Liverpool Bay CCS Ltd

HYNET CARBON DIOXIDE TRANSPORTATION AND STORAGE PROJECT - OFFSHORE

Environmental Statement
Volume 2, chapter 13: Climate Change

EHE7228B
Liverpool Bay CCS Limited
Final
February 2024
Offshore ES
Climate Change

rpsgroup.com

Document status					
Version	**Purpose of document**	**Authored by**	**Reviewed by**	**Approved by**	**Date**
FINAL	Final	RPS	Eni UK Ltd	Eni UK Ltd	February 2024

Prepared by:	**Prepared for:**
RPS	**Liverpool Bay CCS Limited**

Glossary

Term	Meaning
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 CO_2 to the atmosphere by emissions from human activities, by the storage of carbon (i.e. in carbon reservoirs on land or in the ocean).
Cumulative Effects Assessment	Assessment of the likely effects arising from the offshore components of the HyNet CO_2 Transportation and Storage Project ('Proposed Development') alongside the likely effects of other development activities in the vicinity of the Proposed Development.
Effect	The consequence of an impact.
Environmental Impact Assessment	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive and EIA Regulations, including the publication of an Environmental Statement (ES).
Impact	A change that is caused by an action.
Magnitude	Size, extent, and duration of an impact.
Maximum Design Scenario	The maximum design parameters of each Proposed Development asset (both on and offshore) considered to be a worst case for any given assessment but within the range of the Project Description Envelope.
Mitigation Measure	Measure which would avoid, reduce, or remediate an impact.
Nationally Determined Contribution	A climate action plan to cut emissions and adapt to climate impacts. A requirement of the Paris Agreement.
Non-statutory stakeholder	Organisations with whom the regulatory authorities may choose to engage who are not designated in law but are likely to have an interest in a Proposed Development.
Project	The HyNet Carbon Dioxide Transportation and Storage Project.
Proposed Development	The offshore components of the Project which are subject of this Environmental Statement, as described in Chapter 3: Proposed Development Description.
Scoping Opinion	Sets out the Secretary of State's response to the Applicants Scoping Report and contains the range of issues that the Secretary of State, in consultation with statutory stakeholders, has identified should be considered within the EIA.
The Applicant	This is Liverpool Bay CCS Ltd.
Transboundary effects	Impacts from a project within one state affect the environment of another state(s).

Acronyms and Initialisations

Acronyms and Initialisations	Description
CCS	Carbon Capture and Storage
CEA	Cumulative Effects Assessment
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
Defra	The Department for Environment, Food and Rural Affairs
DESNZ	The Department for Energy Security and Net Zero, preceded by the Department for Business, Energy, and Industrial Strategy (2016 to 2023) and the Department of Energy and Climate Change (2008 to 2016)
EIA	Environmental Impact Assessment
ES	Environmental Statement
EU	European Union
GHG	Greenhouse Gas

Acronyms and Initialisations	Description
HRA	Habitats Regulations Appraisal
LDAR	Leak Detection and Repair
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
NDC	Nationally Determined Contribution
NPS	National Policy Statement
O&M	Operations and Maintenance
OP	Offshore Platform
OPRED	Offshore Petroleum Regulator for Environment & Decommissioning
PDE	Project Design Envelope
PoA	Point of Ayr
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change
WBCSD	World Business Council for Sustainable Development
WNMP	Welsh National Marine Plan
WRI	World Resources Institute

Units

Unit	Description
%	Percent
km	Kilometres (distance)
m	Metres (distance)
Mt	Million tonnes (weight)
t	tonnes (weight)

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13 CLIMATE CHANGE

13.1 Introduction

This chapter of the Offshore ES presents the assessment of the likely significant effects (as per the 'Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020 (The '2020 EIA Regulations'), and 'The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended)) on the environment of the Proposed Development on climate change. Specifically, this chapter considers the potential impacts from the construction, operation and maintenance, and decommissioning of the offshore and intertidal components (seaward of the Mean High Water Springs (MHWS) mark) of the development area, which includes the pipelines and cables leading to MHWS.

Likely significant effect is a term used in both the 'EIA Regulations', and in IEMA's guidance on Assessing Greenhouse Gas Emissions (IEMA, 2022) and Climate Change Resilience and Adaptation (IEMA, 2020). Reference to likely significant effect in this Offshore ES refers to 'likely significant effect' as used by the 'EIA Regulations'.

This chapter is supported by information contained within:

- volume 3, appendix O: Greenhouse gas calculations technical report.

13.2 Purpose of this chapter

The primary purpose of the Offshore ES is outlined in volume 1, chapter 1. It is intended that the Offshore ES will provide the statutory and non-statutory stakeholders, with sufficient information to determine the likely significant effects of the Proposed Development on the receiving environment.

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

- the potential effect of greenhouse gas emissions (GHGs) caused directly or indirectly by the Proposed Development, which may have the potential to contribute to climate change; and
- the potential effect of changes in climate on the Proposed Development, which could affect it directly or could modify its other environmental impacts.

In particular, this climate change ES chapter:

- presents the existing environmental baseline established from desk studies;
- identifies any assumptions and limitations encountered in compiling the environmental information;
- presents the likely significant environmental impacts on climate arising from the Proposed Development and reaches a conclusion on the likely significant effects on climate change, based on the information gathered and the analysis and assessments undertaken; and
- highlights any necessary monitoring and/or mitigation measures which are recommended to prevent, minimise, reduce or offset the likely significant adverse environmental effects of the Proposed Development on climate change.

13.3 Study area

The Proposed Development climate change study area is defined as the area encompassing the development area, which will include the following infrastructure.

- Offshore Platforms (OPs), specifically Douglas Process platform, and Hamilton North, Hamilton Main, and Lennox wellhead platforms.

- Offshore carbon dioxide ($CO_{2)}$ injection wells connected to the wellhead platforms, and CO_2 monitoring and sentinel wells, located within the Hamilton, Hamilton North and Lennox fields.
- Offshore pipelines connecting the Point of Ayr (PoA) Terminal to Douglas OP and connecting Douglas OP to the Hamilton North, Hamilton Main and Lennox OPs.
- Offshore inter-platform power and fibre optic cables.
- Offshore power and fibre optic cables connecting the PoA Terminal to Douglas OP (seawards of MHWS).

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

With regards to the Cumulative Effects Assessment (CEA), all developments that emit, avoid or sequester GHGs have the potential to impact the atmospheric mass of GHGs as a receptor, and so may have a cumulative impact on climate change and upon the development. Consequently, cumulative effects due to other specific local development projects are not considered individually but are taken into account when considering the impact of the Proposed Development. However, the potential effects from the wider HyNet project are considered in order to account for the potential effect of the whole carbon capture and storage (CCS) project, as informed by the HyNet Carbon Dioxide Pipeline Town and Country Planning Act (TCPA) (WSP UK, 2023b) and Development Consent Order (DCO) (WSP UK, 2023a) applications which detail the onshore CO_2 transmission and compression elements of the CCS project. Therefore, the study area for the assessment of Cumulative Effects incorporates the Proposed Development's development area, alongside the red line boundaries associated with the HyNet Carbon Dioxide Pipeline TCPA and DCO applications. These are shown within Figure 13.1 in green and blue, respectively. Whole lifetime emissions (i.e. emissions resulting from construction, operation and maintenance, and decommissioning) arising from such elements of the wider HyNet project within the Cumulative Effects study area have been considered.

