.1 As set out in **paragraph 1.10.2.15**, consideration of the Transmission Assets' whole life impact is an important consideration when assessing the Transmission Assets' impacts and subsequent effects on climate change. As such, this section considers the Transmission Assets' net emissions in the context of existing and emerging policy commitments and UK Carbon budgets.

1.11.5.2 The lifetime GHG emissions arising from the consumption of materials and activities required to facilitate the construction, operation and maintenance and decommissioning of the Transmission Assets are presented in **Table 1.16**.

Table 1.16: Net whole life GHG emissions

LCA Stage	Transmission Assets emissions (tCO_2e)
A1-A5	229,947
B1-B5	76,856
C1-C4	51,318
Total	**358,121**

1.11.5.3 The Transmission Assets' net emissions performance can be considered in the following context:

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

1.11.5.4 The Transmission Assets' net emissions accounting for both construction and operation and maintenance phases up to the end of the Sixth Carbon Budget are detailed in **Table 1.17**.

Table 1.17: GHG impacts in the context of the UK's Carbon Budgets

	2028-2032*	2033-2037	Total
UK Carbon Budget (tCO_2e)	690,000,000	965,000,000	1,655,000,000
Transmission Assets GHG impacts (tCO_2e)	234,339	10,979	245,318

*represent only two years of the budget for 2030-2032 in line with Transmission Assets opening year.

1.11.5.5 When considering the above magnitude of emissions across the whole life cycle of the Transmission Assets and the high sensitivity of the climate as a receptor, the Transmission Assets would have a **minor adverse** net effect which is not be significant in EIA terms.

1.11.5.6 As set out in Volume 1, Chapter 2: Policy and legislation context of the ES, the purpose of the Transmission Assets is to connect the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm to the National Grid, contributing to:

- the UK Government's ambition to deliver 50 GW of offshore wind by 2030;
- delivering much needed investment and securing construction and operations jobs in the UK;
- securing our energy supply; and
- the UK's response to the climate change crisis.

1.11.5.7 Therefore, delivery of the Transmission Assets is in line with the NPS EN-1 principle of supporting new renewable and low carbon energy developments, including their associated infrastructure (i.e., electricity transmission infrastructure such as onshore substations, cabling etc), in order to contribute to reductions in GHG emissions. By facilitating the expansion of renewable energy supply, the Transmission Assets would assist the UK Government

target of achieving a fully decarbonised power system by 2035 and aim to become net zero by 2050. This is fully explored within **section 1.13**, in considering the cumulative effects of the Transmission Assets with the Generation Assets. Further details of the policy context for the Transmission Assets are provided in Volume 1, Chapter 2: Policy and legislation context of the ES.

1.11.6 Future monitoring

1.11.6.1 No monitoring to test the predictions made within the impact assessment is considered necessary.

1.12 Cumulative effect assessment methodology

1.12.1 Introduction

1.12.1.1 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 and upon the development. Consequently, cumulative effects due to other specific local development projects are not considered individually but are taken into account when considering the impact of the Transmission Assets by defining the atmospheric mass of GHGs as a high sensitivity receptor in accordance with IEMA GHG Guidance (IEMA, 2022). The construction, operation and maintenance, and decommissioning phase effects of the assessment of the Transmission Assets takes account of cumulative changes in GHG emissions from other energy generation sources.

1.12.1.2 However, the Transmission Assets form the connection to the onshore transmission network for two offshore wind farms, the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm. The Transmission Assets enable the renewable energy generated by these developments to be transmitted to the UK grid, contributing to national electricity decarbonisation. As such, the cumulative effects of these Generation Assets with the Transmission Assets on the global atmospheric mass of CO_2 have been assessed.

1.12.1.3 The climate change CEA methodology has broadly followed the methodology set out in Volume 1, Chapter 5: Environmental assessment methodology of the ES. The cumulative assessment considers three scenarios.

- Scenario 1: Transmission Assets together with Morecambe Offshore Windfarm: Generation Assets.
- Scenario 2: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets.
- Scenario 3: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets.

1.12.1.4 The projects, plans and activities scoped into the CEA are outlined in **Table 1.18**.

1.12.2 Scope of cumulative effects assessment

1.12.2.1 The impacts identified in **Table 1.19** have been selected as those having the potential to result in the greatest cumulative effect on an identified receptor or receptor group. The cumulative effects presented and assessed in this section have been based on the Project Design Envelope set out in Volume 1, Chapter 3: Project description of the ES as well as the publicly available information on other projects and plans.

