# Cambois Connection Marine Scheme

## ES Appendix 5.1 Climate Assessment (Greenhouse Gas Emissions)

July 2023

# Notice

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## Client signoff

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## Tables

# Acronyms and abbreviations

| Acronym | Description |
|---|---|
| BBWF | Berwick Bank Wind Farm |
| BBWFL | Berwick Bank Wind Farm Limited |
| BEIS | Department for Business, Energy and Industrial Strategy |
| CTV | Crew Transfer Vessel |
| DECC | Department of Energy and Climate Change |
| Defra | Department for Environment, Food and Rural Affairs |
| DESNZ | Department for Energy Security and Net Zero |
| EEZ | Exclusive Economic Zone |
| EIA | Environmental Impact Assessment |
| ES | Environmental Statement |
| EU | European Union |
| GHG | Greenhouse Gas |
| HDD | Horizontal Directional Drilling |
| HVAC | High Voltage Alternating Current |
| HVDC | High Voltage Direct Current |
| IEMA | Institute of Environmental Management and Assessment |
| IPCC | Intergovernmental Panel on Climate Change |
| LPA | Local Planning Authority |
| MCZ | Marine Conservation Zone |
| MHWS | Mean High Water Springs |
| MLWS | Mean Low Water Springs |
| MMO | Marine Management Organisation |
| MD-LOT | Marine Directorate Licensing Operations Team |
| N/A | Not Applicable |
| NCC | Northumberland County Council |
| NPF | National Planning Framework |
| OCSP | Offshore Converter Station Platform |
| PDE | Project Design Envelope |
| SSER | SSE Renewables |
| UK | United Kingdom |
| UXO | Unexploded Ordinance |

# Units

| Unit | Description |
|---|---|
| % | Percentage |
| £ | Pound Sterling |
| $CO_{2e}$ | Carbon dioxide equivalent |
| GW | Gigawatt (power) |
| km | Kilometres (distance) |
| $km_2$ | Square kilometres |
| m | Metre (distance) |
| $m_2$ | Square metres |
| MW | Mega Watt |
| nm | Nautical mile (distance) |
| T | Tonnes |
| Mt | Million tonnes |

# 1. INTRODUCTION

This document presents the assessment of the likely significant effects of the Cambois Connection offshore infrastructure (hereafter referred to as "the Marine Scheme") on climate through greenhouse gas (GHG) emissions (Climate Assessment). The Marine Scheme comprises the components of the Cambois Connection that are located seaward of mean high water springs (MHWS).

The development of the Cambois Connection is proposed by Berwick Bank Wind Farm Limited (BBWFL), a wholly owned subsidiary of SSE Renewables (SSER) (hereafter referred to as 'the Applicant').

## 1.1. DESCRIPTION OF THE MARINE SCHEME

The Cambois Connection comprises two proposals, or 'Schemes':

- the Marine Scheme, which comprises the construction, operation and maintenance, and decommissioning of up to four high voltage direct current (HVDC) Offshore Export Cables from up to two Offshore Converter Station Platforms (OCSPs) within the Berwick Bank Wind Farm (BBWF) array area to MHWS of the Landfall location near Cambois, Northumberland; and
- the Onshore Scheme, which comprises the construction, operation and maintenance and decommissioning of a cable Landfall (landward of mean low water springs (MLWS)), including up to four onshore HVDC cables (Onshore Export Cables), an onshore Converter Station, High Voltage Alternating Current (HVAC) grid cables from the Onshore Converter Station to the existing National Grid Blyth substation, and works to integrate into the existing Blyth substation.

The purpose of this infrastructure is to facilitate the export of green energy from the generation assets associated with the BBWF, located in the outer Firth of Forth. A separate application for developing a grid connection to Branxton, East Lothian, has been included as part of the Applicant's application for consent for the BBWF, currently being determined separately. The Cambois Connection will enable the BBWF to reach full generating capacity by the early 2030's.

The Marine Scheme is located within both Scottish and English waters and will therefore require consent from the Marine Directorate Licensing Operations Team (MD-LOT) for the part of the Marine Scheme in Scottish waters[1] and from the Marine Management Organisation (MMO) for the part of the Marine Scheme in English waters[2]. This report considers offshore GHG emissions arising from the components of the Marine Scheme located within Scottish waters, the components of the Marine Scheme located in English waters, and cumulatively, from both areas. In addition, a cumulative assessment has been carried out to provide the GHG emissions arising from the Marine Scheme, the Onshore Scheme and the BBWF.

## 1.2. BACKGROUND TO CLIMATE CHANGE AND REQUIREMENTS FOR ASSESSMENT

Human activities contribute to GHG emissions, such as carbon dioxide ($CO_2$) to the atmosphere, primarily by the combustion of fossil fuels. GHGs trap heat in the atmosphere, with higher concentrations leading to increasing global temperatures. Atmospheric $CO_2$ concentrations now exceed 400 parts per million for the first time in around 3 million years (The Royal Society, 2020), and increased GHG emissions have led to global average surface temperatures of 1°C higher than pre-industrial levels (World Meteorological Organisation (WMO), 2021). There is a global consensus on the need to tackle climate change and for accelerating GHG emissions reductions (Climate Change Committee (CCC), 2021). The impact of climate change is already being felt around the world with changing rainfall patterns and rising sea levels, increasing the risk of heatwaves, floods, droughts and fires, and has already caused damage to ecosystems, people, settlements and infrastructure (Intergovernmental Panel on Climate Change (IPCC), 2022).

Climate change requirements are outlined in the Marine Works (Environmental Impact Assessment) Regulations 2007, which state that the environmental statement should include a description of the factors likely to be significantly affected by the project, including climate (for example):

[1] I.e. the activities required as part of the Marine Scheme located within Scottish offshore waters (12-200 nm).

[2] I.e. the activities required as part of the Marine Scheme located within English inshore waters (Mean High Water Springs (MHWS) – 12 nm) and English offshore waters (12 – 200 nm).

- greenhouse gas emissions; and
- impacts relevant to adaptation.

Assessing the vulnerability of the Marine Scheme to climate change, in particular the impacts of extreme weather caused by climate change during construction, operation and maintenance, and decommissioning, and adaptation to mitigate the potential effects of such impacts, has been scoped out of this assessment as it is not considered likely that the Marine Scheme will be vulnerable to climate change due to its nature and location (subsea cables that will be protected through cable burial along the majority of the route or by additional cable protection where required), as detailed in the Scoping Report (SSER, 2022a). Furthermore, there were no requests at scoping by either MD-LOT or MMO to consider the vulnerability of the Marine Scheme to climate change. Based on the MD-LOT Scoping Opinion (MD-LOT, 2023), the effects of GHG emissions from the Marine Scheme on climate have been considered, as noted in section 1.3 below.

## 1.3. CONSULTATION

Responses to the Scoping Report for the Marine Scheme (SSER, 2022a) relevant to GHG emissions are provided in Table 1-1 (MD-LOT, 2023)[3].

**Table 1-1 – Scoping Comments**

| Organisation | Comment | Response |
|---|---|---|
| Marine Directorate-Licensing Operations Team (MD-LOT) | The Scoping Report proposed at section 4.9 and Table 4-6 that the impact of climate change effects of the Proposed Works will be scoped out of the EIA Report and there will be no standalone topic or chapter on climate. The Scottish Ministers are however mindful that Greenhouse Gas ("GHG") emissions from all projects contribute to climate change. In this regard, the Scottish Ministers highlight the Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide "Assessing Greenhouse Gas Emissions And Evaluating Their Significance" ("IEMA GHG Guidance"), which states that "GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit, as a such any GHG emissions or reductions from a project might be considered significant." The Scottish Ministers have considered this together with the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 and the requirement of the EIA Regulations to assess significant effects from the Proposed Works on climate. The Scottish Ministers therefore advise that the EIA Report must include a GHG Assessment which should be based on a Life Cycle Assessment ("LCA") approach and note that the IEMA GHG Guidance provides further insight on this matter. The Scottish Ministers highlight however that this should include the pre-construction, construction, operation and decommissioning phases, including consideration of the supply chain as well as benefits beyond the life cycle of the Proposed Works. The Scottish Ministers note representation from East Lothian Council which considers the need for the Applicant to assess the impact on climate change resulting from the | This assessment has been undertaken in this report, using the IEMA GHG Guidance and incorporating a whole life carbon assessment. |