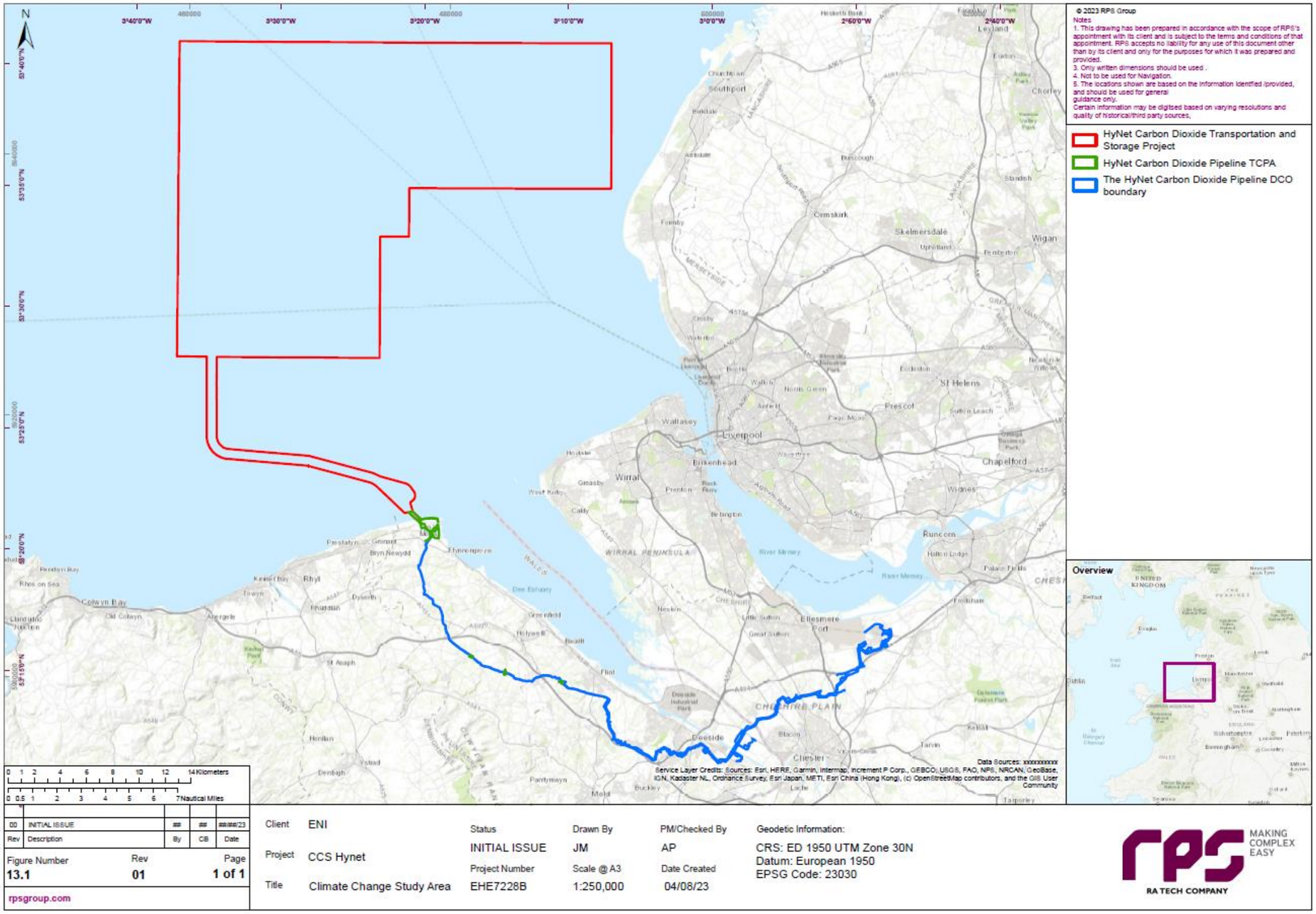

Figure 13.1: Climate Change Study Area

13.4 Policy and legislative context

The policy context for the HyNet Carbon Dioxide Transportation and Storage Project is set out in volume 1, chapter 2. Within this chapter, policy specifically in relation to climate change, is contained in section 2.2 Climate Change and Energy Policy and Legislation and section 2.3 Marine policy.

13.4.1 Marine plans

Table 13.1 sets out a summary of the specific policies in the North West Inshore and North West Offshore Marine Plan (MMO, 2021), and Welsh National Marine Plan (Welsh Government, 2019), relevant to this chapter.

Table 13.1: Summary Of Inshore And Offshore Marine Plan Policies Relevant To This Chapter

Policy	Key Provisions	How and Where Considered in the Offshore ES
North West Inshore and North West Offshore Marine Plan		
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.	Climate change risk to the Proposed Development, including the consideration of resilience/adaptation measures has been scoped out of this assessment (as detailed within section 13.8.2). The assessment of climate risk to the Proposed Development has been scoped out as effects are anticipated to not be significant. Studies conducted from Liverpool Bay have shown that extreme wind and wave climates are not expected to change significantly from those that are currently exhibited. Additionally, long-term analyses have illustrated that although there was a slight increase in the severity of most extreme events, there was little change in the extreme wave climate predicted for Liverpool Bay. The Proposed Development will be re-using and refurbishing existing offshore infrastructure, and introducing a new offshore platform that have been designed for resilience to storms in Liverpool Bay and have been proven operationally. The design of construction and refurbishment works to the sea-surface infrastructure will be to appropriate engineering and safety standards taking into account metocean data for this location. The pipeline and gas injection well are all undersea (and indeed under the seabed in the case of the sequestration volume) with minimal vulnerability to storm events.
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 resultant from the Proposed Development over its construction, operation and maintenance, and decommissioning phases within section 13.11.
Welsh National Marine Plan		
SOC_10	Proposals should demonstrate how they, in order of preference: a) Avoid the emission of greenhouse gases; and/or b) Minimise them where they cannot be avoided; and/or c) Mitigate them where they cannot be minimised. Where significant emission of greenhouse gases cannot be	This chapter provides an assessment of CO_2e emissions resultant from the Proposed Development over its construction, operation and maintenance, and decommissioning phases within section 13.11.

Policy	Key Provisions	How and Where Considered in the Offshore ES
	avoided, minimised or mitigated, proposals for regulated activities must present a clear and convincing case for proceeding.	
SOC_11	Proposals must demonstrate that they have considered the impacts of climate change and have incorporated appropriate adaptation measures, taking into account Climate Risk Assessments for Wales. Proposals that contribute to climate change adaptation and/or mitigation are encouraged.	Climate change risk to the Proposed Development, including the consideration of resilience/adaptation measures has been scoped out of this assessment (as detailed within section 13.8.2). The assessment of climate risk to the Proposed Development has been scoped out as effects are anticipated to not be significant. Studies conducted from Liverpool Bay have shown that extreme wind and wave climates are not expected to change significantly from those that are currently exhibited. Additionally, long-term analyses have illustrated that although there was a slight increase in the severity of most extreme events, there was little change in the extreme wave climate predicted for Liverpool Bay. The Proposed Development will be re-using and refurbishing existing offshore infrastructure, and introducing a new offshore platform that have been designed for resilience to storms in Liverpool Bay and have been proven operationally. The design of construction and refurbishment works to the sea-surface infrastructure will be to appropriate engineering and safety standards taking into account metocean data for this location. The pipeline and gas injection well are all undersea (and indeed under the seabed in the case of the sequestration volume) with minimal vulnerability to storm events.