Table 1.18: List of other projects, plans and activities considered within the CEA

Project/Plan	Status	Distance from the Transmission Assets (nearest point, km)	Description of project/plan	Earliest anticipated dates of construction (if applicable)	Earliest anticipated dates of operation (if applicable)	Overlap with the Transmission Assets
Morecambe Offshore Windfarm: Generation Assets	Submitted	0 km	Offshore wind farm (generation assets)	2026-2029	2029 with a typical operational project lifetime.	Yes
Morgan Offshore Wind Project: Generation Assets	Submitted	0 km	Offshore wind farm (generation assets)	2026-2030	2030 with a typical operational project lifetime.	Yes

Table 1.19: Scope of assessment of cumulative effects

Cumulative effect	Phase[a]			Project(s) considered	Justification
	C	O	D		
Lifetime emissions resultant from the Generation Assets together with (enabled by) the Transmission Assets	✓	✓	✓	Maximum design scenario as described in **Table 1.11** for the Transmission Assets, assessed cumulatively with the following other projects/plans: • Morgan Offshore Wind Project: Generation Assets; and • Morecambe Offshore Windfarm: Generation Assets.	Outcome of the CEA provides consideration of the combined effects of the Transmission Assets with the Generation Assets.

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

1.13 Cumulative effects assessment

1.13.1 Introduction

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

1.13.1.2 The CEA is presented in a series of tables (one for each potential cumulative impact) considering the following:

- Scenario 1: Transmission Assets together with Morecambe Offshore Windfarm: Generation Assets.
- Scenario 2: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets.
- Scenario 3: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets.

1.13.1.3 It is noted that the purpose of the Transmission Assets is in line with NPS EN-1's principle of supporting new renewable and low carbon energy developments and their infrastructure, in order to contribute to reductions in GHG emissions.

1.13.1.4 The generation of such renewable energy from offshore wind is supported by national energy and climate change policy (including the National Infrastructure Strategy, Sixth Carbon Budget and Net Zero Strategy) which highlights 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 Offshore Wind Project and the Morecambe Offshore Windfarm is necessary in order to meet GHG reduction targets.

1.13.1.5 The Transmission Assets will enable the connection to the UK Grid of a total of 1.98 GW capacity from the Generation Assets, which would contribute 4% of the UK Government's commitment for 50 GW capacity from offshore wind by 2030.

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

1.13.2 Net whole life GHG emissions

1.13.2.1 The Transmission Assets will enable the abatement of fossil fuel generation within the UK Grid, through the transmission of renewable energy generated by the Generation Assets.

1.13.2.2 The climate change assessments included within the relevant ESs for the Generation Assets have quantified their lifetime net emissions (from their construction, operation and maintenance and decommissioning), including all avoided emissions associated with the displacement of marginal electricity

generation sources that would be enabled by the Transmission Assets. This has been used to inform the cumulative assessment detailed within **Table 1.20**.

1.13.2.3 The range of avoided emissions provided is the result of a sensitivity analysis. Avoided emissions for each of the Generation Assets have been calculated using both the DESNZ long run marginal, and 'non-renewable fuels' carbon intensities. It is likely that the true value of avoided emissions displaced as a result of each scenario would lie within the ranges presented.

1.13.2.4 The DESNZ long run marginal carbon intensity figures are dynamic and show year-on-year decarbonisation of the UK Grid towards the UK's committed net zero 2050 pledge. As such, the intensity figures account for the assumed abatement of fossil fuel generation sources and the increasing proportion of grid electricity being procured from renewable generation sources. 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. It should be noted that the long run marginal figures are projections, and cannot be taken with absolute certainty.

1.13.2.5 Therefore, the use of the DESNZ long run marginal intensity figures should be treated with caution, especially given the calculation of operational avoided emissions involves comparing the electricity generated by the Generation Assets (and enabled by the Transmission Assets) to a scenario where renewable generation sources comprise an increasing proportion of the UK Grid and become a business as usual, reflected within the decreasing intensity figures. This calculation of avoided emissions therefore compares alike scenarios which may not present a true 'without development' future baseline, so it can be expected that operational avoided emissions are reduced compared to avoided emissions calculated using the DESNZ 'non-renewable fuels' carbon intensity.

