12 CLIMATE CHANGE

Introduction

12.1.1 This chapter provides an assessment of potential impacts of the Project on climate change.

12.1.2 Climate change in the context of new development is typically considered in two parts: the impact of greenhouse gas emissions (GHGs) caused directly or indirectly by the Project, which contribute to climate change; and risks to the new development caused by the changing climate, or changes in the sensitivity or resilience of receptors due to climate change that in turn influence the significance of other environmental effects of the new development on those receptors.

12.1.3 This chapter provides an assessment of potential impacts on climate change. As set out in Chapter 4 and in the consultation section of this chapter, assessment of climate risks has been scoped out of the EIA.

12.1.4 GHG emissions are normally expressed as carbon dioxide equivalents, explained in the methodology section below, and are therefore often referred to as 'carbon' as a shorthand (e.g., when speaking of 'low-carbon power' or 'carbon reduction targets').

12.1.5 This chapter has been prepared by RPS, as competent experts.

Assessment Methodology

Climate Change Policy & Legislation Review

12.1.6 The following relevant planning policy has been considered in relation to this development.

12.1.7 Local Policy & Legislation

- North Ayrshire Local Development Plan 2 (LDP2) (2019); and
- North Ayrshire Council (2021): Environmental Sustainability & Climate Change Strategy 2021 – 2023.

12.1.8 Scottish Policy & Legislation

- Climate Change (Scotland) Act 2009 as amended (2019);
- The National Planning Framework (NPF) for Scotland (2014);
- The Draft National Planning Framework 4 (NPF4) for Scotland (Scottish Government, 2021);
- Scottish Planning Policy (SPP) (Scottish Government, 2020a); and
- Securing a green recovery on a path to net zero: climate change plan 2018–2032 (Scottish Government, 2020b).

12.1.9 UK wide Policy and Legislation

- Climate Change Act (2008);
- The Sixth Carbon Budget: The UK's Path to Net Zero, 2020;
- Net Zero Strategy, 2021;
- Clean Growth Strategy, 2017;
- Energy White Paper: Powering Our Net Zero Future, 2020; and
- National Infrastructure Strategy, 2020.

Local Policy & Legislation

North Ayrshire Local Development Plan 2 (LDP2) (2019).

12.1.10 A focus of LDP2 is introducing "*Policies aimed at reducing our carbon emissions and adapting to climate change. Subject Policies include Heat and Electricity, Waste and Minerals Development.*"

12.1.11 **Policy 3** directly highlights Hunterston as a strategic development area, stating: "*We recognise the strategic national importance of Hunterston as an energy hub and deep-water port. We strongly support the inclusion of Hunterston in the National Planning Framework 4. In particular we will support the following uses:*

- *Renewables generation, manufacture, maintenance, research and development, testing and training (including support for a renewables skills academy)*
- *Strategic grid connections recognising its importance as a landfall to support the offshore renewable energy sector*"

12.1.12 **Policy 29** references Energy Infrastructure development, stating:

"We will support development proposals for energy infrastructure development, including wind, solar, tidal, cropping and other renewable sources, where they will contribute positively to our transition to a low carbon economy and have no unacceptable adverse environmental impacts"

North Ayrshire Council (2021): Environmental Sustainability & Climate Change Strategy 2021 – 2023

12.1.13 The Hunterston Strategic Development Area is identified in the Scottish National Planning Framework and recognised as one of the UKs most important strategic energy locations.

"The imminent decommissioning of all nuclear stations at Hunterston alongside a cessation of handling of carbon fuels within Hunterston means it is at a crossroads in its transition from an energy hub with a significant environmental footprint to a UK centre for clean energy production, supporting clean/blue/circular economy uses and the development of a net zero industrial location." (Page 21)

"The UK Government recognises the strategic importance of Hunterston and £18m has been secured through Ayrshire Growth Deal to develop centres of excellence in innovation, advanced technologies and applied research with a focus on the blue and green economies including low carbon energy /circular economy/aquaculture/advanced manufacture and the servicing of assets for the offshore wind and renewable energy sector." (Page 21)

Scottish Policy & Legislation

Climate Change (Scotland) Act 2009 as amended (2019)

12.1.14 Climate Change (Scotland) Act 2009 as amended (2019) commits the Scottish government to reducing greenhouse gas emissions by 100% of 1990 levels by 2045. The act has a secondary objective of improving transparency by:

- Measuring progress to targets without adjusting for the operation of emissions trading schemes;
- Specifying all targets as percentage reductions from the baseline;
- Aligning the levels of annual, interim and 2050 targets and ensuring they remain aligned (under the 2009 Act, there is both an interim and annual target for 2020, and they have diverged);

- Changing the default position on the use of international offset credits so that they cannot be used without laying secondary legislation, as opposed to the current situation where future use is reviewed every five years; and
- Reducing the extent to which changes in emissions measurement science can influence whether a target is met or missed.