Table 13.2 Summary Of Policies Relevant To Climate Change Within The National Policy Statements

Summary of Relevant Legislation	How and Where Considered in the Offshore ES
NPS EN-1: This NPS sets out how the energy sector can help deliver the Government's climate change objectives by clearly setting out the need for new low carbon energy infrastructure to contribute to climate change mitigation (paragraph 2.2.11 of NPS EN-1) (DECC, 2011).	Detailed within volume 1, chapter 2, section 2.2 Climate Change Policy and the need for the Development.
NPS EN-1: 'CO2 emissions are a significant adverse impact from some types of energy infrastructure which cannot be totally avoided', 'any ES on air emissions will include an assessment of CO2 emissions' (paragraph 5.2.2 of NPS EN-1) (DECC, 2011).	This chapter provides an assessment of CO_2e emissions resultant from the Proposed Development over its construction, operation and maintenance, and decommissioning phases within section 13.11.
Draft NPS EN-1: 'Applicants should include a carbon assessment as part of their ES, including a whole life carbon assessment (including the carbon impacts from construction, operation, and decommissioning). Alongside this, applicants should explain any steps taken to reduce climate change impacts at each of these stages (paragraph 5.3.4 if the draft NPS EN-1) (DESNZ, 2023).'	This chapter provides an assessment of CO_2e emissions resultant from the Proposed Development over its construction, operation and maintenance, and decommissioning phases within section 13.11.

13.5 Consultation

A summary of the key issues raised during consultation activities undertaken to date specific to climate change is presented in Table 13.3 below, together with how these issues have been considered in the production of this Offshore ES chapter.

Table 13.3: Summary Of Key Consultation Of Relevance To Climate Change

Date	Consultee and type of response	Issue raised	Response to issue raised and/or where considered in this chapter
27 January 2023	Scoping Opinion, Offshore Petroleum Regulator for Environment & Decommissioning (OPRED)	The following comments were listed under the heading *'Air Quality and Climate Change Adaptation':* *'The ES should take account of the risks of air pollution from the Project and how these can be managed or reduced'.* *'The England Biodiversity Strategy published by Defra establishes principles for the consideration of biodiversity and the effects of climate change. It is recommended that the ES reflects the principles outlined in this strategy and should aim to identify the effect of the development on climate change and how ecological networks will be maintained'.*	The risks of air pollution from the Proposed Development is scoped out of the EIA due to no likely significant effect in EIA terms or no effect-receptor pathways identified. Justification for scoping out this topic is provided in volume 3, appendix C.1. This climate change chapter of the ES assesses the effect of the Proposed Development on climate change through GHG emissions resultant from the construction, operation and maintenance, and decommissioning phases, in addition to considering avoided emissions resultant from the cumulative effect of the wider HyNet project. This climate change chapter of the ES does not consider the impact of climate change on biodiversity and ecological networks. Such in-combination effects have been assessed in the applicable topic chapters within the ES (volume 2, chapter 7) where relevant, through consideration of how climate change is likely to affect the future baseline environment and sensitivity of receptors.

13.6 Methodology to inform the baseline

13.6.1 Desktop study

Information regarding GHG emissions leading to climate change within the climate change study area has been collated through detailed and comprehensive review of currently accessible studies and datasets. Key data sources are listed in Table 13.4 below, noting that this list is not exhaustive.

Table 13.4: Summary Of Key Desktop Reports

Title	Source	Year	Author
UK Government GHG Conversion Factors for Company Reporting.	Department for Energy Security and Net Zero (DESNZ) and Department for Environment, Food and Rural Affairs (Defra)	2023	DESNZ and Defra
Inventory of Carbon and Energy (ICE) database.	Circular Ecology, University of Bath.	2019	Jones and Hammond

13.6.2 Identification of designated sites

There are no relevant designated sites for climate change for the purpose of this EIA assessment.

13.6.3 Site-specific surveys

No site-specific surveys have been undertaken to inform the EIA for climate change.

13.7 Existing baseline description

13.7.1 Climate change

The current baseline environment for the Proposed Development comprises three existing OPs and connecting submarine pipelines and cables. These OPs form part of the Douglas OP Complex, comprising the current Douglas OP which is the control hub for operations and contains facilities for personnel; alongside the Lennox, Hamilton North, and Hamilton Main OPs, which are all unmanned oil and gas wellhead platforms.

Such infrastructure has been used for the extraction and transport of natural gas from gas reservoirs in Liverpool Bay to the PoA gas terminal. As emissions associated with such activity are attributed to the existing Douglas OP, where changes to its operation and decommissioning not included within the scope of this application, current baseline emissions are considered to be zero.

Land within the climate change study area that is not currently occupied by OP foundations, pipelines and cables, consists of various subtidal habitats of mixed sediments (including coarse sediment, sandy mud, fine sand, muddy sand, and deep sand) supporting diverse benthic communities. This is confirmed in volume 2, chapter 7.

13.8 Key parameters for assessment

13.8.1 Maximum design scenario

A range of potential Proposed Development impacts on climate change have been identified which could potentially occur during the construction, operation and maintenance, and decommissioning phases of the Proposed Development.

Impacts that have been scoped into the assessment are outlined in Table 13.5 along with the identified maximum design scenarios. The maximum design scenarios have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the details provided in volume 1, chapter 3. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (PDE) (e.g. different infrastructure layout), to that assessed here, be taken forward in the final design scheme.

Table 13.5: Maximum Design Scenario Considered For Each Impact As Part Of The Assessment Of Likely Significant Effects On Climate Change

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O&M	D		
The impact of GHG emissions arising from the manufacturing and installation of the Proposed Development, including materials, transport and use of plant / offshore marine vessels.	✓	×	×	**Construction Phase** • Greatest number of transport vehicles and vessels for the installation of the Proposed Development (2 no. heavy lift vessel return trips, 4 no. tug/anchor handler vessel return trips, 3 no. cargo barge return trips, 1 no. diving support vessel return trip, and 28 no. crew boat return trips for the installation of the New Douglas platform; 10 no. tug/anchor handler vessel return trips, 9 no. cargo barge return trips, 80 no. support vessel return trips, 3 no. survey vessel return trips, 2 no. pre-comm vessel return trips, 1 no. seabed preparation vessel return trips, 76 no. crew transfer vessel return trips for the installation of the Hamilton Main, Hamilton North and Lennox OP topsides; and 4 no. cable lay installation and support vessel return trips, 1 no jack-up vessel return trip, 2 no. multicat vessel return trips, 3 no. working boat return trips, 1 no. support vessel return trips, 4 no. crew transfer vessel return trips, 1 no. cable protection installation vessel return trip, 1 no. cable burial installation vessel return trip for the installation of cables and pipeline). • The greatest weight of materials for the construction of the New Douglas OP (jacket – 2,940 tonnes, topsides – 2,290 tonnes). • The greatest number of OPs to be renovated (3), and their maximum weight for deck replacement (Hamilton Main – 1,100 tonnes, Hamilton North – 950 tonnes, Lennox – 1,400 tonnes). • The maximum length of new pipeline (592 m from existing PoA to New Douglas, 175 m from existing Hamilton Main OP gas export to New Douglas, 128 m from existing Lennox OP gas export to New Douglas, 195 m from existing Lennox gas injection to New Douglas, 68 m from existing Hamilton North to New Douglas). • The maximum length of cable routes (33.99 km for cable no. 1 from PoA Terminal to Douglas OP, 33.95 km for cable no. 2 from PoA Terminal to Douglas OP, 10.87 km cable from Douglas OP to Hamilton OP, 14.89 km cable from Douglas OP to Hamilton North OP, 32.34 km cable from Douglas OP to Lennox OP). • The maximum weight number of cable crossings (10) alongside the maximum weight of cable protection rock aggregate and area of crossing protection concrete.	**Construction phase** • The greatest number and size of structures and maximum length of the pipeline and cables will result in the greatest consumption of fuel and materials, representing the greatest potential for GHG emissions.