1.13.2.6 Given the uncertainty of the projections, and the comparison of the electricity generated by the Generation Assets with a scenario that relies on the increasing proportion of renewable generators supplying the UK Grid, it is likely that the true value of the avoided emissions displaced (and therefore the beneficial effects) as a result of the Generation Assets' contribution to the UK Grid would be higher than the avoided emissions as calculated using the DESNZ long run marginal carbon intensities.

1.13.2.7 The DESNZ 'non-renewable fuels' carbon intensities conclude a greater level of avoided emissions. However, these are static baselines and do not account for future UK Grid decarbonisation. Nevertheless, the 'non-renewable fuels' represent those fuels that renewable developments such as the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm are directly removing from the UK Grid.

1.13.2.8 It should be noted that the emissions total for the Transmission Assets includes transmission infrastructure and activities that support 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 (i.e. the CEA does not

1.13.2.9 attribute emissions arising solely from the Morecambe Offshore Windfarm: Transmission Assets to Scenario 1, but considers emissions arising from the Transmission Assets as a whole). As such, Scenario 1 and 2 likely present overestimates as they apportion total emissions for the Transmission Assets to the Morecambe Generation Assets, and Morgan Generation Assets, respectively.

1.13.2.10 While each phase is considered separately, 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 353,073 and -34,669,172 tCO_2e
- Scenario 2: between 33,306 and -50,973,394 tCO_2e.
- Scenario 3: between 28,258 and -86,000,687 tCO_2e.

1.13.2.11 As detailed in **paragraphs 1.13.2.3 to 1.13.2.7**, the range in net GHG emissions arises from the calculation of operational avoided emissions using both the DESNZ long run marginal, and 'non-renewable fuels' carbon intensities. Given the nature of the DESNZ long run marginal carbon intensities (i.e. comparing alike scenarios where renewable generation sources become business as usual, and which may not present a true 'without development' future baseline), calculated avoided emissions are naturally lower and do not exceed emissions arising from construction, operation and maintenance, and decommissioning. Furthermore, given the DESNZ long run marginal carbon intensities do not account for emissions arising from the construction, and decommissioning of generation assets, the comparison of whole life GHG emissions arising from a renewable generation project with the long run marginal intensities is unlikely to present avoided emissions or a carbon payback.

1.13.2.12 To provide further context, the following electricity generation carbon intensities have been calculated for each scenario, informed by the relevant operation and maintenance stage emissions and energy generated over the respective whole project's lifetime.

- Scenario 1: 6.91 gCO_2e/kWh
- Scenario 2: 1.42 gCO_2e/kWh
- Scenario 3: 3.31 gCO_2e/kWh

1.13.2.13 These intensities are lower than the current grid average (207 gCO_2e/kWh), fossil fuel generation (437 gCO_2e/kWh) and the Climate Change Committee's electricity emissions intensity targets for 2030 (50 gCO_2e/kWh) and 2035 (10 gCO_2e/kWh), thereby demonstrating that the electricity generated by the Generation Assets enables and aids UK Grid decarbonisation. Given the operation and maintenance emissions reported for each project do not account for the decarbonisation of associated activities (i.e. vessel movements and material replacement) in line with the UK's planned

decarbonisation of the manufacturing and transport sectors, it can be expected that the true carbon intensities will be reduced compared to those reported above. As such, it is likely that the carbon intensity for each cumulative scenario would align with the Climate Change Committee's electricity emissions target of 2 gCO_2e/kWh by 2050.

Table 1.20: Net GHG emissions

	Scenario 1: Transmission Assets together with Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets
Construction phase			
Magnitude of impact	The cumulative effect is predicted to be of international spatial extent, short term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be 1,109,688 tCO_2e.	The cumulative effect is predicted to be of international spatial extent, short term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be 2,157,399 tCO_2e.	The cumulative effect is predicted to be of international spatial extent, short term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be 3,037,140 tCO_2e.
Sensitivity of receptor	The receptor is deemed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.		
Significance of effect	Overall, the magnitude of the cumulative impact is deemed to be 1,109,688 tCO_2e and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **moderate adverse** significance, which is significant in EIA terms.	Overall, the magnitude of the cumulative impact is deemed to be 2,157,399 tCO_2e and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **moderate adverse** significance, which is significant in EIA terms.	Overall, the magnitude of the cumulative impact is deemed to be 3,037,140 tCO_2e and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **moderate adverse** significance, which is significant in EIA terms.
Further mitigation	The Applicants are committed to exploring options to reduce construction related emissions. Areas to be explored 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. • consideration of low carbon criteria within procurement activities, in partnership with the supply chain. This commitment is identified within **Table 1.10**, commitment number CoT42.		
Residual significance	With these commitments to look at opportunities to reduce construction related emissions, the impact magnitude is predicted to reduce, and the residual effect is likely to be	With these commitments to look at opportunities to reduce construction related emissions, the impact magnitude is predicted to reduce, and	With these commitments to look at opportunities to reduce construction related emissions, the impact magnitude is predicted to reduce, and the