The National Planning Framework (NPF) for Scotland (2014)

12.1.15 The National Planning Framework (NPF) for Scotland provides four planning outcomes that explain how planning should support each vision, focusing on developing a sustainable place, a low carbon place, a natural and resilient place, and a more connected place.

12.1.16 The NPF demonstrates the planning ambition to make Scotland a successful, sustainable place. It highlights the need to ensure that development facilitates adaptation to climate change, reduces resource consumption and lowers greenhouse gas emissions.

12.1.17 Through the vision for a low carbon place, the NPF commits the Scottish Government to achieving an 80% reduction in greenhouse gas emissions by 2050. It highlights the need for planning to facilitate the maintenance of secure energy supplies, improved energy efficiency and to further diversify the energy supplies that will be required.

"The Scottish Government's Land Use Strategy sets out key principles for the use and management of Scotland's land. It emphasises that land use should deliver multiple benefits and encourages us to make best use of assets to support primary activities including food production, flood management and carbon storage."

Scottish Planning Policy (SPP) (Scottish Government, 2020a)

12.1.18 According to the SPP, the planning system should "support economically, environmentally and socially sustainable places by enabling development that balances the costs and benefits of a proposal over the longer term."

12.1.19 It identifies policies and commitments within the subject of "a low carbon place", specifically for delivering heat and electricity. The SPP states that planning must facilitate the transition to a low carbon economy. Key Policy Principles include:

- Support the change to a low carbon economy, consistent with national objectives and targets, including achieving:
  - 30% of overall energy demand from renewable sources by 2020;
  - 11% of heat demand from renewable sources by 2020; and
  - the equivalent of 100% of electricity demand from renewable sources by 2020.
- Support the development of electricity generation from a diverse array of renewable energy sources/technologies, including the expansion of renewable energy generation capacity.
- Reduce the emissions and energy usage in new buildings and infrastructure by enabling development that contributes to:
  - Energy efficiency;
  - Heat recovery;
  - Efficient energy supply and storage; and
  - Electricity and heat from renewable sources.

Securing a green recovery on a path to net zero: climate change plan 2018–2032 (Scottish Government, 2020b)

12.1.20 This report is an update on the 2018 Climate Change Plan, committing to reduce emissions by 75% by 2030 and to net zero by 2045. This Plan sets out the approach to delivering a green recovery and shows the path to achieving the Scottish Government's climate change targets.

12.1.21 It emphasises the ambition for Scotland to continue to export large amounts of clean electricity to the rest of the UK, supporting carbon emissions reductions across the UK. The Scottish Government also ensure the need to address the substantial challenges of maintaining security of supply and a resilient electricity system.

12.1.22 Key Policies and commitments include:

- "*Support the development of a wide range of renewable technologies by addressing current and future challenges, including market and policy barriers;*
- *Support improvements to electricity generation and network asset management, including network charging and access arrangements that encourage the deployment and viability of renewables projects in Scotland;*
- *A new renewable, all energy consumption target of 50% by 2030, covering electricity, heat and transport; and*
- *Support the development of technologies which can deliver sustainable security of supply to the electricity sector in Scotland and ensure that Scottish generators and flexibility providers can access revenue streams to support investments*."

The Draft National Planning Framework 4 (NPF4) for Scotland (Scottish Government, 2021)

12.1.23 Chapter 12 of the National Developments section of this document states:

'The electricity transmission grid will need substantial reinforcement including the addition of new infrastructure to connect and transmit the output from new on and offshore capacity to consumers in Scotland, the rest of the UK and beyond'.

UK wide Policy and Legislation

Climate Change Act (2008)

12.1.24 The Climate Change Act 2008 as amended commits the UK government to reducing greenhouse gas emissions by 100% of 1990 levels by 2050 and created a framework for setting a series of interim national carbon budgets and plans for national adaptation to climate risks.