[3] Responses to the Onshore Scheme Scoping Report in relation to climate and GHG emissions will be provided within the climate assessments report for the Onshore Scheme.

| Organisation | Comment | Response |
|---|---|---|
| | Proposed Works in this regard. The Scottish Ministers further direct the Applicant to NatureScot representation in relation to the recommendation to consider the carbon cost of the Proposed Works and to what extent this will be offset by the production of green energy. | |
| East Lothian Council | Climate change will affect everyone. There does not appear to be any assessment proposed of the impact on climate change of the project itself, either directly from use of materials and methods of construction, or indirectly, although supporting Scottish and UK climate change targets is given as one of the reasons for the project. An assessment of the projects effect on climate change should therefore be included. | An assessment of the effects on climate change has been undertaken in this report, following the IEMA GHG Guidance and will incorporate a whole life carbon assessment. |
| NatureScot | The EIAR should also consider the carbon cost of the additional export cable (including supply chain) and to what extent this is offset through the production of green energy. | An assessment of the GHG emissions associated with the Marine Scheme has been carried out, and the assessment includes consideration of the production of green energy as part of the findings of the assessment. |
| NatureScot | We welcome the inclusion of the blue carbon assessment in section 8.5.4 and we are content that the potential for significant effects to blue carbon storage have been scoped out for further assessment. | Comments noted |

## 1.4. PURPOSE OF THE ASSESSMENT

The Climate Assessment has been undertaken in accordance with the following IEMA guidance:

Assessing Greenhouse Gas Emissions and Evaluating their Significance, February 2022 (IEMA,2022).

This assessment:

- Sets the scope and boundaries of the Climate Assessment;
- Presents the existing environmental baseline and the future baseline for the assessment;
- Identifies assumptions and limitations in compiling the environmental/climate information;
- Presents the likely significant effects on the climate arising from the Marine Scheme through GHG emissions; and
- Highlights any mitigation measures which are recommended to prevent, minimise or reduce the GHG emissions impacts that give rise to any adverse likely significant effects of the Marine Scheme.

# 2. POLICY & LEGISLATIVE CONTEXT

Policy and legislation specifically in relation to climate are provided in Table 2-1. UK carbon reduction targets and carbon budgets are provided in Table 2-2 and Scotland carbon reduction targets are provided in Table 2-3.

**Table 2-1 – Summary of Legislation and Policy Relevant to Climate**

| Policy/ Legislation | Summary |
|---|---|
| International | |
| Paris Agreement (2015) | Strengthened negotiations at COP21 led to the 2015 Paris Agreement, the aim of which is to maintain the increase in global average temperature at 'well below' 2°C and 'pursue efforts' to limit the temperature increase even further to 1.5°C.<br>In 2018, the IPCC published a special report (IPCC, 2018) in response to the Paris Agreement, to present the impacts of the targeted 1.5°C temperature rise. The report highlighted that to achieve this, global emissions must decrease by 45% by 2030 (against a 1990 baseline), and that net zero global emissions (where emissions and removals from the atmosphere are balanced) must be achieved by 2050. This is noted to require rapid and far-reaching transitions of every sector on an unprecedented scale.<br>The Glasgow Climate Pact, resulting from COP26 held in 2021, strengthened focus on limiting the temperature rise to 1.5°C, recognising the severity of climate impacts above this limit. |
| National (UK) | |
| Climate Change Act (2008) as amended in 2019 | To support international efforts, the UK Climate Change Act (2008) set a legal reduction target of 80% for the UK against 1990 levels by 2050. It also introduced a series of carbon 'budgets' for five-year periods, to act as stepping-stones to the overall reduction. There are budgets currently set up to 2037.<br>In response to the ambitions of the Paris Agreement, in 2019 the Climate Change Act was amended to set the overall reduction target by 2050 to at least 100% in net emissions against 1990 levels.<br>The UK has so far outperformed its budgets, but progress is slowing, and the country is not on track to meet its future budgets or the overall reduction target, according to the most recent Progress Report to Parliament by the CCC (CCC, 2023). |
| The Marine Works (Environmental Impact Assessment) Regulations 2007 | An environmental impact assessment is required to identify, describe and assess factors likely to be significantly affected by the development, including climate. |
| Construction 2025 (UK Government, 2013) | Construction 2025 is a UK Government strategy paper that sets out how efficiency improvements will be created in construction covering sustainability and carbon and including a target to reduce whole life emissions by 50% by 2025 in the built environment.<br>The included emissions reduction target of 50% is not project specific, and the efficiency improvements are broad. In terms of the Marine Scheme and emissions reduction, the reduction target should be taken into account when developing specific mitigation measures, where relevant. |
| British Energy Security Strategy (Department for Business, Energy & | This policy paper outlines the UK Government's plans to make Britain energy independent, reduce reliance on foreign sources of energy and to work towards their net zero 2050 target. |

| Policy/ Legislation | Summary |
|---|---|
| Industrial Strategy (BEIS), 2022) | It includes plans to deliver 50 GW of energy generation via offshore wind by 2030 and enable smarter planning to increase the pace of deployment by 25%. |
| Powering Up Britain (HM Government, 2023a) | This policy paper outlines the UK Government's plans for setting out how the government will enhance the country's energy security and deliver on net zero commitments, by diversifying, decarbonising and domesticating energy production by investing in renewables. |
| Carbon Budget Delivery Plan (HM Government, 2023b) | The plan sets out a package of proposals and policies and associated timescales and delivery risks that enable carbon budgets 4-6 to be met. Under the power sector is the policy to review the offshore transmission network to ensure this supports the delivery of offshore wind generation assets. |
| National (Scotland) | |
| Climate Change (Scotland) Act (2009) | This Act was a direct parallel of the UK's Climate Change Act (2008) requiring a reduction target of 80% against 1990 levels by 2050 for Scotland only. It also sets annual GHG emission targets.<br>The Act requires the preparation of strategic programmes for climate change adaptation, as soon as reasonably practicable after each round of UK Climate Change Risk Assessment. |
| The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 | This Act changed the legal reduction target set in the 2009 Climate Change Act to 100% reduction against 1990 levels by 2045. This moved the target data for 'net zero' for Scotland forward by five years, and set statutory interim targets and annual targets. |
| Update to the Climate Change Plan 2018 – 2032 | This Plan sets out the Scottish Government's pathway to the targets set by the Climate Change Act 2019 and acknowledges the importance of offshore wind's role in supporting the transition away from oil and gas, together with the development of high voltage transmission networks. |
| Scotland's Climate Change Plan 2018-2032: Securing a Green Recovery on a Path to Net Zero, 2020 | Updates the Scottish Government's 2018 Climate Change Plan and sets out ambitious targets to reduce emissions by 75% by 2030 and to net zero by 2045. It includes policies and proposals for each sector including under electricity, the need to continue rapid growth in renewable generation. |
| Scottish Government National Planning Framework (NPF) 4 2023 | The NPF provides the framework for Scotland's long-term spatial development. NPF 4 sets out the plans and strategies for Scotland for 2045 across a range of sectors including climate change and energy. It includes how to tackle and adapt to climate change, and how to make progress towards the target of net zero emissions, including the importance of offshore renewables and transmission infrastructure in transitioning to net zero. |
| National (England) | |
| Draft Overarching Energy National Policy Statement (NPS) for Energy (EN-1)[4] | The NPS sets out the national policy for the delivery of major energy infrastructure in England and Wales. Although the Marine Scheme is not classed as a nationally significant infrastructure project, the NPS does indicate Government's policy intent. |

[4] A suite of draft revised Energy NPSs were published and consulted on by the UK Government in March 2023, and consultation closed on 23 June 2023. The consultation responses will be subject to consideration and the draft revised NPSs may now be revised before the NPSs are formally adopted. There is currently no date for the next stage of the review process and therefore this ES presents the current adopted NPSs which have been considered during the preparation of this ES. It is however noted by the Applicant that the new draft NPSs state that they may be material considerations in other applications which are not considered under the Planning Act (2008), this includes the Marine Scheme. The draft EN-1 states that "To support the achievement of the transition to net zero, government is accelerating the co-ordination of the development of the grid network to facilitate the UK's net zero energy generation development and transmission." Further detail on the consideration of the draft NPSs in this ES is provided in Volume 2, Chapter 2: Policy and Legislation.