	Scenario 1: Transmission Assets together with Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets
	minor adverse, which is not significant in EIA terms.	the residual effect is likely to be **minor adverse**, which is not significant in EIA terms.	residual effect is likely to be **minor adverse**, which is not significant in EIA terms.
Operation and maintenance phase			
Magnitude of impact	The cumulative effect is predicted to be of international spatial extent, long term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be -824,905 to -35,847,150 tCO_2e.	The cumulative effect is predicted to be of international spatial extent, long term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be -2,229,131 to -53,235,831 tCO_2e.	The cumulative effect is predicted to be of international spatial extent, long term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be -3,130,891 to -89,159,836 tCO_2e.
Sensitivity of receptor	The receptor is deemed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.		
Significance of effect	Overall, the magnitude of the cumulative impact is deemed to be -824,905 to -35,847,150 tCO_2e and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be **beneficial**, which is significant in EIA terms.	Overall, the magnitude of the cumulative impact is deemed to be -2,229,131 to -53,235,831 tCO_2e and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be **beneficial**, which is significant in EIA terms.	Overall, the magnitude of the cumulative impact is deemed to be -3,130,891 to -89,159,836 tCO_2e and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be **beneficial**, which is significant in EIA terms.
Further mitigation	n/a	n/a	n/a
Residual significance	n/a	n/a	n/a
Decommissioning phase			
Magnitude of impact	The cumulative effect is predicted to be of international spatial extent, short term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor	The cumulative effect is predicted to be of international spatial extent, short term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor indirectly.	The cumulative effect is predicted to be of international spatial extent, short term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor indirectly.

	Scenario 1: Transmission Assets together with Morecambe Offshore Windfarm: Generation Assets	Scenario 2: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets	Scenario 3: Transmission Assets together with Morgan Offshore Wind Project: Generation Assets and Morecambe Offshore Windfarm: Generation Assets
	indirectly. The magnitude is therefore, considered to be 68,290 tCO_2e.	The magnitude is therefore, considered to be 105,037 tCO_2e.	The magnitude is therefore, considered to be 122,009tCO_2e.
Sensitivity of receptor	The receptor is deemed to be of high vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be high.		
Significance of effect	Overall, the magnitude of the cumulative impact is deemed to be 68,290 tCO_2e and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	Overall, the magnitude of the cumulative impact is deemed to be 105,037 tCO_2e and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.	Overall, the magnitude of the cumulative impact is deemed to be 122,009 tCO_2e and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.
Further mitigation	n/a	n/a	n/a
Residual significance	n/a	n/a	n/a

Sensitivity of the receptor

1.13.2.14 In accordance with **paragraph 1.10.2.7**, the receptor (global climate) is considered to be of high sensitivity, as it is highly vulnerable, of low recoverability and high value.

Magnitude of impact

1.13.2.15 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 353,073 and -34,669,172 tCO_2e
- Scenario 2: between 33,306 and -50,973,394 tCO_2e.
- Scenario 3: between 28,258 and -86,000,687 tCO_2e.

1.13.2.16 The magnitude of calculated avoided emissions over the lifetime of the Generation Assets using the DESNZ 'non-renewable fuels' carbon intensities, as reported within each climate change assessment, results in significant avoided emissions. As such, it can be seen that the emissions associated with the construction, operation and maintenance, and decommissioning of the Transmission Assets are far exceeded by the avoided emissions from the Generation Assets they enable.