12.1.25 At present, the Third, Fourth, Fifth and Sixth Carbon Budgets, set through The Carbon Budget Orders 2009, 2011 and 2016, are 2.54 $GtCO_2e$ for 2018-2022, 1.95 $GtCO_2e$ for 2023-2027, 1.73 $GtCO_2e$ for 2028-2032 and 0.97 $GtCO_2e$ for 2032-2037 respectively. The Sixth Carbon Budget is the first Carbon Budget that is consistent with the UK's net zero target, requiring a 78 % reduction in GHG emissions by 2035 from 1990 levels. The Climate Change Act 2008 as amended (2019) does not set Scotland-specific carbon budgets.

12.1.26 The Climate Change Act also created the Committee on Climate Change (now Climate Change Committee) to give advice on carbon budgets and report on progress. The Committee through its Adaptation Sub-Committee also gives advice on climate change risks and adaptation. Its advice regarding carbon and climate policy relevant to the Project is summarised below.

The Sixth Carbon Budget: The UK's Path to Net Zero, 2020

12.1.27 It has been advised that "*the UK sets its Sixth Carbon Budget to require a reduction in UK emissions of 78% by 2035 relative to 1990. This will be a world-leading commitment, placing the UK decisively on the path to Net Zero by 2050 at the latest, with a trajectory that is consistent with the Paris Agreement*."

12.1.28 Meeting the recommended budget will require major investment, with the upscaling of low carbon markets and supply chains. These investments should also have climate resilience in mind to account for the impacts of future climate change. Key objectives should be:

- Reducing demand and improving efficiency: Require changes that will reduce carbon-intensive activities and the improvement of efficiency in the use of energy and resources;
- take-up of low carbon solutions: Phase out fossil fuel generation by 2035;
- expansion of low carbon energy supplies: Increasing renewables to 80% of generation by 2050; and
- electricity generation: Will require a significant expansion of low carbon generation; This includes low cost renewables.

12.1.29 Increasing the renewables penetration in the UK electricity mix to 80% by 2050 will largely be met with intermittent, non-dispatchable generation types (the CCC suggest that up to 140 GW of offshore wind should be deployed by 2050). To meet this target, there will be significant need for HV Subsea cabling.

Net Zero Strategy, 2021

12.1.30 The 2021 Net Zero Strategy (HM Government, 2021) is the UK's national strategy for delivering emissions reductions in accordance with section 14 of the Climate Change Act, which is concerned with the duty to report on proposals and policies for meeting carbon budgets.

12.1.31 A key policy of the Net Zero Strategy is that by 2035, the UK will be powered entirely by clean electricity, subject to security of supply.

12.1.32 Key relevant information mentioned includes ensuring wind and solar generation are reliable. These technologies must be complimented by flexible technologies such as interconnectors, helping to minimise the amount of generation and network capacity required to meet our demand needs. To achieve this, supply chains for technologies such as interconnectors need to be resilient to ensure the UK can build the capacity it needs for a reliable system.

12.1.33 The Net Zero Strategy also highlights that, to reduce emissions across the economy, the energy sector must maximise *'system flexibility, including through storage technologies, demand side response, and interconnectors – to integrate renewables, balancing the intermittency of renewables and helping to maintain system operability'.*

Clean Growth Strategy, 2017

12.1.34 The 2017 Clean Growth Strategy for the UK (BEIS, 2018) contains a key objective of 'Delivering Clean, Smart, Flexible Power' and details specific policies through which this can be achieved:

- Policy 33 of the report states the government's intention to phase out the use of unabated coal for electricity production by 2025;
- Policy 35 sets government's intentions to improve the route to market for renewable technologies, with up to £557 million for further Contract for Different auctions;
- Policy 36 details plans to target a total carbon price in the power sector which will give businesses greater clarity on the total price they will pay for each tonne of emissions.

12.1.35 The Strategy discusses a potential low-carbon pathway whereby annual emissions are as low as 16 $MtCO_2e$ by 2032. The report states this is only likely to be achieved if low-carbon power generation including renewables and nuclear has the capacity to provide at least 80% of generation demand. The report also highlights the Government's plans to invest £177 million in further reducing the cost of renewables.