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O&M	D		
				• The maximum number of new CO_2 injection wells (13).	
The impact of GHG emissions arising from materials and use of offshore marine vessels required for operation and maintenance.	×	✓	×	**Operation and Maintenance Phase** • The greatest number of maintenance vehicles and machinery across the lifetime of the Proposed Development (15 no. jack-up vessel return trips, 15 no. other vessel return trips, and 300 no. helicopter return trips).	**Operation and maintenance phase** • The greatest number vehicle movements will result in the greatest consumption of fuel and materials, representing the greatest potential for GHG emissions.
The impact of GHG emissions associated with energy and fuel use during the operation phase.	×	✓	×	**Operation and Maintenance Phase** • The greatest number of offshore platforms (4 no. including New Douglas OP).	**Operation and maintenance phase** • The greatest number of offshore platforms will result in the greatest consumption of energy and fuel, representing the greatest potential for GHG emissions.
The impact of GHG emissions from decommissioning works (plant, fuel, and vessel use) and recovery or disposal of materials.	×	×	✓	**Decommissioning phase** • Greatest number of transport vehicles and vessels for the decommissioning of the Proposed Development (5 no. main decommissioning and support vessel return trips, 8 no. tug/anchor handler return trips, 5 no. cargo barge return trips, 20 no. cable decommissioning and support vessel return trips, 108 no. crew transfer vessel return trips). • The greatest weight of materials for the construction of the New Douglas OP (jacket – 2,940 tonnes, topsides – 2,290 tonnes). • The greatest number of OPs to be renovated (3), and their maximum weight for deck replacement (Hamilton Main – 1,100 tonnes, Hamilton North – 950 tonnes, Lennox – 1,400 tonnes), alongside materials from their foundations. • The maximum length of new pipeline (592 m from existing PoA to New Douglas, 175 m from existing Hamilton Main OP gas export to New Douglas, 128 m from existing Lennox OP gas export to New Douglas, 195 m from existing Lennox gas injection to New Douglas, 68 m from existing Hamilton North to New Douglas), alongside lengths of pre-existing pipeline. • The maximum length of cable routes (33.99 km for cable no. 1 from PoA Terminal to Douglas OP, 33.95 km for cable no. 2 from PoA Terminal to Douglas OP, 10.87 km cable from Douglas OP to Hamilton OP, 14.89 km cable from Douglas OP to Hamilton North OP, 32.34 km cable from Douglas OP to Lennox OP).	**Decommissioning phase** • 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 Proposed Development.

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O&M	D		
				• The maximum weight number of cable crossings (10) alongside the maximum weight of cable protection rock aggregate and area of crossing protection concrete. • The maximum number of CO_2 injection wells (13).	
The impact of CO_2 transportation, sequestration and long-term storage.	×	✓	✓	**Operation and Maintenance, and Decommissioning Phases** • The maximum amount (by volume) of CO_2 storage across the lifetime of the Proposed Development.	The purpose of the Proposed Development is to enable CO_2 transportation, sequestration, and storage. The wells will be sealed at the decommissioning stage of the Proposed Development, ensuring all stored CO_2 injected over the lifetime of the Proposed Development will remain stored within subsea reservoirs. No further assessment beyond that detailed for the operation and maintenance phases is provided.

13.8.2 Impacts scoped out of the assessment

On the basis of the baseline environment and the Proposed Development Description outlined in volume 1, chapter 3, three impacts are proposed to be scoped out of the assessment for climate change. Such impacts were proposed to be scoped out in the HyNet Carbon Dioxide transportation and Storage Project - Offshore Scoping Report (Eni, 2022) and no concerns were raised by key consultees. These impacts are outlined, together with a justification for scoping them out, in Table 13.6, below.

Table 13.6 Impacts Scoped Out Of The Assessment For Climate Change (Tick Confirms The Impact Is Scoped Out)

Potential Impact	Phase			Justification
	C	O&M	D	
GHG emissions from leaks and/or damage to the Proposed Development components within the development area into the environment during operation or during long-term sequestration use following decommissioning of the infrastructure	×	✓	✓	• Emissions from potential leaks and damage to the structural integrity of the development area offshore components could lead to increases in surrounding CO_2 pollution and concentration, causing impacts to environmental and human health in the immediate vicinity and/or partial or full reversal of the sequestration benefits of the development. • However, these are not considered to be likely or expected effects of the Proposed Development. Engineering and geological studies undertaken in the planning of the sequestration facility to date have shown its suitability for stable, long-term storage and the purpose of the engineering design of the facility will be to ensure this is achieved. • Further, during the operation of the facility, fugitive emissions will be monitored through a Leak Detection and Repair (LDAR) programme as part of preventative maintenance activities, to ensure any unplanned CO_2 release is avoided or minimised as much as is reasonably practicable. • Any material amount of CO_2 leakage is therefore considered to be possible in an accident or disaster scenario. However, such an event is considered highly unlikely (given the above designed-in protection). The risk assessment carried out by the Applicant for the project identified that there is no significant risk of CO_2 leakage from the storage complexes, or of harm to the environment or human health. The risk assessment identified and evaluated the leak paths via which CO_2 can leave the subsurface storage complexes, and included a register itemising each foreseeable leak scenario, its associated risk levels and prevention and mitigation control measures. Of all the scenarios considered, loss of containment due to an in-field legacy well providing a leak path was judged the highest risk, but even so was judged “unlikely” once the project-specific prevention and mitigation measures are taken into account. All other scenarios were considered less likely, being ranked either “rare” or “practically non-credible”. The risk assessment took account of the Measurement, Monitoring and Verification plan (MMV) that will be implemented during operation.
In-combination effects of climate change with other environmental impact pathways	✓	✓	✓	• In-combination effects will be assessed in the applicable topic chapters within the ES, through consideration of how climate change is likely to affect the future baseline environment and sensitivity of

Potential Impact	Phase			Justification
	C	O&M	D	
				receptors, and it will not be duplicated within the scope of the climate change ES chapter.
Climate change risk to the Proposed Development and resilience/adaptation measures	✓	✓	✓	• Studies conducted from Liverpool Bay have shown that extreme wind and wave climates are not expected to change significantly from those that are currently exhibited in present day. Additionally, long-term analyses have illustrated that although there was a slight increase in the severity of most extreme events, there was little change in the extreme wave climate predicted for Liverpool Bay. • The Proposed Development will be re-using and refurbishing existing offshore infrastructure, and introducing a new offshore platform that have been designed for resilience to storms in Liverpool Bay and have been proven operationally. The design of refurbishment works to the sea-surface infrastructure will be to appropriate engineering and safety standards taking into account metocean data for this location. The pipeline and gas injection well are all undersea (and indeed under the seabed in the case of the sequestration volume) with minimal vulnerability to storm events.