**Table 2-2 – UK Carbon Budgets as set in Carbon Budget Orders 2009, 2011, 2016 and 2021**

| UK carbon budget period | UK carbon budget level |
|---|---|
| 1st carbon budget (2008 to 2012) | 3,018 $MtCO_2e$ |
| 2nd carbon budget (2013 to 2017) | 2,782 $MtCO_2e$ |
| 3rd carbon budget (2018 to 2022) | 2,544 $MtCO_2e$ |
| 4th carbon budget (2023 to 2027) | 1,950 $MtCO_2e$ |
| 5th carbon budget (2028 to 2032) | 1,725 $MtCO_2e$ |
| 6th carbon budget (2033 to 2037) | 965 $MtCO_2e$ |

Table source: Advice on reducing the UK's emissions - Climate Change Committee (theccc.org.uk)

**Table 2-3 – Scotland Carbon Reduction Targets as set by Climate Change (Emissions Reductions Targets) (Scotland) Act 2019**

| Year | Carbon Reduction Target Against 1990 Baseline GHG Emissions (%) | Annual target ($tCO_2e$) |
|---|---|---|
| 1990 (baseline year | n/a | 81,600,000 (actual emissions) |
| 2025 | 65.5 | 28,152,000 |
| 2030 | 75.0 | 20,400,000 |
| 2035 | 82.5 | 14,280,000 |
| 2040 | 90.0 | 8,160,000 |
| 2045 | 100 (Net-zero emissions) | 0 |

Table source: Climate change: Reducing greenhouse gas emissions - gov.scot (www.gov.scot) Note: There are yearly carbon reduction targets up until 2045. They are not shown here to reduce table length.

# 3. STUDY AREA AND BASELINE

## 3.1. STUDY AREA

The study area includes all carbon emitting activities within the Marine Scheme boundary, relevant carbon emitting activities beyond the Marine Scheme boundary that contribute to the total carbon footprint of the construction, operation and maintenance and decommissioning of the Marine Scheme, and energy generation from alternative sources.

The GHG assessment is a wide-ranging topic in terms of potential sources, both originating within the Marine Scheme boundary and from much further afield and is not limited to the geographic extent of the Marine Scheme boundary.

## 3.2. BASELINE

### 3.2.1. METHODOLOGY TO INFORM BASELINE

The baseline conditions for the assessment are informed by the total background emissions of GHGs from all sources, i.e. all UK GHG emissions, as provided by national statistics. In addition, baseline environmental characteristics for the Marine Scheme with specific reference to GHG emissions are provided for the existing situation and in the future, assuming the Marine Scheme is not implemented.

### 3.2.2. UK GHG EMISSIONS

#### 3.2.2.1. Emissions

The total UK territorial emissions for 2021 (last reported year) were 426.5 million tonnes (Mt) carbon dioxide equivalent[5] ($CO_2e$), (BEIS and Department for Energy Security & Net Zero (DESNZ), 2023a). Provisional figures have been released for 2022, with the total UK territorial emissions for 2022 being 417.1 Mt $CO_2e$ (BEIS and DESNZ, 2023b).

The UK has in place carbon budgets for five-year periods up to 2037, as shown in Table 2-2. Whilst budgets have not yet been set beyond 2037, there is a legal requirement for the UK to reach net zero emissions by 2050, as set in the Climate Change Act 2008 and for Scotland to reach net zero emissions by 2045 as set in the Climate Change Scotland Act 2009 (as amended by the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019).

#### 3.2.2.2. Electricity Generation

The UK emitted 0.193 $kgCO_2e$ for each kWh of energy generated in 2022 (last reported year, long-run marginal figure) (BEIS and DESNZ, 2023c). This emissions factor has been projected by BEIS up until 2100. The emissions factor is projected to decrease significantly over the next 10 years, due to lower carbon forms of energy generation coming online and older, higher carbon forms of energy generation (i.e. fossil fuels) being phased out. The emissions factor is projected to be 0.091 $kgCO_2e$/kWh in 2030 (first operating year of the Cambois Connection). The emissions factor continues to decrease until 2050 when the emissions factor is 0.002 $kgCO_2e$/kWh. It is then projected to remain at this low level of residual emissions until 2100.

### 3.2.3. SCOTLAND GHG EMISSIONS

#### 3.2.3.1. Emissions

The total GHG emissions for Scotland for 2021 (the last reported year) were 41.6 $MtCO_2e$ (Scottish Government, 2023a).

Scotland has a legislated target to achieve net zero by 2045. To help the delivery of this long-term target, Scotland's climate change legislation also includes annual targets for every year until 2045 (see Table 2-3). This includes a target of a 79.5%[6] reduction in GHG emissions from the 1990 baseline emissions by 2030 (first

[5] Includes carbon dioxide and other greenhouse gases included the Kyoto Protocol, adopted 1997 and ratified in 2005. Details about each of the Kyoto Protocol GHGs can be found here: Global Warming Potentials (IPCC Second Assessment Report) | UNFCCC

[6] Target not shown in Table 2-3, but noted on the website given as the table's source.

operating year of the Cambois Connection). This percentage reduction increases by 1.5% each year until reaching a 90% reduction in 1990 baseline emissions by 2040. It then increases by 2% each year until reaching a 100% reduction in GHG emissions by 2045, i.e. net zero.

#### 3.2.3.2. Electricity Generation

In 2021, 57% of Scotland's electricity generation came from renewable energy sources, with a further 30% from nuclear. In 2022, there was a total of 13.9 GW of installed capacity across the country, due to increases in onshore and offshore wind capacity over the course of 2022 (Scottish Government, 2023b).

Scotland has already reached its target of having an electricity grid intensity below 50 $gCO_2e$/kWh, with a grid intensity of 41.4 $gCO_2e$/kWh reached in 2019. This shows that the GHG emissions associated with producing electricity have reduced over time, as non-renewable energy sources, such as coal fired power stations have closed down. The Scottish Government anticipates that grid intensity will remain at or below 50 $gCO_2e$/kWh in the future, with the increased penetration of renewable sources and no planned expansion of fossil fuel power generation.

### 3.2.4. ENGLAND GHG EMISSIONS

The total GHG emissions for England for 2021 (the last reported year) were 333.6 $MtCO_2e$ (National Atmospheric Emissions Inventory (NAEI), 2023).

### 3.2.5. MARINE SCHEME SPECIFIC BASELINE GHG EMISSIONS

The Marine Scheme will be located both in Scottish offshore waters (beyond 12nm) and English inshore and offshore waters (MHWS-200nm), and will be partially located in designated sites, i.e. the Firth of Forth Banks Complex Nature Conservation Marine Protected Area (ncMPA) in Scottish waters, and in the Berwick to St Mary's MCZ and the Coquet to St Mary's MCZ in English waters at the Landfall (refer to Marine Scheme Accompanying Documents to the Marine Licence Application, MPA / MCZ Assessments). It also crosses shipping lanes and the area is used by commercial fisheries. The vessels range from smaller fishing and recreational vessels up to large tankers and cargo vessels (refer to Marine Scheme ES, Volume 2, Chapter 13: Shipping and Navigation). Whilst there are GHG emissions associated with the vessels that use the shipping routes through the offshore site, these have not been possible to be quantified with any certainty due to the vast array of vessel types that travel through the Marine Scheme and issues with calculating the distances and fuel consumption for each journey travelled.

The total current baseline emissions are unknown, hence for the purposes of this assessment, a conservative GHG emissions baseline of zero is applied, which represents a robust worst-case approach.

### 3.2.6. FUTURE BASELINE SCENARIO

If the Marine Scheme is not constructed, the Firth of Forth Banks Complex MPA (ncMPA) is considered likely to continue in its current state, despite the proposed implementation of the BBWF whose array area partially overlaps with the ncMPA[7], and unless any other development comes forward that may impact it. The vessel movements that currently occur within the Marine Scheme boundary will continue along the current routes that exist, taking into account any changes resulting from the proposed BBWF, the construction of the Seagreen Wind Farm to the north, and construction of the Inch Cape Wind Farm and Neart na Gaoithe Wind Farm in the north-west. A robust, conservative approach estimates that total vessel traffic will grow by 20% by 2050 (Berwick Bank Wind Farm Offshore EIA Report, Volume 2, Chapter 13, Section 13.7.2; SSER, 2022b).