Energy White Paper: Powering Our Net Zero Future, 2020

12.1.36 The Energy White Paper builds on the Ten Point Plan to set energy-related measures in a long-term strategic vision, working towards the net zero emissions target for 2050. It establishes a shift from fossil fuels to cleaner energy in terms of power, buildings and industry, whilst creating jobs and growing the economy. In addition to this, the best solutions should be determined for very low emissions and reliable supply, keeping cost low for consumers.

12.1.37 Focusing on electricity is key for the transition away from fossil fuels and decarbonising the economy by 2050. Some commitments from this white paper include:

- Accelerate the deployment of clean electricity generation through the 2020s;
- Invest £1 billion in UK's energy innovation programme to develop the technologies of the future such as advanced nuclear and clean hydrogen; and
- Ensure that the transformation of the electricity system supports UK jobs and new business opportunities, at home and abroad.

12.1.38 The Net Zero Innovation Portfolio has been developed and aims to "*accelerate the commercialisation of innovative low-carbon technologies, systems and processes in power, buildings and industry to set the UK on the path to net zero and create world-leading industries and new jobs*." It looks to focus on ten priority areas, including a focus on targeting 40GW of offshore wind by 2030.

12.1.39 The white paper highlights that "*a higher level of interconnector capacity could decrease cumulative emissions in Great Britain by up to 199$MtCO_2e$ by 2050, as well as reducing total system costs*." The UK government plans to achieve this by working with Ofgem, developers, and other European partners to enable the realisation of at least 18GW of interconnector capacity by 2030.

National Infrastructure Strategy, 2020

12.1.40 The National Infrastructure Strategy focuses on the investment and delivery of infrastructure, which is fundamental to delivering net zero emissions by 2050. The strategy sets out the UK Government's plans to deliver on this target, decarbonising the economy and adapting to climate change:

- Work towards meeting the net zero emissions target by 2050 – Decarbonise the UK's power, heat and transport networks, and take steps to adapt to climate change impacts. This will require increased investments in network infrastructure, storage and increased low carbon generation capacity.
- Reducing emissions across whole sectors of the economy must be done in a sustainable way that minimises cost.

Guidance & Recommendations

12.1.41 Overarching principles from IEMA's (2017) guidance and the WRI & WBCSD greenhouse gas protocol suite of documents (2004) have been adhered to in this assessment, as they outline how to address GHG emissions assessment and mitigation in relation to EIA:

- IEMA (2017): Assessing Greenhouse Gas Emissions and Evaluating their Significance

- WRI & WBCSD (2004): the Greenhouse Gas Protocol suite of documents

Study Area

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

Baseline Methodology

12.1.43 As the application site is not in active use, there is no baseline of activity for GHG emissions to be calculated. The site is brownfield land with no potential for significant GHG fluxes or carbon stocks due to vegetation or peat on site, so further baseline survey has not been required.

GHG Calculation Methodology

12.1.44 The emissions resulting from the construction of the Project were calculated via information provided regarding building materials and quantities. This information was transposed in One Click LCA, whereby emissions were calculated using the software's extensive database of Environmental Product Declarations (EPD) and carbon intensities for generic construction materials. The resulting projected carbon intensity of the Project was then compared with relevant benchmarks.

12.1.45 GHG emissions from operational energy and fuel use (including transport) have been calculated based on the project information set out in Chapter 2 and application of emission factors published by BEIS.

12.1.46 Key published data sources (in addition to the OneClick EPD database) used in the assessment included:

- BEIS & Defra (2021): Greenhouse gas reporting: conversion factors 2021
- RICS (2015): Methodology to calculate embodied carbon of materials
- One Click LCA (2021): Embodied Carbon Benchmarks For European Buildings
- Jones & Hammond (2019): Inventory of Carbon and Energy (ICE) database V3.0

Consultation

12.1.47 In November 2021, XLCC submitted a Scoping Report for the Project. On the 17th of December 2021, North Ayrshire Council issued a Scoping Opinion.

Table 12.1: Consultation Responses Relevant to this Chapter

Date	Consultee and Issues Raised	How/ Where Addressed
Date	Consultee and Issues Raised	How/ Where Addressed
10th November 2021	Submission of EIA Scoping Report to North Ayrshire Council (NAC), setting out the proposed scope of the climate change chapter and approach to the assessment. Assessment of climate risks, GHG emissions from land-use change and lifecycle GHG emissions from cable product were proposed to be scoped out.	The assessment has been undertaken in accordance with the scope and approach set out in the EIA Scoping Report.
25th November 2021	A member of public has commented on methane emissions and emissions arising from fuel use from movement of persons to and from the Project.	Both topics have been addressed in the Assessment of Operational Effects section within this chapter.