13.9 Methodology for assessment of effects

The climate change impact assessment has followed the methodology set out in volume 1, chapter 5. Specific to the climate change impact assessment, the following guidance documents has also been considered:

- IEMA guidance on 'Assessing Greenhouse Gas Emissions and Evaluating their Significance' (IEMA, 2022).

In order to undertake a climate change impact assessment, information gathered in volume 3, appendix O has been utilised. This information is sourced from primary calculations and secondary sources to calculate the effect of the Proposed Development on climate change.

13.9.1 Assessment methodology

GHG emissions have been estimated by applying published emissions factors to activities required for the Proposed Development. The emissions factors relate to a given level of activity, or amount of fuel, energy or materials used, to the mass of GHGs released as a consequence. The GHGs considered in this assessment are those in the 'Kyoto basket' of global warming gases expressed as their CO_2-equivalent (CO_2e) global warming potential (GWP). This is denoted by CO_2e units in emissions factors and calculation results. GWPs used are typically the 100-year factors in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (IPCC, 2013) or as otherwise defined for national reporting under the United Nations Framework Convention on Climate Change (UNFCCC).

Additional guidance used for the quantification of GHG emissions includes:

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

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

- Scope 1 emissions: direct GHG emissions from sources owned or controlled by the company, (e.g. from combustion of fuel 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).
- 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.

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

The assessment has considered:

- the GHG emissions arising from the Proposed Development; and
- the net impact on climate change due to these changes in GHG emissions overall.

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 Proposed Development, including construction-stage emissions, have been evaluated where possible when determining the significance of effects.

13.9.2 Impact assessment criteria

Determining the overall significance of the effect of the Proposed Development on GHG emissions is a three-stage process that involves defining:

- Magnitude of the impact
  - In accordance with the IEMA Guidance (2022) GHG emissions can be quantified directly and expressed based on their GWP as tonnes of CO_2e emitted, the magnitude of impact is reported numerically. Where a quantifiable figure is not possible this is expressed qualitatively.
- Sensitivity of receptor
  - GHG emissions have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The global atmospheric mass of the relevant GHGs and consequent warming potential, expressed in CO_2e, has therefore been treated as a single receptor of high sensitivity (given the importance of the global climate as a receptor).
- Significance of effect
  - Assessment guidance for GHG emissions (IEMA, 2022) describes five levels of significance for emissions resulting from a development, each based on whether the GHG emission impact of the development will support or undermine a science-based 1.5°C compatible trajectory towards net zero. To aid in considering whether effects are significant, the guidance recommends that GHG emissions should be contextualised against pre-determined carbon budgets, or applicable existing and emerging policy and performance standards where a budget is not available. It is a matter of professional judgement to integrate these sources of evidence and evaluate them in the context of significance.

Taking the guidance into account, the following have been considered in contextualising Proposed Development GHG emissions:

- the magnitude of net GHG emissions as a percentage of national and local carbon budgets (where feasible); and
- whether the Proposed Development contributes to, and is in line with, the UK's policy for GHG emissions reductions, where these are consistent with science-based commitments to limit global climate change to an internationally-agreed level (as determined by the UK's nationally determined contribution (NDC) to the Paris Agreement (BEIS, 2022a).

Effects from GHG emissions are described in this chapter as adverse, negligible or beneficial based on the following definitions, which closely follow the examples in Box 3 of the IEMA guidance (IEMA, 2022) as detailed in Table 13.7.

Table 13.7: IEMA (2022) Guidance Definitions Of Significance

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

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.

GHG emissions associated with a proposed project are often reported as a whole life figure (net emissions) that takes account of all project stages. The net whole life figure is the key element for determining the Proposed Development's whole life impact on climate change. However, it is noted in the IEMA guidance (2022) that due to the nature of GHG emissions, it is good practice to include a section that reports on the whole life GHG emissions of the project, alongside the sections that assess construction, operation and decommissioning effects in isolation.

13.10 Embedded mitigation

As part of the Proposed Development design process, a number of mitigation measures have been proposed to reduce the potential for impacts on climate change (see Table 13.8). As there is a commitment to implementing these measures, they are considered inherently part of the design of the Proposed Development and have therefore been considered in the assessment presented in section 13.11 below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These measures are considered standard industry practice for this type of development.

Table 13.8: Mitigation Measures Adopted As Part Of The Proposed Development

Mitigation measures adopted as part of the Proposed Development	Justification
During the construction and operational phases vessel fuel consumption will be minimised by optimising vessel scheduling, with consideration given to the co-ordination of activities and material delivery. Activities will be limited on the speed of vessels, and fuel used will have a low sulphur component (0.1%). Vessels older than 20 years will not be used.	During the construction and operational phase emissions resultant from fuel consumption by vessel movements will be minimised by ensuring the use of lower sulphur content fuel, providing an efficient and optimised vessel schedule to reduce the number of journeys, and avoiding the use of older vessels.
During the operational phase, energy demand associated with the OPs will be reduced through energy efficiency opportunities. These include the use of efficient low loss transformers, variable frequency drives (VFDs) on CO_2 compressors, LED light bulbs, low voltage electrical installations, compressor efficiency specification and optimisation, efficient air coolers, energy monitoring systems (to comply with ISO 50001 certification), and Real Time Monitoring and Advanced Process Control (a computer-based algorithm that automatically optimises the process parameters and promotes a reduction in energy consumption from approximately 3% to 7%).	The implementation of energy efficiency opportunities on the OPs results in the reduced consumption of energy during the operation of the Proposed Development, thereby reducing emissions of GHGs to the atmosphere associated with such energy consumption.
During the operational phase fugitive emissions will be monitored through a Leak Detection and Repair (LDAR) programme as part of the preventative maintenance activities, to avoid or minimise their presence as low as reasonably practicable.	Fugitive emissions may take place during the operational phase of the Proposed Development, but every effort will be made to minimise them. Such gas release would result in the increased concentration of GHGs in the atmosphere, further contributing to the effects of climate change.
At the end of the Proposed Development's lifetime, materials removed during decommissioning will be recycled where practicable.	The recycling of materials at the end of the Proposed Development's lifetime not only prevents materials from being sent to landfills, but also reduces the need for the extraction of primary materials, thereby reducing emissions associated with such processes.

13.11 Assessment of significance

The EIA considered the potential impacts of the construction, operation and maintenance, and decommissioning phases of the Proposed Development within the climate change study area and followed the methodology outlined in section 13.9. Further detail can be found in volume 3, appendix O.

13.11.1 Emissions to the atmosphere

13.11.1.1 GHG emissions associated with construction/refurbishment activities, including materials, transport and use of plant / offshore marine vehicles

This impact considers the embodied carbon emissions associated with the consumption of materials and fuel required to construct the Proposed Development. This impact entails an assessment of the construction of the New Douglas platform, refurbishment of the Hamilton North, Hamilton Main, and Lennox OPs, and laying of new cables and pipework. Maximum design scenarios were assumed to ensure the greatest potential for GHG emissions were calculated, representing a conservative estimate of impact. The following items are considered within this assessment:

- New Douglas platform foundations and substructure;
- refurbishment of satellite OP topsides (Hamilton North, Hamilton Main, and Lennox), and New Douglas platform topside;

- new sub-sea cables and associated protection;
- new pipelines;
- side-tracking of injection wells; and
- vessel movements.