As mentioned in section 3.2.2 the emissions factor for UK energy generation is projected to continuously decrease until 2050 when it reaches 0.002 $kgCO_2e$/kWh. This rate of decrease is based on a variety of factors and is altered every year based on changes in policy, current energy generation capacity, economics and planned projects. The projection would remain similar in future years, without the Marine Scheme and associated BBWF and would only be materially impacted by large scale changes in government policy, geopolitical events or economic issues.

[7] The MPA Assessment carried out for the consent application for BBWF concluded that none of the assessed impacts were predicted to lead to a significant risk of hindering the achievement of the conservation objectives for any protected features of the Firth of Forth Banks Complex ncMPA (SSER, 2022b). The MPA/MCZ Assessment carried out for the Marine Scheme application in Scottish waters concludes for the Firth of Forth Banks Complex ncMPA that the Marine Scheme will not, on its own or cumulatively with BBWF, lead to a significant risk of hindering the achievement of the overall conservation objectives for the protected features of the Firth of Forth Banks Complex ncMPA (Marine Scheme Accompanying Documents to the Marine Licence Application, MPA/MCZ Assessments).

# 4. ASSESSMENT METHODOLOGY

The potential impacts of GHG emissions are very specific in terms of receptors and impacts because:

- There is only one receptor, the atmosphere, which is non-site-specific;
- There is only one direct impact, global warming, which is also non-site-specific; and
- All units of $CO_2e$ can be considered to have the same impact no matter where they are emitted.

Therefore, assessment of the effects of the Marine Scheme on climate is limited to quantification of the magnitude of GHG emissions, from individual sources and in total, and comparisons of these to the baseline. Different GHGs have different global warming potentials, and to account for this they will be reported throughout this assessment as their $CO_2e$ value.

## 4.1. GUIDANCE

The assessment has been undertaken in accordance with the following guidance:

- IEMA (2022) Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance; and
- PAS 2080: Carbon Management in Infrastructure.

## 4.2. IMPACTS TO BE ASSESSED

Table 4-1 presents the elements included in the assessment, including their data sources.

**Table 4-1 – Elements Included in the Assessment for the Marine Scheme**

| Phase | GHG Emission Sources | Data Sources |
|---|---|---|
| Site Preparation and Construction | Embodied $CO_2e$ emissions of construction materials, including emissions from raw material extraction through manufacture | Estimates of construction materials and quantities were provided by the Cambois Connection design team |
| | Emissions associated with the transportation of construction materials to the Marine Scheme | Source locations of materials are not yet known so reasonable worst case scenario estimates have been made |
| | Emissions associated with construction activities from vessels | Data provided by the Applicant based on Cambois Connection design as presented in Volume 2, Chapter 5: Project Description |
| | Emissions associated with the transfer of employees to and from the site | Data provided by the Applicant based on Cambois Connection design as presented in Volume 2, Chapter 5: Project Description |
| Operation and Maintenance | Emissions associated with vessel movements during the operations and maintenance phase to and from the site | Data provided by the Applicant based on Cambois Connection design as presented in Volume 2, Chapter 5: Project Description |
| | Emissions associated with replacement of cable components | Data provided by the Applicant based on Cambois Connection design as presented in Volume 2, Chapter 5: Project Description |
| Decommissioning | Emissions associated with the waste and recycling processes of the Marine Scheme's materials | Quantity and type of decommissioned material assumed to be the same as the materials used in construction |

| Phase | GHG Emission Sources | Data Sources |
|---|---|---|
| | Emissions associated with the decommissioning activities from plant and vessels | Plant and vessel requirements are assumed to be the same as those required during the construction phase |
| | Emissions associated with the transportation of decommissioned materials | End-of-life locations of materials are not yet known so reasonable worst case scenario estimates have been made |

Table 4-2 presents the elements not included in the assessment for the Marine Scheme, and the justification for their exclusion. The elements excluded are not anticipated to materially affect the outcomes resulting from this assessment. It is considered that the elements not included in the assessment would not contribute to more than 5% of total GHG emissions. This is in line with a proportionate approach which considers that where expected GHG emissions are less than 1% of total GHG emissions they can be excluded from assessment, provided that the combined exclusions are not more than a maximum of 5% of total GHG emissions, in accordance with IEMA guidance.

**Table 4-2 – Elements Not Included in Assessment for the Marine Scheme**

| Phase | GHG Emission Sources | Justification |
|---|---|---|
| Site Preparation and Construction | Emissions from the collection, treatment and disposal of solid waste | It is anticipated that the quantity of solid waste produced from the construction phase is minor and would account for <1% of total emissions. |
| | Emissions associated with employee travel (terrestrial) to the port | Data for the travel of employees to the site is not available at this stage. It is considered that emissions would be <1% of total emissions based on professional judgement from assessment of other projects. |
| Operation and Maintenance | Emissions from the collection, treatment, and disposal of solid waste | It is anticipated that the quantity of solid waste produced during operation is negligible and therefore has been scoped out. |
| | Emissions from the treatment of liquid effluent from staff on site | It is anticipated that the quantity of liquid waste produced during operation is negligible and therefore has been scoped out. |
| | Emissions associated with employees commuting to and from the port (this excludes travel from port to the Marine Scheme) | The anticipated volume of employee commuting is not yet known for the site nor where the employees would be locating from. It is considered that emissions would be <1% of total emissions based on professional judgement from assessment of other projects. |
| Decommissioning | Emissions associated with employee travel (terrestrial) to the port | Data for the travel of employees to the site is not available at this stage. It is considered that emissions would be <1% of total emissions based on professional judgement from assessment of other projects. |

| Phase | GHG Emission Sources | Justification |
|---|---|---|
| Site Preparation, Construction, Operation and Maintenance, and Decommissioning | GHG emissions resulting from the loss of carbon stored in subsea sediments (blue carbon) | Scoped out in accordance with the Scoping Report and NatureScot's comment on this matter in the Scoping Opinion (see Table 1-1). |

## 4.3. CALCULATING CONSTRUCTION GHG EMISSIONS

The design data for the assessment has been provided by the Applicant and reflects the Applicant's design of the Marine Scheme at this stage, in accordance with the Project Design Envelope (PDE) approach followed by the Applicant for the Marine Scheme ES (see Volume 2, Chapter 5: Project Description).

A quantification of construction phase GHG emissions has been calculated using the Atkins' Carbon Knowledgebase tool, which contains a detailed library of calculation formulae and over 1,000 emissions factors from authoritative sources such as the Inventory of Carbon and Energy (ICE, versions 1.6(a), 2.0 and 3.0) (Circular Ecology, 2022), the Department for Environment, Food and Rural Affairs (Defra) Greenhouse Gas Reporting Conversion Factors (Defra, 2022), and the EMEP/CORINAIR Emission Inventory Guidebook (EMEP/EEA, 2019). The tool calculates the construction phase emissions in accordance with PAS 2080: Carbon Management in Infrastructure, the international standard for assessing carbon emissions throughout a project's lifecycle.

It is not yet known at this stage where materials will be sourced from. Therefore, the following assumptions have been made using the RICS (2017) guidance:

- Export Cable components (Globally sourced) – 10,000km by sea, 200km by road;
- Cable protection components (Nationally sourced) – 300km by road;
- Cable ducts (Nationally sourced) – 300km by road;
- Cable crossing protection (Nationally sourced) – 300km by road; and
- Decommissioned materials (Nationally disposed or recycled) – 300km by road.

Several components of the Marine Scheme do not have a detailed design at this stage. Where it has not been possible to identify the material composition of Marine Scheme components, conservative assumptions have been made. Assumptions regarding the construction phase GHG emissions are listed in Section 4.7.

## 4.4. CALCULATING OPERATION AND MAINTENANCE GHG EMISSIONS

The operation and maintenance phase of the Marine Scheme has two key areas:

- Operational electricity, water, and material consumption; and
- Maintenance and repair.

The Marine Scheme as part of the Cambois Connection will transfer electricity from BBWF to the National Grid Blyth substation. Therefore the Marine Scheme will not require any operational energy to operate.

For the Marine Scheme, it is assumed that the Offshore Export Cables will need replacing along an estimated 1,000m of its total length for four repair events during the lifetime of the Marine Scheme.