Date	Consultee and Issues Raised	How/ Where Addressed
17th December 2021	There are no comments on climate change in North Ayrshire Council's Scoping Opinion or from any statutory consultees' responses.	N/A
30th November 2021	Fairlie Community Council "*The report also describes the degassing of the hot extruded cable as liberating methane, which is a product of the cross linking reaction, yet there is no mention of what they intend to do with the methane which rather detracts from any green credentials. We hope that NAC will require more information with regard to whether storage, reuse or disposal is intended for the methane and the other gases likely to be by products of the processes."*	Methane emissions have been addressed in the Assessment of Operational Effects section within this chapter.
13th December 2021	NatureScot "The development is required to undertake consideration of greenhouse gases as part of the EIA. Methane is identified as being a by-product (Scoping report section 2.2.27) of the cable manufacturing process and our advice is that this source of GHG is also included in the calculation of Operational phase GHG emissions from activities on site."	Methane emissions have been addressed in the Assessment of Operational Effects section within this chapter.

Assessment Criteria and Assignment of Significance

Receptor Sensitivity/Value

12.1.48 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 severe consequences of global climate change and cumulative nature of long-lived GHGs in the atmosphere.

Magnitude of Impact

12.1.49 As GHG emissions can be quantified directly and expressed based on their GWP as tonnes of CO_2e emitted[1], the magnitude of impact is reported numerically rather than requiring descriptive terms.

Significance of Effects

12.1.50 Assessment guidance for GHG emissions (IEMA, 2017) indicates that in principle, any GHG emissions may be considered to be significant, and advocates as good practice that GHG emissions should always be reported at an appropriate, proportionate level of detail in an EIA Report. There are, however, no clear, generally agreed thresholds or methods for evaluating the significance of GHG effects in EIA. Under the principle that all GHG emissions might be considered significant it is a matter of professional judgement as to how best to contextualise a project's GHG impact. To aid in considering whether effects are significant, the guidance referenced above recommends contextualising the magnitude of a development's GHG impacts in several possible ways.

[1] GHGs considered are the 'Kyoto basket' of global warming gases, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride (where applicable), expressed as CO_2-equivalent global warming potential (GWP). This is denoted by CO_2e units in emissions factors and calculation results. GWPs used are typically the 100-year factors in the IPCC's Fourth Assessment Report, as those are used for calculation of most government statistics on climate change, or as otherwise defined in sources of emission factor data; or where applied directly, are those in the IPCC's Sixth Assessment Report as being the latest published evidence.

12.1.51 Taking the guidance into account, the following factors have been considered in contextualising the Project's GHG emissions:

- with reference to the magnitude of gross and net GHG emissions as a percentage of national and local carbon budget (where feasible); and
- with reference to whether the Project contributes to and is in line with existing policy and regulatory requirements for achieving the UK's national carbon budgets, where these are consistent with science-based commitments to limit global climate change to an internationally agreed level.

12.1.52 Effects from GHG emissions are described in this chapter as being adverse, neutral/negligible or beneficial based on the following definitions.

- **Adverse**: the development's GHG impacts would be greater than a comparable baseline, would not meet the existing and emerging policy requirements and design standards for new-build, and/or would not contribute to decarbonisation in line with local and national policy goals. A development with adverse effects falls short of contributing to the UK's trajectory towards net zero.
- **Neutral or negligible**: the development's GHG impacts would be consistent with existing and emerging policy requirements and design standards for new builds thereby contributing to decarbonisation in line with local and national policy goals, or the impact is little or no net GHG change. A development with neutral effect is in line with measures necessary to achieve the UK's trajectory towards net zero.
- **Beneficial**: the development's GHG impacts would be reduced compared to the baseline or through measures that go well beyond existing and emerging policy and design standards for new builds and would contribute to radical decarbonisation or net zero well before 2050. A development with beneficial effects provides GHG performance that is 'ahead of the curve' for the trajectory to net zero and helps achieve this sooner.