New Douglas platform foundations and substructure

At this stage in the Proposed Development design, detailed material quantities for the construction of the New Douglas platform foundations and substructure are not yet available. However, as it is an overwhelmingly steel based structure, the estimated shipping lift weight has scaled by the carbon factor for galvanised steel (Jones and Hammond, 2019), totalling 32,458 tCO_2e.

Total weight of steel driven piles used to secure the foundations and substructure have been scaled by an appropriate steel emissions factor (Jones and Hammond, 2019), totalling 2,346 tCO_2e, and bringing the total GHG emissions associated with the construction of the New Douglas platform foundations and substructure to 34,804 tCO_2e.

Refurbishment of satellite OPs (Hamilton North, Hamilton Main, and Lennox), and New Douglas Platform topside.

At this stage in the Proposed Development design, detailed material quantities for the construction of the OP topsides are not yet available. As such, the carbon factor for galvanised steel (Jones and Hammond, 2019), has been scaled by the lift weight of each topside. This estimate provides good coverage of the likely emissions associated with the construction of the OP topsides, as steel is overwhelmingly the most significant material used. GHG emissions associated with the OP topsides is 15,842 tCO_2e.

The potential impact of the proposed transformers to be installed on the OPs has been estimated using an intensity for the manufacturing GWP of 2,190 $kgCO_2e$ per MVA (ABB, 2003). This was scaled by the total transformer rating to be installed, to give an estimated embodied carbon value of 43.8 tCO_2e.

New sub-sea cables and associated protection

Material quantities of cable core (aluminium or copper) for the 33 kV cables and fibre optic cables were estimated based on the total length of each cable, and informed by technical product information (ABB, 2010; Sterlite Technologies Limited, 2020). Emissions factors for each material (Jones and Hammond, 2019) were then scaled by the estimated quantities to give an embodied carbon value of 27,322 tCO_2e.

Two forms of cable protection have been specified: concrete mattressing, and rock protection. The total volume of concrete mattressing has been scaled by a concrete emissions factor totalling 2,981 tCO_2e. The total weight of rock protection required has been scaled by an EPD for rock aggregate, this amounts to 323 tCO_2e.

Total GHG emissions for the construction of sub-sea cabling and associated protection is 30,626 tCO_2e.

New pipelines

Emissions associated with the total length of new pipeline have been calculated using a relevant product EPD for steel pipes (OneClick LCA, 2021). The length of pipeline was converted to weight using a steel pipe weight chart (Octal Steel, 2023) to enable the emissions factor to be applied. GHG emissions associated with the new pipelines required totalled 387 tCO_2e.

Injection wells

Emissions from the construction of injection wells can be broken into two main stages, fuel consumed during the drilling of wellbores, and emissions associated with the materials associated with well completion (predominantly steel and cement).

In relation to GHG emissions associated with the drilling of wells, a conservative assumption for the typical daily diesel fuel consumption for an offshore drilling rig has been utilised (IPIECA, 2013). This has been scaled by the number of drilling days required for each well and the emissions factor for fuel oil (DESNZ and DEFRA, 2023). This results in emissions associated with the fuel required to drill wells amounting to 27,286 tCO_2e.

In relation to the completion stage of well construction, GHG emissions arise from embodied carbon from the quantities of steel and cement used to complete the wellbores. Material quantities provided by the Applicant's design team have been scaled by the relevant emissions factors for steel piping and cement (Jones and Hammond, 2019), totalling 10,932 tCO_2e.

Total GHG emissions associated with the construction of wells is 38,218 tCO_2e.

Vessel movements

Emissions associated with fuel combustion from vessel 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 17,852 tCO_2e during the construction phase.

Summary

Table 13.9: Construction Stage GHG Emissions

Item	Emissions (tCO_2e)
New Douglas Platform foundations and substructure	34,804
Refurbishment of satellite OPs and Douglas OP topside	15,886
New sub-sea cables and associated protection	30,626
New pipelines	387
Injection wells	38,218
Vessel movements	17,852
Total	**137,772**

Magnitude of impact

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 137,772 tCO_2e.

Sensitivity of receptor

In accordance with section 13.9.2, the receptor is deemed to be of high sensitivity, as it is highly vulnerability, of low recoverability and high value.

Significance of the effect

Overall, the magnitude of the impact is deemed to be 137,772 tCO_2e and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **moderate adverse** significance, which is significant in EIA terms.

Secondary mitigation and residual effect

Overall, following mitigation, the magnitude of the impact is deemed to be 137,772 tCO_2e and the sensitivity of the receptor is considered to be high. The effect will, therefore, be **moderate adverse**, which is significant in EIA terms.

Climate change mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the designed in measures outlined in section 13.10) is significant in EIA terms.

13.11.1.2 GHG emissions associated with materials and use of offshore marine vehicles required for operation and maintenance

Emissions during the operational phase of the Proposed Development comprise activities contributing to the operation and maintenance of the Proposed Development. Maintenance can be divided into preventative maintenance and corrective maintenance.

- Preventative maintenance: proactive repair to, or replacement of, known ware components based on routine inspections or monitoring systems.
- Corrective maintenance: reactive repair or replacement of failed or damaged components.

The Proposed Development's maintenance activities largely involve routine inspection, replacement of consumables (e.g. filters, oils, lubricants), minor repairs and replacements, 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.

Major component replacement (i.e. transformers and equipment to be included on OPs) is not envisaged to be required during the operational lifetime of the Proposed Development, and as such has not been considered further.

Cable and pipeline repair and replacement may be required over the Proposed Development's lifetime. In the absence of detailed information regarding maintenance programmes of such elements, it has been conservatively assumed that the entire length of new pipeline and cable will be replaced once over the Proposed Development's 25-year lifetime.

Emissions associated with maintenance vessel and helicopter movements have also been captured over the Proposed Development's 25-year lifetime. Emissions associated with fuel combustion from vessel and helicopter movements have been calculated based on the maximum number of movements proposed during the operation and maintenance phase, assuming the longest journey distance travelled to reach a conservative estimate. Anticipated fuel consumption for each movement was scaled by an appropriate current emissions factor, to give total estimated emissions of 23,566 tCO_2e during the construction phase.

The GHG emissions arising from the consumption of materials and activities required to facilitate the operation and maintenance of the Proposed Development are presented in Table 13.10, below.

Table 13.10: Operation And Maintenance Stage GHG Emissions

Item	Emissions (tCO_2e)
Cable replacement	27,323
Pipeline replacement	387
Vessel movements	20,635
Helicopter movements	2,931
Total	**51,275**

Magnitude of impact

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 therefore considered to be 51,275 tCO_2e.

Sensitivity of receptor

In accordance with section 13.9.2, the receptor is deemed to be of high sensitivity, as it is highly vulnerability, of low recoverability and high value.

Significance of the effect

Overall, the magnitude of the impact is deemed to be 51,275 tCO_2e and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **moderate adverse** significance, which is significant in EIA terms.