The number of maintenance vessels and their respective trips for the Marine Scheme has been calculated by the design team and modelled as part of this assessment on the worst-case assumption that all these vessels will require diesel fuel to operate initially. However, a decarbonisation rate has been applied which allows for a year on year decrease in emissions reflecting the decarbonisation of the shipping sector as it reaches net zero in 2050. This is noted below in section 4.7. A quantification of operation and maintenance GHG emissions has been calculated using the Atkins' Carbon Knowledgebase tool, as described above in section 4.3.

## 4.5. CALCULATING DECOMMISSIONING GHG EMISSIONS

The decommissioning phase of the Marine Scheme has three key areas:

- Breakdown and removal of material from the site;

- Transportation of material to waste facilities;
- Treatment of waste material.

At the moment there is limited information available about the exact processes required to decommission the Marine Scheme. It is likely that by the time the Marine Scheme is decommissioned the processes will be different from those currently practiced as decommissioning is not expected to take place until 2065 at the earliest. Therefore broad assumptions have been made to model the emissions that could arise during the decommissioning phase.

It is assumed that the vessel movements and plant used to decommission the Marine Scheme are the same as those in the construction phase. However, given that decommissioning will take place from 2065, i.e. 15 years and 20 years after net zero targets should have been achieved in accordance with UK and Scottish net zero targets respectively (refer to section 2), all vessels and plant are assumed to have net zero emissions. This is a fair assumption given that the same quantity of material needs to be taken from the site as was added in the first place and that net zero emission vessels will likely have been operating for at least 15 years, in accordance with assuming decarbonisation of the shipping sector during the course of the operation and maintenance phase.

The same assumption is used for the on-land transportation of materials which will be transported to nationally based waste facilities (300km distance using RICS, 2017 guidance).

As details on waste management are not available at this stage (refer to Volume 3, Chapter 5: Project Description), all decommissioned materials are assumed to be disposed of in landfill and not recycled. This would represent a worst-case scenario for the materials.

## 4.6. SIGNIFICANCE ASSESSMENT

The method of assessment of whether the calculated GHG emissions from the Marine Scheme will have a significant effect on climate has been determined in accordance with IEMA's 2022 guidance. There is no legal limit for GHG emissions for any one development. The guidance suggests that the level of significance should be related to how a project contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050, or 2045 for Scotland, as stated in section 6.2 of the guidance: "*The crux of significance…is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050 (or other date as defined in targets for devolved administrations)*."

The IEMA 2022 guidance document notes that practitioners need to consider whether project GHG emissions are aligned to achieving net zero by 2050, using the science based 1.5°C trajectory. Where this is not the case, then the effects are judged to be moderate adverse or major adverse, and thus can be classed as a significant effect. Projects that are compatible with the trajectory can have their effects classed as minor adverse, or where the project achieves GHG emission mitigation that goes beyond the trajectory, negligible. In both cases, the effects are not considered to be significant. Projects that result in GHG emissions being avoided or removed from the atmosphere can be considered to have a significant beneficial effect. The IEMA 2022 guidance notes that the UK 2050 target for net zero and interim carbon budgets are considered by the UK Climate Change Committee to be compatible with the required trajectory.

The percentage contribution of the Marine Scheme to the national carbon budgets has been determined in accordance with IEMA 2022 guidance on significance. Although the IEMA guidance suggests that, for context, it would be good practice to consider a project's GHG emissions in relation to sector-based targets, there are currently no sector budgets for electricity transmission or generation or any other sector provided by the UK Climate Change Committee, the body responsible for developing the UK and devolved administrations' carbon budgets. Sector-based targets have therefore not been considered in accordance with current UK legislation.

As the Marine Scheme is split across both Scottish and English jurisdictions, the calculations of GHG emissions have been presented as a total and as relevant to each jurisdiction. However, the assessment of significance of the total GHG emissions as a result of the Marine Scheme has been undertaken by comparing the total emissions with the UK carbon budgets, as the Marine Scheme would be constructed and operated in its entirety. Hence, the GHG emissions produced by the Marine Scheme in Scottish waters would not occur without the GHG emissions arising from the Marine Scheme in English waters and vice versa.

## 4.7. LIMITATIONS AND ASSUMPTIONS

The key limitation of the assessment is the information available within the Project Design Envelope for the Marine Scheme to enable estimations of GHG emissions at the time of the assessment. This has required assumptions

to be made, and some industry standard data to be used as a proxy. The following assumptions have been made during the carbon assessment:

- Carbon factors are drawn from the Inventory of Carbon and Energy (ICE versions 2.0 and 3.0);
- The Offshore Export Cables will be made up of 4 cables each approximately up to 180km long, with up to 140km of the Offshore Export Cable route in English waters and up to 40km in Scottish waters;
- The Offshore Export Cables' core material will be aluminium rather than copper, as a worst-case scenario;
- Emissions from construction vessel movements, plant usage, and employee transportation (from port to offshore sites) for the Offshore Export Cables were calculated using a 3.5:1 ratio[8], based on the proportion of the Offshore Export Cable route's length in each of the English and Scottish waters (140 km and 40 km respectively);
- Transportation of materials has been modelled using RICS (2017) guidance. See Section 4.3.
- Rock bags, using virgin rock material, will be used as Offshore Export Cable protection material, as a worst-case scenario;
- The Marine Scheme is expected to start construction phase works in Q4 2026 ending in Q4 2029. Further details are available in Volume 2, Chapter 5: Project Description.
- Commissioning of the Cambois Connection and hence of the Marine Scheme is planned to commence in 2030;
- The Cambois Connection and hence the Marine Scheme will be operational for 35 years;
- GHG emissions from shipping will decrease at a steady rate year-on-year until reaching net zero in 2050 due to the anticipated decarbonisation of shipping vessels in line with the UK government's net zero legislation (UK Chamber of Shipping, undated);
- It is assumed as a worst case that all fuel used in vessels operating at the Marine Scheme will be diesel in the Marine Scheme's first year of construction, and a year-on-year decarbonisation rate has been applied to these vessels as required to reach the UK Government's net zero by 2050;
- It is assumed that there will be up to four major Offshore Export Cable repair events of up to 1,000m each over the lifetime of the Marine Scheme. It is therefore assumed a maximum of 4,000m of the Offshore Export Cable will be replaced over 35 years.
- Decommissioning vessel movements, plant usage and employee transportation (from port to offshore sites) will be the same as those during the construction phase;
- All decommissioning vessels and plant will have net zero emissions in accordance with assuming decarbonisation of the shipping sector during the operation and maintenance phase (refer to Section 4.5); and
- All decommissioned materials will be sent to landfill, as a worst-case assumption (refer to section 4.5).

[8] Ratio derived from 140/40 = 3.5

# 5. ASSESSMENT

## 5.1. CONSTRUCTION

An assessment of the construction phase GHG emissions has been carried out based on the elements scoped into the assessment (refer to section 4.2) and the assumptions made (refer to section 4.7). The results in Table 5-1 provide the predicted GHG emissions arising from construction phase of the Marine Scheme.

The Marine Scheme is estimated to generate 241,586 $tCO_2e$ during the construction phase. The greatest quantity of GHG emissions are derived from the embodied carbon resulting from the production of the materials.

**Table 5-1 – Marine Scheme Construction Phase GHG Emissions**

| Component Category | Sub-component Category | GHG Emissions ($tCO_2e$) |
|---|---|---|
| Materials | Offshore Export Cables | 142,934.3 |
| | Cable Protection (Rock) | 20,927.6 |
| | Crossing Protection (Rock) | 1,172.3 |
| | Landfall: Offshore Cable Ducts | 5,743.7 |
| | **Subtotal** | **170,777.9** |
| Transportation | Offshore Export Cables | 1,986.3 |
| | Cable Protection (Rock) | 49,696.9 |
| | Crossing Protection (Rock) | 2,783.9 |
| | Landfall: Cable Ducts | 52.8 |
| | **Subtotal** | **54,519.9** |
| Construction Activities | Construction Fuel Consumption | 16,287.9 |
| | **Subtotal** | **16,287.9** |
| **Total** | | **241,585.7**[9] |

## 5.2. OPERATION AND MAINTENANCE

An assessment of the operational and maintenance phase GHG emissions has been carried out based on the elements scoped into the assessment (refer to section 4.2) and the assumptions made (refer to section 4.7). These GHG emissions are shown in Table 5-2.