12.1.53 As previously discussed, GHG emissions have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. Therefore, the conventional EIA matrix-style approach (as described in Chapter 4: Environmental Assessment Methodology) for determining significance of effect does not align with the approach for assessing climate change impacts described above.

12.1.54 As such, all adverse or beneficial effects are considered to be significant, taking into account the IEMA guidance and the high sensitivity of the receptor. Neutral or negligible effects are not considered to be significant.

Limitations of the Assessment

12.1.55 The Project is expected to be in operation for at least 25 years, during which time the GHG emission impacts arising from its operation are likely to decrease, depending on measures taken at a national level (particularly the decarbonisation of energy supplies and transport). As such, the operational-stage conclusion using present-day emissions factors represents a conservative assumption.

12.1.56 At this stage of planning and early design, there is limited information available about construction materials and works from which to estimate the impact of the construction of the Project on climate change. For this reason, both published benchmarks for typical industrial buildings and the available project-specific materials estimates have been used. Published benchmark values used are a useful metric for carbon intensity estimation as they are drawn from a range of data sources and should include the majority of relevant materials, products and on-site works required to construct industrial buildings of this type. However, published benchmarks scaled based on gross internal area will not account well for the Project's 185m extrusion tower or other development-specific items of major plant such as cable carousels. Key material estimations provided by the

client do account for the extrusion tower, but are limited only to quantities of steel and concrete, excluding other construction materials, products and works.

12.1.57 The assessment of GHG emissions arising from the Project's construction may therefore be an underestimation, but is considered to be sufficiently representative of the likely order of magnitude of construction-stage impacts for the purpose of identifying potential significant effects and any recommended mitigation measures.

12.1.58 The purpose of the Project is to increase the production capacity of high-voltage sub-sea cables that are required by the renewable energy industry, which in turn increases capacity for the deployment of offshore wind and interconnector projects. This is likely to support GHG emission reduction benefits, outside the scope of the EIA, through the role the factory's products play in enabling the renewable energy transition. This cannot be assessed quantitatively within the scope of the EIA but a qualitative commentary on the wider system benefit is made in the operational effects section.

Baseline Environment

12.1.59 The site baseline, as a former industrial site now in disuse, is not a significant source or sink of GHG emissions.

12.1.60 As a brownfield site comprising hardstanding there is no vegetation cover or peat soil with significant carbon stocks that could be subject to disturbance, so soil and woodland carbon stocks in the baseline are not likely to be significant.

Future Baseline Conditions

12.1.61 The future baseline encompasses changes in the baseline carbon intensity of factors such as electricity, heating fuel, transport fuel or energy and the embodied carbon in construction materials. All of these are expected to decrease over time in line with national decarbonisation policy goals. For the purpose of this assessment, present-day values have been used (appropriately representative of the construction period and initial year of operation) to be conservative.

Mitigation Measures Adopted as Part of the Project

12.1.62 Good working practices during the construction of the Project are defined through a Code of Construction Practice (CoCP). The CoCP at Appendix 2.1 of this EIAR will ensure that, where possible, construction activities generating GHG emissions are undertaken efficiently in order to minimise emissions in the following ways.

- Where practicable, pre-fabricated elements would be delivered to the site ready for assembly, which will reduce on-site construction waste and reduce vehicle movements as part of the construction process.
- Construction materials should be sourced locally where practicable, to minimise the impact of transportation.
- Vehicles used in road deliveries of materials, equipment and waste arisings on- and off-site would be loaded to full capacity to minimise the number of journeys associated with the transport of these items.
- All machinery and plant would be procured to adhere with emissions standards prevailing at the time and should be maintained in good repair to remain fuel efficient.
- When not in use, vehicles and plant machinery involved in site operations would be switched off to further reduce fuel consumption.

- Where possible, local waste management facilities would be used to dispose of all waste arisings, to reduce distant travelled and associated emissions.
- The volume of waste generated would be minimised, and resource efficiency maximised, by applying the principles of the waste hierarchy throughout the construction period. Segregated waste storage should be employed to maximise recycling potential for materials.
- Equipment and machinery requiring electricity would only be switched on when required for use. Procedures should be implemented to ensure that staff adhere to good energy management practices, e.g., through turning off lights, computers and heating/air conditioning units when leaving buildings.