1.13.2.17 When using the DESNZ long run marginal carbon intensities, avoided emissions are not reported. However, as detailed in **paragraphs 1.13.2.3** to **1.13.2.7**, given the nature of the DESNZ long run marginal intensities (i.e. comparing alike scenarios where renewable generation sources become business as usual, and which may not present a true 'without development' future baseline) avoided emissions during operation are expected to be lower, and therefore would not exceed lifetime emissions from each scenario.

1.13.2.18 When considering the electricity generation carbon intensity of each scenario (**paragraph 1.13.2.12**), each is lower than the current grid average and fossil fuel generation intensities, and would exceed the Climate Change Committee's electricity emissions intensity targets for 2030 and 2035, thereby demonstrating that the Generation Assets and Transmission Assets would enable and aid the decarbonisation of the UK Grid.

1.13.2.19 Furthermore, the Transmission Assets will enable the connection to the UK Grid of a total of 1.98 GW capacity from the Generation Assets, which would contribute 4% of the UK Government's commitment for 50 GW capacity from offshore wind by 2030. By facilitating the expansion of renewable energy supply, the Transmission Assets would assist the UK Government target of achieving a fully decarbonised power system by 2035 and aim to become net zero by 2050.

Significance of effect

1.13.2.20 The Transmission Assets will enable the abatement of fossil fuel generation within the UK Grid, through the transmission of renewable energy generated by the Generation Assets.

1.13.2.21 Overall, the combined magnitude of impact has been assessed quantitatively, accounting for the net emissions associated with the Transmission Assets, in addition to the avoided emissions resulting from the Generation Assets, alongside associated generation emission intensities.

1.13.2.22 The total effect will, therefore, be a **beneficial** effect, which is **significant** in EIA terms.

Further mitigation and residual effect

1.13.2.23 No further mitigation is required.

1.13.3 Future monitoring

1.13.3.1 No monitoring to test the predictions made within the impact assessment is considered necessary.

1.14 Transboundary effects

1.14.1.1 A screening of transboundary impacts has been carried out and any potential for significant transboundary effects with regard to climate change from the Transmission Assets upon the interests of other states has been assessed as part of the ES. The potential transboundary impacts are assessed within Volume 1, Annex 5.4: Transboundary screening of the ES.

1.14.1.2 All developments that emit GHGs have the potential to impact the atmospheric mass of GHGs as a receptor, and so may have a transboundary impact on climate change. Consequently, transboundary effects due to other specific international development projects are not individually identified but would be taken into account when considering the impact of the Transmission 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.

1.14.1.3 It is noted that over the lifetime of the Transmission Assets, when considered cumulatively with the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm, potential transboundary impacts and resulting effects will be beneficial.

1.15 Inter-related effects (in-combination climate impacts)

1.15.1.1 Inter-relationships are the impacts and associated effects of different aspects of the Transmission Assets on the same receptor. These are as follows.

- Project lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the Transmission Assets (construction, operation and maintenance, and decommissioning), to interact to potentially create a more significant effect on a receptor group than if just one phase were assessed in isolation.
- Receptor led effects: Assessment of the scope for all relevant effects across multiple topics to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on climate change, such as direct habitat loss or disturbance, may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects may be short term, temporary or transient effects, or incorporate longer term effects.

1.15.1.2 A description of the likely interactive effects arising from the Transmission Assets with climate change – in-combination climate impacts - is provided in Volume 4, Chapter 3: Inter-related effects of the ES.

1.15.1.3 The assessment of inter-related effects with climate change – in-combination climate impacts – is detailed below, the methodology used for this assessment is detailed at **section 1.10.4**. The main areas where there is potential for inter-related effects, subject to assessment, are:

- Volume 2, Chapter 1: Physical processes of the ES;
- Volume 3, Chapter 2: Hydrology and flood risk of the ES;
- Volume 3, Chapter 3: Onshore ecology and nature conservation of the ES;
- Volume 3, Chapter 4: Onshore and intertidal ornithology of the ES;
- Volume 3, Chapter 8: Noise and vibration of the ES; and
- Volume 3, Chapter 10: Landscape and visual resources of the ES

1.15.1.4 During the initial screening exercise, a number of environmental topics were identified for further assessment as effects identified within relevant chapters may be altered when also considering the impact of future climate change. Relevant topics and impacts are detailed within **Table 1.21**.