Maintenance vessels will transit between port and site during the operation and maintenance phase of the Marine Scheme. These vessels will begin this process in the first year of operation. During this first year, up to 277.9 $tCO_2e$ GHG emissions will be generated. It is assumed that the shipping sector will decarbonise at a steady rate in line with the UK Government's net zero target and will be net zero by 2050.

Additionally, emissions will be generated by the replacement of sections of the Offshore Export Cable over its 35-year operational lifespan. It is assumed that there will be up to four separate events where up to 1,000m of

[9] The construction phase GHG emissions for the Marine Scheme are lower than what had been predicted when the Marine Scheme was assessed cumulatively with BBWF in the Climate Assessments Report for BBWF (SSER, 2022c). As the Marine Scheme was only at the Scoping stage at the time, assumptions were made for the Marine Scheme during the BBWF assessment based on the design information available at the time. The design of the Marine Scheme has progressed since the BBWF assessment, with the design parameters and assumptions now being more refined.

Offshore Export Cable will need to be replaced. Each replacement of cable and the vessel fuel consumption involved will cause up to 209.9 $tCO_2e$ to be emitted.

**Table 5-2 – Operation and Maintenance Phase GHG Emissions**

| Component Category | Sub-component Category | Operating Lifetime GHG Emissions ($tCO_2e$) |
|---|---|---|
| Key component replacement | Replacement of Offshore Export Cables | **793.6** |
| | Fuel consumption | **45.9** |
| Maintenance vessel transit | Fuel consumption | **2,917.5** |
| **Total** | | **3,757.0** |

## 5.3. DECOMISSIONING

An assessment of the decommissioning phase GHG emissions has been carried out based on the elements scoped into the assessment (refer to section 4.2) and the assumptions made (refer to section 4.7). These emissions are shown in Table 5-3. The Marine Scheme is estimated to generate up to 3,176 $tCO_2e$ during the decommissioning phase. All of the emissions are generated during the disposal and processing of the materials to landfill. All decommissioning vessels and plant are assumed to have net zero emissions in accordance with assuming decarbonisation of the shipping sector during the operation and maintenance phase (refer to Sections 4.5 and 4.7).

**Table 5-3 – Decommissioning Phase GHG Emissions**

| Component Category | Sub-component Category | GHG Emissions ($tCO_2e$) |
|---|---|---|
| Decommissioning | Waste disposal and processing | 3,176.1 |
| **Total** | | **3,176.1** |

## 5.4. TOTAL EMISSIONS OF THE MARINE SCHEME

Overall, the total GHG emissions resulting from the construction, operation and maintenance, and decommissioning of the Marine Scheme will be up to 248,519 $tCO_2e$ and are shown in Table 5-4.

**Table 5-4 – Marine Scheme Lifecycle GHG Emissions**

| Lifecycle Stage | GHG Emissions ($tCO_2e$) |
|---|---|
| Construction | 241,585.7 |
| Operation and Maintenance | 3,757.0 |
| Decommissioning | 3,176.1 |
| **Total** | **248,518.8** |

### 5.4.1. EMISSIONS WITHIN THE SCOTTISH JURISDICTION

Up to 40km of the Offshore Export Cable route and associated cable protection is located within the part of the Marine Scheme located in Scottish offshore waters. As mentioned in Section 4.7, it is assumed that the total construction vessel movements, plant usage and employee transport emissions associated with the Offshore Export Cable route are split in a 3.5:1 ratio between the parts of the Marine Scheme in English waters and the part of the Marine Scheme in Scottish waters.

Emissions from the Marine Scheme that arise from activities within Scottish offshore waters are presented in Table 5-5.

**Table 5-5 – Marine Scheme GHG Emissions within the Scottish Jurisdiction**

| Lifecycle Stage | GHG Emissions ($tCO_2e$) |
|---|---|
| Construction | 50,266.3 |
| Operation and Maintenance | 835.2 |
| Decommissioning | 706.0 |
| **Total** | **51,807.5** |

### 5.4.2. EMISSIONS WITHIN THE ENGLISH JURISDICTION

Up to 140km of the Offshore Export Cable route and associated cable protection is located within the part of the Marine Scheme located in English inshore and offshore waters along with the cable crossing protection and Landfall cable ducts. As mentioned in Section 4.7, it is assumed that the total construction vessel movements, plant usage and employee transport emissions associated with the Offshore Export Cable route are split in a 3.5:1 ratio between the parts of the Marine Scheme in English waters and the part of the Marine Scheme in Scottish waters.

Emissions from the Marine Scheme that arise from activities within English inshore and offshore waters are presented in Table 5-6.

**Table 5-6 – Marine Scheme GHG Emissions within the English Jurisdiction**

| Lifecycle Stage | GHG Emissions ($tCO_2e$) |
|---|---|
| Construction | 191,319.5 |
| Operation and Maintenance | 2,921.8 |
| Decommissioning | 2,470.4 |
| **Total** | **196,711.7** |

### 5.4.3. COMPARISON TO UK CARBON BUDGETS

The Applicant is committed to reducing GHG emissions wherever practicable and to supporting the UK and Scottish Governments in meeting their carbon reduction targets.

It is assumed that the construction phase takes place in stages from 2026 to 2029 and that the GHG emissions resulting from this phase are spread evenly over these stages. This period falls over the 4$^{th}$ (2023-2027) and 5$^{th}$ (2028-2032) carbon budgets of the UK Government.

The Marine Scheme will operate during the 5$^{th}$ (2028-2032) and 6$^{th}$ (2033-2037) carbon budget periods. The operation and maintenance phase will extend until after the Scottish Government's 2045 and the UK Government's 2050 net zero target date. The decommissioning phase will occur after the net zero target dates and emissions from this phase are therefore not included in the table below.

Table 5-7 shows the proportion of the relevant carbon budgets that the Marine Scheme would contribute to the UK Government's 5-year budget periods.

**Table 5-7 – Comparison of Marine Scheme to UK Government Carbon Budgets ($tCO_2e$)**

| Project Stage | Relevant Carbon Budget | | | |
|---|---|---|---|---|
| | 4th (2023-27) | 5th (2028-32) | 6th (2033-37) | 2038-2050 |
| **UK Government Carbon Budget** | **1,950,000,000** | **1,725,000,000** | **965,000,000** | **n/a** |
| Marine Scheme construction GHG emissions | 92,918 | 148,668 | - | - |
| Marine Scheme Operation and Maintenance GHG emissions | - | 792 | 1,042 | 1,084 |
| **Total GHG emissions** | **92,918** | **149,460** | **1,042** | **1,084** |
| Percentage of UK Government carbon budget | 0.005% | 0.009% | 0.0001% | N/A |

Note: This table does not include the GHG emissions resulting from the replacement of cable components as it is not known at this stage when any replacements might take place and hence into which of these carbon budgets (5th and 6th budget) they might fall, if in any.

Table source: Advice on reducing the UK's emissions - Climate Change Committee (theccc.org.uk)

## 5.5. ASSESSMENT OF SIGNIFICANCE

The GHG emissions from the construction phase of the Marine Scheme do not contribute more than 0.009% to any of the UK carbon budgets that fall within this phase.

The GHG emissions from the operation and maintenance phase of the Marine Scheme do not contribute more than 0.0001% to any UK carbon budgets that fall within this phase.

The GHG emissions from the decommissioning phase of the Marine Scheme do not contribute to any UK carbon budget as these emissions fall after the UK Government's net zero target to be met by 2050.

Overall, the assessment has found that the Marine Scheme will emit a total of 248,518.8 $tCO_2e$ during its lifetime. These emissions do not contribute more than 0.009% to any of the UK carbon budgets that are currently set and fall with the Marine Scheme's construction and operation and maintenance phases, which amounts to a very small proportion of the carbon budgets. Therefore, using professional judgement, it is considered that the GHG emissions from the Marine Scheme during the construction and operation and maintenance phases will at no point impact the UK Government's ability to meet its carbon budgets. The UK carbon budgets align with the GHG emissions reduction trajectory required to limit warming to 1.5°C, in line with IEMA guidance (2022) for determining significance, as noted in section 4.5. Therefore, the Project can be considered to have a **non-significant, minor adverse effect on the climate during the construction and operation and maintenance phases.** Furthermore, given the low quantity of emissions the Marine Scheme is estimated to generate as a worst case during decommissioning after the net zero targets have been met, the Marine Scheme is considered to have a **non-significant, minor adverse effect** during the decommissioning phase.