Assessment of Construction Effects

12.1.63 The construction of the Project would involve the use of raw materials and manufactured products in construction which would cause indirect GHG emissions through the supply chain and delivery to the site: this is referred to as the 'embodied carbon' of those materials and products. Use of plant and energy during construction works on site will also cause both direct and indirect GHG emissions.

12.1.64 Construction phase GHG emissions have been estimated based on published lifecycle assessment data for materials used in the Project's design (where available) and estimates of direct GHG emissions from the use of onsite construction plant. The construction stage emissions assessed cover carbon life cycle assessment (LCA) stages A1-A3, i.e., the emissions associated with the extraction, processing and manufacturing of materials and where possible also included stages A4 and A5, transport to site and installation on site.

Magnitude of Impact

Calculation based on carbon intensity benchmark

12.1.65 One Click LCA (2021) publishes an EU average benchmark of 500 $kgCO_2e/m^2$ of gross internal area (GIA) for industrial buildings, the most relevant category for the Project. RICS (2015) provides two relevant benchmark values, 'multistorey factory complex' and 'other industrial/utilities/specialist uses', both of which have a carbon intensity value of 545 $kgCO_2e/m^2$. These benchmarks are for lifecycle stages A1-3.

12.1.66 Based on the indicative masterplan, the Project will have a GIA of approximately 234,290 m^2. Based on these benchmarks, construction stage GHG emissions from the embodied carbon in materials used of between **117,145 tCO_2e** and **127,688 tCO_2e** are estimated.

Calculation based on building materials estimate

12.1.67 The developer has made an initial estimate of the expected quantities of key construction materials for the Project, shown in Table 12.2.

Table 12.2: Expected Construction Quantities of Project

Material	Quantity	Unit
Concrete (0.35m slabs)	90,000	m^3
Concrete (for tower)	91,500	m^3
Steel (building frames and cladding)	21,000	tonnes

12.1.68 A typical concrete density of 2.4 t/m^3 has been assumed, yielding an estimate of approximately 216,000 t and 219,600 t of concrete for 0.35 m slabs and in the construction of the tower respectively. To be conservative, a relatively carbon-intense concrete product has been assumed, selecting reinforced concrete with 40/50 MPa from the ICE database (Jones & Hammond, 2019),

which has an embodied carbon intensity value of 0.172 kgCO_2e/kg. A 'steel section' product with embodied carbon intensity value of 1.55kg CO_2e/kg has been assumed for the steel estimate.

12.1.69 Table 12.3 shows the estimated carbon intensity of materials in tCO_2e alongside a total figure for the development's proposed material use.

Table 12.3: A1-A3 carbon intensity of materials

Material	Quantity of material (tonnes)	Embodied carbon (tCO_2e)
Reinforced Concrete 40/50 MPa	216,000	37,152
Reinforced Concrete 40/50 MPa	219,600	37,771.2
Steel (Section)	21,000	32,500
Total	**456,600**	**107,473.2**

12.1.70 Estimates of typical GHG emissions from transport of materials to site and construction activity on site (LCA stages A4 and A5) are published in EPDs for these materials, accessed in OneClick. With addition of the estimated A4 and A5 emissions, the total estimated increases to **114,872 tCO_2e.**

Discussion

12.1.71 Having considered both benchmark information and the key materials estimates available at this stage of design, construction-stage GHG emissions are estimated to be in the order of **107,473.2** to **127,688 tCO_2e**.

12.1.72 As set out in the limitations section, above, there are strengths and weaknesses to the use of benchmark data and key materials data for estimating the total construction-stage GHG emissions. Conservatively, the upper estimate of **127,688 tCO_2e** has been used as the construction stage impact.

Sensitivity of Receptor

12.1.73 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_2-equivalents, has therefore been treated as a single receptor of **high sensitivity** (given the severe consequences of global climate change and contribution of cumulative sources).

Significance of Effect

12.1.74 The majority of emissions occur at LCA stages A1-3. Embedded mitigation commitments that could reduce emissions from stages A4 and A5 are incorporated in the CoCP, but at this stage any specific GHG emission reductions cannot be quantified.

12.1.75 Based on the available information at this stage of design, no embedded mitigation measures for A1-3 embodied carbon impacts are incorporated to reduce total construction GHG emissions, such as leaner design, choosing lower carbon intensity materials or using recycled materials in line with circular economy principles. Therefore, it cannot be concluded that the GHG impacts at the construction stage are in keeping with current and emerging local and national climate policy to reduce emissions in line with Scotland's trajectory towards net zero.