Table 1.21: In-combination climate impacts

Topic	Impact	Justification	Effect
Physical processes (Volume 2, Chapter 1 of the ES)	Impacts to sediment transport and sediment transport pathways due to the presence of infrastructure and associated potential impacts to physical features and bathymetry.	Projected future changes to sea level and storminess may result in altered interaction between sediment transport processes and the presence of infrastructure.	Not significant
Hydrology and flood risk (Volume 3, Chapter 2 of the ES)	Impact of increased flood risk arising from additional surface water runoff during operation of the onshore substations.	The projected future increase in precipitation may result increased flood risk.	Not significant
	Impact of increased flood risk arising from damage to existing flood defences during the construction and decommissioning	Where onshore elements of the Transmission Assets are located within or near existing flood defences, activities required to	Not significant

Topic	Impact	Justification	Effect
	of the onshore elements of the Transmission Assets.	facilitate the decommissioning of such elements may impact the integrity (or efficacy) of flood defence infrastructure and increase the risk of flooding within the site and the surrounding area. This risk may be compounded by future sea level rise resulting from climate change.	
Onshore ecology and nature conservation, onshore and intertidal ornithology (Volume 3, Chapters 3 and 4 of the ES)	Impact of temporary and permanent habitat loss and disturbance during construction, operation and decommissioning of the onshore elements of the Transmission Assets.	Projected future climate change may exacerbate habitat loss, in addition to the success of the ecological mitigation strategy as selected species may not be suitable for future climate conditions.	Not significant
Noise and vibration (Volume 3, Chapter 8 of the ES)	The impact of noise generated during operation and maintenance of the onshore substations on human receptors.	Projected temperature increases may result in increased cooling demand within substation buildings, leading to increased noise generated by cooling plant.	Not significant
Landscape and visual resources (Volume 3, Chapter 10 of the ES)	The impact of the onshore and offshore elements of the Transmission Assets on the landscape character during the construction, operation and maintenance and decommissioning activities.	Projected future climate change may impact the success of the Outline Landscape Management Plan (document reference J2) developed primarily in relation to the landscape proposals at the onshore substation sites, but also to reinstate hedgerows through which the cable corridor passes.	Not significant

1.15.1.5 The environmental topics and relevant impacts identified above have been assessed as follows with regard to in-combination climate impact effects. There is no change in the significance of effects reported in each topic chapter of the ES and as such no further mitigation is required:

- The assessment of physical processes (Volume 2, Chapter 1 of the ES) considers future changes in sea level and storminess as a result of climate change within the future baseline. It is identified that such changes are unlikely to have the effect of significantly altering tidal patterns and sediment transport regimes offshore. In the near-shore or intertidal areas increased storminess may have the potential to alter existing sediment transport regimes, however the presence of buried export cables would not influence these changes. As such, there is no change in the reported significance of effect when assessed in-combination with climate impacts.
- The assessment of flood risk, taking into account increases in rainfall rates due to climate change, has been addressed in Volume 3, Chapter 2: Hydrology and flood risk of the ES, ensuring the drainage design is able to accommodate increasing volumes of surface water runoff associated with the effects of climate change. With regards to impacts on

flood defence infrastructure during the decommissioning phase, there is not anticipated to be any in-combination impact with climate change, as onshore and offshore cables will either remain *in-situ* or be removed via joint bays without further excavation, and as such flood defence infrastructure will not be impacted. As such, there will be no change in the reported significance of effect when assessed in-combination with climate impacts.

- The assessments of landscape and visual resources (Volume 3, Chapter 10 of the ES), onshore ecology and nature conservation (Volume 3, Chapter 3 of the ES) and onshore and intertidal ornithology (Volume 3, Chapter 4 of the ES) consider future climate projections when determining appropriate mitigation measures to be implemented to manage the visual and ecological effects of the Transmission Assets. When developing detailed mitigation, climate resilient plant species will be specified in order to ensure the success of the planned mitigation over the Transmission Assets' lifetime. This approach is detailed within the Outline Landscape Management Plan (document reference J2) and Ecological Management Plan. As such, there will be no change in the reported significance of effect when assessed in-combination with climate impacts.
- The assessment of noise and vibration (Volume 3, Chapter 8 of the ES) has been undertaken based on the assumption that the onshore substation plant items will operate at their maximum duty. As such, the assessment yields the maximum noise effects resultant from the cooling plant to be installed at the proposed onshore substation buildings. Given it is not anticipated that the cooling plant will operate consistently at maximum capacity under current climate conditions, the installed capacity will be able to manage future temperature rise to some extent, with any associated increase in use or duty already captured within the assessment assumptions. Additionally, noise generated by the cooling plant will not be the dominant source of noise associated with the operation and maintenance of the onshore substations. As such, any increase in noise levels from increased operation or capacity of cooling plant during the Transmission Assets' lifetime as a result of projected climatic changes is not anticipated to result in a change in significance associated with operation and maintenance noise effects.