## 5.6. CUMULATIVE EFFECTS

The effects of GHG emissions are essentially inherently cumulative; it is their concentration in the atmosphere, not the actual level of GHG emissions, that determines the warming effect (i.e. it is the 'stock' rather than the 'flow' which is important). In addition, it is the global excess of GHG emissions from human activities all over the world that contributes to the overall effect on climate, not only local GHG emissions. And it is the global atmosphere that is the receptor for these GHG emissions. For these reasons, the impact of the Project should be considered in the context of overall GHG emissions from the UK. As noted in the IEMA guidance (2022), the effects of GHG emissions from specific cumulative projects should not be individually assessed as there is no basis for selecting any particular project over any other.

The Marine Scheme is one part of the Cambois Connection which also includes an Onshore Scheme that allows for the Marine Scheme to connect to the National Grid Blyth substation (Volume 2, Chapter 5: Project Description). Both the Marine Scheme and the Onshore Scheme need to be constructed for the Cambois Connection to operate as intended. Therefore a cumulative assessment of the GHG emissions for the Onshore Scheme has been undertaken and is presented here. The Onshore Scheme is due to be constructed from 2025 to 2030 and will begin operation in the same year as the Marine Scheme.

The Onshore Scheme will emit up to 73,435.3 $tCO_2e$ during its lifetime[10].

The BBWF will produce the electricity that the Cambois Connection (Marine Scheme and Onshore Scheme) will export to the National Grid. The BBWF will be constructed between 2025 and 2032 which overlaps with the construction phase of the Cambois Connection. The Marine Scheme would only be constructed and subsequently operated if BBWF is also constructed and operated. Since the Marine Scheme is therefore connected to BBWF, a cumulative assessment of the GHG emissions associated with the BBWF together with the Marine Scheme and the Onshore Scheme of the Cambois Connection is presented here in order to provide a precautionary, worst-case assessment of potential GHG emissions.

BBWF will emit a total of 7,678,553 $tCO_2e$ during the lifetime of BBWF project. This data is adapted from the BBWF ES (SSER, 2022b) and includes decommissioning of BBWF. A summary of the calculations for the decommissioning phase are provided below.

An assessment of the decommissioning phase GHG emissions has been carried out based on the materials and components scoped into the BBWF Effects on Climate assessment (SSER, 2022c). The following assumptions have been made for the decommissioning phase of BBWF:

- Decommissioning of BBWF will begin in 2063;
- All materials and components used in the construction of BBWF would be decommissioned, under a worst-case scenario approach, in accordance with the approach to decommissioning set out in the BBWF EIA, Volume 2, Chapter 3: Project Description (SSER, 2022d);
- Decommissioning vessel movements, plant usage and employee transportation will be the same as those during the BBWF construction phase, however all decommissioned vessels and plant will have net zero emissions, given that decommissioning will commence in 2063, i.e. 13 years and 18 years after net zero targets should have been met in accordance with Scottish and UK Government targets for net zero by 2045 and 2050 respectively (refer to section 2, and which are also set out in the BBWF Climate Assessments Report (SSER, 2022c)), and hence by assuming decarbonisation of the shipping sector has occurred by 2050 during the operation and maintenance phase, in accordance with the assumptions made for the Marine Scheme (refer to sections 4.5 and 4.7) and which has also been assumed in the BBWF Climate Assessments Report (SSER, 2022c);
- Third party vessels, which will have to travel longer distances due to potential diversion of shipping routes around the BBWF array area during BBWF's decommissioning, will have net zero emissions. This is based on the assumption that decarbonisation of the shipping sector will occur by 2050, in accordance with the assumption made in the BBWF Climate Assessments Report that the shipping sector will decarbonise by 2050 during the course of the operation and maintenance phase (SSER, 2022c); and
- As details on waste management are not available at this stage (SSER, 2022d and SSER, 2022e), all decommissioned materials are assumed to be sent to landfill, as a worst-case assumption.

The emissions BBWF is estimated to generate during the decommissioning phase are shown in Table 5-8. BBWF is estimated to generate up to 5,854 $tCO_2e$ during the decommissioning phase. All of the emissions are generated during the disposal and processing of the decommissioned materials to landfill under a worst-case scenario.

**Table 5-8 – BBWF Decommissioning Phase GHG Emissions**

| Component Category | Sub-component Category | GHG Emissions ($tCO_2e$) |
|---|---|---|
| Decommissioning | Waste disposal and processing | 5,854 |
| **Total** | | **5,854** |

[10] The emissions for the Onshore Scheme are based on the data currently available and will be reviewed and updated if necessary for the submission of the Onshore ES. However, no significant changes to the magnitude of predicted emissions are expected.

As a result of the inclusion of decommissioning phase emissions, the updated BBWF project lifecycle GHG emissions are shown in Table 5-9. BBWF will emit an estimated 7,678,553 $tCO_2e$ during the project's lifecycle.

**Table 5-9 – BBWF Lifecycle GHG Emissions**

| Lifecycle Stage | GHG Emissions ($tCO_2e$) |
|---|---|
| Construction | 6,260,562 |
| Operation & Maintenance | 1,412,137 |
| Decommissioning | 5,854 |
| **Total** | **7,678,553** |

Table 5-10 compares the cumulative GHG emissions of the Marine Scheme, the Onshore Scheme and BBWF with the UK carbon budgets. As BBWF is due to be constructed between 2025 and 2033 (SSER, 2022d), the cumulative GHG emissions will occur during the 4th, 5th and 6th UK carbon budgets. The combined emissions of the Marine Scheme, the Onshore Scheme and BBWF will release 2,548,059 $tCO_2e$ during the 4th carbon budget, 4,388,687 $tCO_2e$ during the 5th carbon budget and 493,626 $tCO_2e$ during the 6th carbon budget.

**Table 5-10 – Comparison of Cumulative GHG Emissions to UK Government Carbon Budgets ($tCO_2e$)**

| Project | Relevant Carbon Budget | | | |
|---|---|---|---|---|
| | 4th (2023-27) | 5th (2028-32) | 6th (2033-37) | 2038-2050 |
| **UK Government Carbon Budget** | **1,950,000,000** | **1,725,000,000** | **965,000,000** | **n/a** |
| Berwick Bank GHG emissions | 2,441,752 | 4,185,669 | 490,929 | 554,349 |
| Onshore Scheme GHG emissions | 13,389 | 53,558 | 1,655 | 1,782 |
| Marine Scheme GHG emissions | 92,918 | 149,460 | 1,042 | 1,084 |
| **Total cumulative GHG emissions** | **2,548,059** | **4,388,687** | **493,626** | **557,215** |
| Percentage of UK carbon budget | 0.13% | 0.25% | 0.05% | n/a |

The cumulative GHG emissions from the Marine Scheme, the Onshore Scheme and BBWF do not contribute to more than 0.25% of any of the UK carbon budgets that fall within the construction and operation and maintenance phases, which amounts to a very small proportion of the UK carbon budgets. Therefore, it is considered that these cumulative GHG emissions will not impact the UK Government's ability to meet its carbon budgets. The UK carbon budgets align with the GHG emissions reduction trajectory required to limit warming to 1.5°C, in line with IEMA guidance (2022) for determining significance.

Therefore, using professional judgement and the small proportion of the carbon budgets that the three projects contribute to, the GHG emissions resulting cumulatively from the Marine Scheme, Onshore Scheme and BBWF are considered to have a **non-significant, minor adverse cumulative effect** on the climate during the **construction phases** of all three projects.

There are currently no carbon budgets set beyond 2038 when BBWF, the Marine Scheme and the Onshore Scheme will still be operating and when their decommissioning phases occur. However, using professional judgement and given the low quantity of emissions these three projects are estimated to generate during their decommissioning phases after 2050, BBWF, the Marine Scheme and Onshore Scheme are considered to have **a non-significant, minor adverse cumulative effect on the climate during the decommissioning phases.**

The inclusion of BBWF's low-carbon energy generation capabilities changes the significance of the cumulative effect on the climate during the operation and maintenance phases of all three projects. The generation of low-carbon energy from BBWF will result in less energy being produced from high-carbon energy sources (i.e. fossil fuel sources). Therefore BBWF will save 10,815,010 $tCO_2e$[11] from being emitted into the atmosphere that otherwise would have been emitted from these conventional, higher-carbon forms of energy generation (CCC, 2013). Taking into account this saving results in an **overall cumulative saving of 4,226,640 $tCO_2e$** from being emitted into the atmosphere during the lifecycle of the Marine Scheme, Onshore Scheme and BBWF. The saving would begin during the UK's 5th carbon budget and would continue for 35 years.