Secondary mitigation and residual effect

Overall, following mitigation, the magnitude of the impact is deemed to be 51,275 tCO_2e and the sensitivity of the receptor is considered to be high. The effect will, therefore, be **moderate adverse**, which is significant in EIA terms.

Climate change mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the designed in measures outlined in section 13.10) is significant in EIA terms.

13.11.1.3 GHG emissions associated with energy and fuel use during the operation phase

Activity associated with the OPs results in energy consumption during the operational phase of the Proposed Development. The New Douglas platform will be a Normally Unmanned Installation (NUI), primarily designed to be operated remotely through automated processes. The platform will be the hub for the CCS operations, receiving and distributing CO_2 to the satellite platforms. When necessary, the Douglas platform will provide pressure control and heating prior to distribution of the CO_2. The satellite platforms will include facilities necessary for CO_2 treatment and injection. The Proposed Development includes the construction of new energy supply to the offshore infrastructure, which will supply electricity to the OPs to maintain gas compression, heating, and to meet utility loads, as described above.

The OPs energy demand will be met by grid electricity, provided through a new connection to the grid at the PoA Terminal. This will replace the existing gas turbine generator currently used to generate energy for use at the existing PoA Terminal and OPs, which will be disinvested. This switch to electricity from gas will enable the decarbonisation of the operational energy demand in the long-term – despite emissions associated with grid electricity currently exceeding those from natural gas, under the UK's climate targets and ambitions the power system is intended to be fully decarbonised by 2035. As such, operational emissions resultant from the Proposed Development will be reduced in comparison to the current operational infrastructure (i.e. the existing Douglas Platform and PoA Terminal).

To calculate operational emissions associated with energy consumption, modelled energy demands were scaled by projected grid average electricity conversion factors (BEIS, 2022b), which account for the projected decarbonisation of grid electricity, to give lifetime operational emissions of 30,386 tCO_2e (2025 to 2050) presented in Table 13.11, below.

Table 13.11: Operational GHG Emissions Associated With Energy And Fuel Use

Item	Emissions (tCO_2e)
OP energy consumption	30,386
Total	**30,386**

Magnitude of impact

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 therefore considered to be 360,998 tCO_2e.

Sensitivity of receptor

In accordance with section 13.9.2, the receptor is deemed to be of high sensitivity, as it is highly vulnerability, of low recoverability and high value.

Significance of the effect

Overall, the magnitude of the impact is deemed to be 30,386 tCO_2e and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

No further climate change mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the designed in measures outlined in section 13.10) is not significant in EIA terms.

13.11.1.4 GHG emissions from decommissioning works (plant, fuel and vessel use) and recovery or disposal of materials

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

While detailed information is not yet available regarding the decommissioning of the New Douglas platform and repurposed satellite platforms at the end of the Proposed Development's operational phase, it is anticipated that the decommissioning of the Proposed Development would be undertaken in accordance with all the environmental legislation and technology available at the time. The components of the OPs, cables and pipelines, are considered to be highly recyclable. When disposing of such elements, recycling is the preferred option. This not only prevents materials from being sent to landfills, but also reduces the need for the extraction of primary materials. Material which cannot be recycled might be used for incineration or energy from waste. 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.

Emissions associated with fuel combustion from vessel 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 2,833 tCO_2e during the construction phase.

The GHG emissions arising from the consumption of fuel required to facilitate the decommissioning of the Proposed Development are presented in Table 13.12, below.

Table 13.12: Decommissioning Stage GHG Emissions

Item	Emissions (tCO_2e)
Vessel movements	2,833
Total	**2,833**

Magnitude of impact

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 2,833 tCO_2e.

Sensitivity of receptor

In accordance with section 13.9.2, the receptor is deemed to be of high sensitivity, as it is highly vulnerability, of low recoverability and high value.

Significance of the effect

Overall, the magnitude of the impact is deemed to be 2,833 tCO_2e and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Secondary mitigation and residual effect

No further climate change mitigation is considered necessary because the likely effect in the absence of further mitigation (beyond the designed in measures outlined in section 13.10) is not significant in EIA terms.

13.11.1.5 CO_2 transportation and long-term storage.

During the operational phase of the Proposed Development, venting and fugitive emissions may take place but every effort will be made to minimise these. Fugitive emissions are unintentional leakages of gases or vapours from pressure-containing equipment or facilities and would typically occur at flanges, valves and other equipment interfaces. During the operational phase, fugitive emissions would be monitored through a LDAR programme as part of preventative maintenance activities (as detailed in section 13.10), to avoid or minimise their presence as low as reasonably practicable. As such, fugitive emissions have not been assessed further.

There will be a requirement for periodical venting of CO_2 equipment during planned maintenance activities, such as pigging operations, inspection of equipment, inspection and replacement of filter cartridges, and vent maintenance. Indicative venting emissions have been provided by the Applicant's design team, which total an average of 89.15 tCO_2 per year, or 2,318 tCO_2e over the Proposed Development's operational lifetime.

The purpose of the Proposed Development is to enable the re-purposing of depleted hydrocarbon reservoirs for CO_2 storage, by providing the necessary infrastructure to transport CO_2 from industrial sources captured and transported onshore, to the storage reservoirs offshore. The New Douglas CCS platform will receive CO_2 from the onshore PoA Terminal, and distribute CO_2 to the Hamilton Main, Hamilton North, and Lennox wellhead platforms which will inject CO_2 into the depleted hydrocarbon reservoirs for long term storage.

As informed by the Applicant's design team, the Proposed Development has the potential to capture approximately 4.5 $MtCO_2$ per year from 2027, reaching a total of between 110,250,000 tCO_2 and 116,040,000 tCO_2 reinjected CO_2 over the Proposed Development's lifetime. The former has been used to inform the assessment in order to provide the most conservative approach of CO_2 removed and stored.

It must be noted that GHG chapters included within the onshore environmental assessments for both the HyNet Carbon Dioxide Pipeline DCO application (which assesses the onshore CO_2 pipeline, connection to PoA

Terminal, installation of Block Valve Stations, utility connection, and other above ground infrastructure) and HyNet Carbon Dioxide Pipeline TCPA application (which assesses the modification to the PoA Terminal, foreshore works, and installation of Block Valve Stations) acknowledge the CO_2 stored as a result of the CCS project as a whole. Both chapters include such an effect within their assessment of significance for the operational phase. As such, it should be understood that the quantity of CO_2 stored has been included and assessed within three ES chapters and as such there is a risk of triple counting. The value of CO_2 stored should be taken as one common value as a result of the entire CCS project, not three independent values of stored CO_2 that can be totalled.

Despite being assessed already within two ES chapters (as described above), the quantity of CO_2 stored has been assessed within this chapter given the inclusion of the gas storage reservoirs within the description of the Proposed Development.

Table 13.13: Emissions Associated With CO_2 Transportation And Storage

Item	Emissions (tCO_2e)
Venting	2,318
CO_2 storage	-110,250,000
Total	**-110,247,682**

Magnitude of impact

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 therefore considered to be - 110,247,682 tCO_2e.

Sensitivity of receptor

In accordance with section 13.9.2, the receptor is deemed to be of high sensitivity, as it is highly vulnerability, of low recoverability and high value.

Significance of the effect

Overall, the magnitude of the impact is deemed to be -110,247,682 tCO_2e and the sensitivity of the receptor is considered to be high. The effect will, therefore, be **beneficial**, which is significant in EIA terms.