1.16 Summary of impacts, mitigation measures and monitoring

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

1.16.1.2 The potential impact of GHG emissions due to the Transmission 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 Transmission Assets have also been assessed and reported.

1.16.1.3 **Table 1.22** presents a summary of the impacts, measures adopted as part of the Transmission Assets and residual effects in respect to climate change. The impacts assessed include the following.

- The impact of GHG emissions arising from the manufacturing and installation of the Transmission Assets.
- The impact of GHG emissions arising from the consumption of materials and activities required to facilitate the operation and maintenance of the Transmission 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 land use and sea bed change.
- The impact of the effects of climate change on the Transmission Assets' onshore and offshore infrastructure over the operation and decommissioning phases.

1.16.1.4 Overall, it is concluded that there will be the following significant effects arising from the Transmission Assets during the construction, operation and maintenance, or decommissioning phases.

- Construction phase: emissions from the manufacturing of the Transmission Assets would result in emissions of up to 229,947 tCO_2e. This would be a significant **moderate adverse** effect (in EIA terms) with a residual effect of **minor adverse**, which is not significant, when accounting for further (secondary) mitigation.

1.16.1.5 **Table 1.23** presents a summary of the cumulative impacts, mitigation measures and residual effects. The cumulative impacts assessed include the following.

- The impact of avoided GHG emissions on the atmospheric concentration of GHGs from the operation and maintenance phase of the Generation Assets, enabled by the Transmission Assets.

1.16.1.6 Overall, it is concluded that there will be the following significant cumulative effects from the Transmission Assets alongside other projects/plans.

- net whole life GHG emissions: the avoided emissions resulting from the displacement of higher emitting electricity generation sources, as reported within the climate change assessments for both the Generation Assets, are enabled by the Transmission Assets. This would result in a **significant beneficial** effect in EIA terms.

1.16.1.7 It is noted that over the lifetime of the Transmission Assets, when considered cumulatively with the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm, potential transboundary impacts and resulting effects will be beneficial.

Table 1.22: Summary of environmental effects, mitigation and monitoring

Description of impact	Phase[a]			Commitment number	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
The impact of GHG emissions arising from the manufacturing and installation of the Transmission Assets.	✓	×	×	CoT49	229,947 tCO_2e	High	Moderate adverse effect (significant)	CoT42	Minor adverse (not significant)	None
The impact of GHG emissions arising from the consumption of materials and activities required to facilitate the operation and maintenance of the Transmission Assets.	×	✓	×	CoT71	76,856 tCO_2e	High	Minor adverse effect (not significant)	None proposed beyond existing commitments.	Minor adverse effect (not significant)	None
The impact of GHG emissions arising from decommissioning works (e.g., plant, fuel and vessel use) and the recovery (or disposal) of materials.	×	×	✓	CoT36	51,318 tCO_2e	High	Minor adverse effect (not significant)	None proposed beyond existing commitments.	Minor adverse effect (not significant)	None
The impact of GHG emissions arising from land use change during the construction, operation and maintenance and decommissioning phase.	✓	✓	✓	n/a	C: Negligible O: Negligible D: Negligible	C: High O: High D: High	C: Negligible O: Negligible D: Negligible (not significant)	None proposed beyond existing commitments.	C: Negligible O: Negligible D: Negligible (not significant)	None

Description of impact	Phase[a]			Commitment number	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
The impact of climate change on the Transmission Assets.	×	✓	✓	CoT11, CoT35, CoT49, CoT71	n/a	n/a	Negligible	None proposed beyond existing commitments.	Negligible	None

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

Table 1.23: Summary of cumulative environmental effects, mitigation and monitoring

Description of effect	Phase[a]			Commitment number	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
Tier 2										
Transmission Assets and Generation Assets – net whole life GHG emissions	✓	✓	✓	n/a	353,073 to -86,000,687 tCO_2e avoided emissions	High	Beneficial (significant)	None proposed beyond existing commitments.	Beneficial (significant)	None

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

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