In line with the IEMA guidance (2022), the saving provided by BBWF will result in an **overall significant beneficial effect** on the climate from these cumulative effects, which would not be achievable without the Cambois Connection.

## 5.7. MITIGATION MEASURES

Mitigation against effects on climate is the reduction in GHG emissions released in association with the Marine Scheme during the construction, operation and maintenance and decommissioning phases. Mitigation should follow the carbon reduction hierarchy in PAS 2080:2023: Avoid, Switch, Improve. Mitigation should be applied to the Marine Scheme where practicable, however, these measures do not need to be implemented for the likely significant assessment outcomes in Section 5.6 to be met. Their implementation would result in further GHG emissions savings.

Mitigation measures set out in Table 5-11 require consideration to reduce GHG emissions resulting from construction activities.

**Table 5-11 – Mitigation Measures during Construction**

| Life Cycle Module | Sub-component | Mitigation Measures |
|---|---|---|
| Materials | Onshore | Reduction of materials consumption should be carried out, where practicable, in line with any design changes. In addition, consideration should be given to alternative low carbon materials e.g. recycled aggregates, cement substitution etc. |
| | Offshore | Low carbon alternatives should be investigated for the key bulk materials that make up the cable components, particularly aluminium, steel, and plastics. The design team should work with the supply chain to identify possible alternative materials that could replace these key components. |
| Transport | Materials | Transportation of materials should be reduced by reducing the quantity of materials required, where practicable. Additionally, where practicable, detailed design and procurement measures should be specified to reduce the necessity to source materials from long distances. |
| Construction Processes | Construction plant use | Construction plant GHG emissions should be avoided and reduced by designing for efficient construction processes as part of design development. During construction, plant GHG emissions should be managed via a Construction Environmental Management Plan (CEMP), which should specify plant operator efficiency requirements. |
| | Construction water use | Construction water consumption should be reduced by designing for efficient construction processes as part of design development. During construction mains water |

[11] This number is higher than in the BBWF Climate Assessments Report (SSER, 2022c) due to the use of an updated, more appropriate load factor of 46.9% taken from the ESO (2022).

| Life Cycle Module | Sub-component | Mitigation Measures |
|---|---|---|
| | | consumption should be managed via a CEMP, which should specify reduction and reuse measures, where practicable. |
| | Construction waste transportation | Avoidance and reduction of waste generation and hence waste transport should be carried out in accordance with the mitigation measures outlined in a CEMP. |
| | Construction waste off-site processing | Avoidance and reduction of waste generation and hence off-site waste processing should be carried out in accordance with the mitigation measures outlined in a CEMP. |
| | Employee commuting | Local contractors should be used where practicable, reducing the distance driven by employees. Public transport or low carbon options should be encouraged. |
| | Construction vessel movement | Reduce the volume of marine fuel consumed through efficient planning of vessel movements, reducing the distance that construction vessels travel during the construction phase. |
| | Construction vessel fuel | Identify whether there are opportunities to use more fuel-efficient vessels, alternative, lower-carbon fuels or electric-powered vessels. |

Mitigation measures set out in Table 5-12 should be considered during the operation and maintenance phase to reduce GHG emissions resulting from operation and maintenance activities of the Marine Scheme. The proposed mitigation measures do not need to be implemented for the results and outcomes in Section 5.6 to be achieved but to improve the results further. Several of the mitigation measures are already being considered by the Applicant.

**Table 5-12 – Mitigation Measures during Operation and Maintenance**

| Life Cycle Module | Mitigation Measures |
|---|---|
| Maintenance and repair | The mitigation measures detailed in Table 5-11 for the construction stage also apply to ongoing maintenance and repair. The design of the cable components should be carefully considered to minimise the need for replacement. |
| Operational vessel movement | Reduce the volume of marine fuel consumed through efficient planning of vessel movements, reducing the distance that operational vessels travel during the operational phase. |
| Operational vessel fuel | Identify whether there are opportunities to use more fuel-efficient vessels, alternative, lower-carbon fuels or electric-powered vessels. |

Mitigation measure set out in Table 5-13 should be considered during the decommissioning phase, if decommissioning is required, to reduce GHG emissions resulting from decommissioning activities of the Marine Scheme. The proposed mitigation measures do not need to be implemented for the results and outcomes in Section 5.6 to be achieved but to improve the results further. The mitigation measures in relation to re-use and recycling are already being considered by the Applicant; however any details on waste management are not available at this stage (refer to Volume 3, Chapter 5: Project Description).

**Table 5-13 – Mitigation Measures during Decommissioning**

| Life Cycle Module | Mitigation Measures |
|---|---|
| Opportunities for recycling | Identify whether there are opportunities to increase the recyclability of the materials generated during decommissioning, where practicable. |

| Life Cycle Module | Mitigation Measures |
|---|---|
| Opportunities for waste reduction | Identify whether there are opportunities to decrease the amount of waste generated during decommissioning by increasing the re-use of the materials generated during decommissioning, where practicable. |
| Decommissioning vessel movement | Reduce the volume of marine fuel consumed through efficient planning of vessel movements, reducing the distance that decommissioning vessels travel during the decommissioning phase. |
| Decommissioning vessel fuel | Identify whether there are opportunities to use even more fuel-efficient vessels, alternative, lower-carbon fuels or electric-powered vessels. |

# 6. SUMMARY

The construction of the Marine Scheme will contribute 241,586 $tCO_2e$ of GHG emissions during the construction phase. Once fully commissioned and operational the Marine Scheme will generate 3,757 $tCO_2e$ during its operation and maintenance phase. The Marine Scheme will generate 3,172 $tCO_2e$ of GHG emissions during the decommissioning phase.

The GHG emissions from the Marine Scheme do not contribute more than 0.009% to any of the current UK carbon budgets that fall within its lifetime. Therefore, the Marine Scheme can be considered to have a **minor adverse, non-significant effect on the climate.**

A cumulative assessment was completed for the effects of the Marine Scheme with the Onshore Scheme (and hence for the Cambois Connection as a whole) and with the BBWF on which the implementation of the Cambois Connection and hence the Marine Scheme are dependent. The cumulative assessment shows that the cumulative GHG emissions arising from the Marine Scheme, the Onshore Scheme and BBWF contribute to no more than 0.25% to any of the UK's current carbon budgets.

It is considered that these cumulative GHG emissions at no point will impact the UK Government's ability to meet its carbon budgets. Therefore, the GHG emissions resulting from the cumulative assessment are considered to have a **non-significant, minor adverse cumulative effect** on the climate, which occurs during the overlapping construction phases of the Marine Scheme, the Onshore Scheme and BBWF**.**

The decommissioning phases of the Marine Scheme, the Onshore Scheme and BBWF will occur after the Scottish and UK net zero targets are required to be met. As a worst case, it has been assumed that there will be a small quantity of emissions generated during decommissioning by each project, but that these are considered to have a non-significant minor adverse cumulative effect on the climate during the decommissioning phases.

The inclusion of BBWF's low-carbon energy generation capabilities in the operation and maintenance phase of the cumulative assessment changes the significance of the Marine Scheme's effect on the climate during the operation and maintenance phase. Cumulatively, there will be a **significant beneficial effect** on the climate during the operation and maintenance phases of the Marine Scheme, Onshore Scheme and BBWF due to BBWF's energy production offsetting the need for more conventional, higher-carbon energy generation sources (i.e. fossil fuels). Cumulatively, there will be a saving of 4,226,640 $tCO_2e$ from the generation of energy from BBWF. Cumulatively, there will be an **overall significant beneficial effect** on the climate during the Marine Scheme's lifetime due to these cumulative effects, which would not be achievable without the Cambois Connection.

Without low-carbon energy generation, such as BBWF and the associated required electricity transmission to the National Grid, which the Marine Scheme will support BBWF in delivering, the average grid GHG intensity will not decrease as is projected, which could adversely affect the UK's and Scotland's ability to meet their carbon reduction targets.

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