Secondary mitigation and residual effect

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

13.11.2 Net whole life GHG emissions and context

As set out in section 13.9.2, consideration of the Proposed Developments' whole life impact is an important consideration when assessing the Proposed Developments' impacts and subsequent effects on climate change. As such, the consideration of the Proposed Developments' net emissions in the context of existing and emerging policy commitments and UK Carbon budgets is important.

The lifetime GHG emissions arising from the consumption of materials and activities required to facilitate the construction, operation and maintenance, and decommissioning of the Proposed Development are presented in Table 13.14 below.

Table 13.14: Net Whole Life GHG Emissions

Stage	Proposed Development Emissions (tCO_2e)
Construction	137,772
Operation and maintenance	83,979
Decommissioning	2,833
CO_2 stored	-110,250,000
Total	**-110,025,415**

Consideration of the Proposed Developments' net emissions performance can be considered with the following contextualisation:

- 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.

The Proposed Developments' net emissions accounting for both construction and operational stages up to the end of the Sixth Carbon Budget are detailed in Table 13.15 below.

Table 13.15: GHG Impacts In The Context Of The UK's Carbon Budgets

	2023-2027	2028-2032	2033-2037	Total
UK Carbon Budget (tCO_2e)	1,950,000,000	1,730,000,000	960,000,000	4,640,000,000
Proposed Development GHG impacts (tCO_2e)	-6,605,188	-22,486,356	-22,488,173	-51,579,716
Percentage of UK Carbon Budget (%)	-0.339%	-1.300%	-2.343%	-1.112%

When considering the above magnitude of emissions across the whole lifetime of the Proposed Development and the high sensitivity of the climate as a receptor, the Proposed Development would have a **beneficial** net effect which would be significant in EIA terms.

13.12 Cumulative impact assessment

All developments that emit, avoid or sequester GHGs have the potential to impact the atmospheric mass of GHGs as a receptor, and so may have a cumulative impact on climate change. Consequently, cumulative effects due to other specific local development projects are not individually considered but are taken into account when considering the impact of the Proposed Development by defining the atmospheric mass of GHGs as a high sensitivity receptor. The construction, operational and decommissioning phase effects of the assessment of the Proposed Development takes account of cumulative changes in GHG emissions from other energy generation sources.

However, the Proposed Development forms one element of the CCS Project - a wider proposed network transporting and preparing CO_2 for capture and storage. Applications forming part of the wider CCS network are as follows:

- HyNet Carbon Dioxide Pipeline TCPA – the scope of this application includes the modification of the PoA Terminal, foreshore works, and the installation of three Block Valve Stations.
- HyNet Carbon Dioxide Pipeline DCO – the scope of this application includes onshore gas pipelines, six Block Valve Stations, embedded pipe bridge, utility connection infrastructure and other above ground supporting infrastructure.

The Proposed Development enables the CO_2 captured and compressed upstream in the wider project, as included within the scope of the applications listed above, to be transported to injection wells and stored within subsea reservoirs, enabling emissions to the atmosphere from connected industries to be avoided.

The cumulative effects of the Proposed Development, within the context of the wider Project on the global atmospheric mass of CO_2 has been assessed (Table 13.16). Emissions resultant from the HyNet Carbon Dioxide Pipeline TCPA application, and HyNet Carbon Dioxide Pipeline DCO application have been informed by their respective GHG assessments, included within Chapter 10 of each ES.

Table 13.16: Cumulative Effects

Stage	Element of wider CCS Project (tCO_2e)		
	Proposed Development	HyNet Carbon Dioxide Pipeline TCPA	HyNet Carbon Dioxide Pipeline DCO
Construction	137,772	18,146	70,899
Operation	81,661	174,296	4,521
Operation (venting and fugitive emissions)	2,318	10,473	1,344
Decommissioning	2,833	2,465	12,754
Sub-total	224,585	205,380	89,518
	519,483		
CO_2 Storage	-110,250,000		
Total	**-109,730,517**		

The quantity of carbon stored over the lifetime of the CCS project is anticipated to far exceed those emissions associated with the construction, operation and decommissioning of each element of the CCS project, and as such will aid in delivering the UK's net zero targets.

Magnitude of impact

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 therefore considered to be -109,730,517 tCO_2e.

Sensitivity of receptor

In accordance with section 13.9.2, the receptor is deemed to be of high sensitivity, as it is highly vulnerability, of low recoverability and high value.

Significance of the effect

Overall, the magnitude of the impact is deemed to be -109,730,517 tCO_2e and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **beneficial** significance, which is significant in EIA terms.

Secondary Mitigation and residual effect

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

13.13 Conclusion

Information on climate change within the climate change study area was collected through desktop review of currently accessible studies and datasets. Key data sources include the UK Government GHG Conversion Factors for Company Reporting (DESNZ and Defra, 2023) and ICE database (Jones and Hammond, 2019), alongside Proposed Development parameters as informed by the Applicant's design team.

The impacts assessed include:

- GHG emissions arising from the manufacturing and installation of the Proposed Development;
- GHG emissions arising from materials and use of offshore marine vessels required for operation and maintenance;
- GHG emissions associated with energy and fuel use during the operational phase;
- GHG emissions from decommissioning works and recovery or disposal of materials; and
- CO_2 transportation and long term storage.

Overall, it is concluded that there will be the following significant effects arising from the Proposed Development during the construction, operational and maintenance or decommissioning phases:

- **Moderate adverse** effect arising from GHG emissions associated with the manufacture and installation of the Proposed Development. The magnitude of this effect totals 137,772 tCO_2e, the sensitivity of the receptor is considered to be high.
- **Moderate adverse** effect arising from GHG emissions associated with materials and use of offshore marine vessels required for operation and maintenance of the Proposed Development. The magnitude of this effect totals 51,275 tCO_2e, the sensitivity of the receptor is considered to be high.
- **Minor adverse** effect arising from GHG emissions associated with emissions from energy use during the operation of the Proposed Development. The magnitude of this effect totals 30,386 tCO_2e, the sensitivity of the receptor is considered to be high.
- **Beneficial** effect arising from CO_2 transportation and long term storage by the Proposed Development. The magnitude of this effect totals **-**110,247,682 tCO_2, the sensitivity of the receptor is considered to be high.
- **Beneficial** effect arising from the net whole life GHG emissions associated with the Proposed Development. The magnitude of this effect totals **-**110,025,415tCO_2, the sensitivity of the receptor is considered to be high.

The cumulative impacts assessed include:

- The net effects associated with the construction, operation and decommissioning of the Proposed Development alongside those associated with the wider CCS project reported within the HyNet Carbon Dioxide Pipeline TCPA and DCO applications. Such applications assess the onshore gas pipeline, and modification of the PoA Terminal.

Overall, it is concluded that there will be the following significant cumulative effects from the Proposed Development alongside other projects/plans:

- **Beneficial** net effect arising from the CO_2 transportation and long term storage by the Proposed Development, enabled by the onshore transportation and pressurisation of CO_2 undertaken by the onshore elements of the wider CCS project. The magnitude of this effect totals -109,730,517tCO_2, the sensitivity of the receptor is considered to be high.

No potential transboundary impacts have been identified regarding effects of the Proposed Development.

13.14 References

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