12.1.76 Considering the potential magnitude of GHG emissions set out in paragraph 12.1.74 and the significance criteria set out in paragraph 12.1.52, the magnitude of impact on the **high sensitivity** receptor would result in a **significant adverse** construction-stage effect in its unmitigated state of design.

Further Mitigation

12.1.77 Construction-stage GHG impacts could be further mitigated through lean design, sustainable procurement practises and close engagement with the supply chain, to ensure that any products used in the construction of the project are manufactured, delivered and installed with reduced GHG impacts. This should be informed by LCA undertaken during further design stages.

Building Design and Embodied Carbon

12.1.78 A sustainability commitment should be adopted and required through procurement of the main construction contractor. This should commit the development to ensuring that as many of the materials used as possible are sustainably sourced and have low embodied energy/carbon values.

12.1.79 The life cycle impacts of the main building elements should be further considered at detailed design stage, prior to construction. This process should follow good practice guidance such as that in the RICS (2017) Whole Life Carbon Assessment and the UK Green Building Council (2019) Net Zero Carbon Buildings Framework Definition.

12.1.80 An embodied carbon reduction target that meets or exceeds policy requirements for decarbonising the construction sector at that time should be set and the LCA during detailed design should be used to identify a pathway to achieve that via specific materials/product choices.

12.1.81 Greater transparency into the GHG impacts of products being specified for the project can be achieved by requesting environmental product declarations (EPD) from manufacturers; wherever possible, products/materials covered by an environmental product declaration (EPD) should be used, which would apply for example to BRE Green Guide materials.

12.1.82 In line with the good practice guidance set out above, the following hierarchy should be applied to reducing embodied carbon impacts:

- **Reducing** total materials required through lean design;
- **Substituting** materials for products with better whole-life carbon performance; and
- Considering **offsetting** residual emissions.

12.1.83 Examples of materials substitution options include, where structurally possible, increasing the rate of substitution of ordinary Portland cement with low carbon cementitious material alternatives (e.g., fly ash or ground-granulated blast furnace slag) or using carbon neutral concrete products (e.g., Cemex Vertua). Reusing onsite hardcore waste for subbase fill, using recycled binders and plastics in any tarmac and block paving, and engaging with cladding panel suppliers in order to specify low carbon products in procurement may also be appropriate to this development. It is possible that some structural steel elements could be substituted with cross-laminated timber alternatives, but typically only for smaller buildings (e.g., admin or store buildings) with limited beam spans and loadings.

Residual Effect

12.1.84 With implementation of the proposed mitigation measures during detailed design, the Project's construction-stage climate change impacts through direct and indirect greenhouse gas emissions have the potential to be significantly reduced compared to a typical business-as-usual approach and could therefore contribute to the goals set out in local and national policy for decarbonisation, in line with the Scotland's trajectory towards net zero.

12.1.85 In that case, the Project could potentially avoid significant adverse effects and have a negligible residual effect.

Future Monitoring

12.1.86 As set out above, further lifecycle assessment of construction stage emissions is recommended to inform a carbon reduction goal; achievement of this should be monitored through a post-completion update to the LCA.

Accidents and/or Disasters

12.1.87 It not considered likely that there will be any construction-stage accidents and/or disasters that would cause significant GHG emissions.

Assessment of Operational Effects

12.1.88 Operational phase GHG emissions from activities on site have been calculated based on estimated electricity consumption and fuel use by plant on site, based on process data for plant use provided by the developer. GHG emissions from transportation of goods to and from the site have also been calculated based on the heavy goods vehicle (HGV) and staff traffic estimates set out in Chapter 10: Traffic and Transport.

12.1.89 However, the traffic flow estimates are not informed by assumptions about the origins of raw materials. Conservative estimates have been made about transport distances and modes for the dominant raw materials used by the Project for the purposes of this assessment.

Magnitude of Impact

Methane

12.1.90 The operation of the Project will cause scope 1 (direct) GHG emissions due to the XLPE cross-linking process off gassing methane (CH_4) during the manufacturing process on site. It is estimated that the methane released will amount to approximately 10,000 kg per annum.

12.1.91 The 100-year Global Warming Potential (GWP) for fossil CH_4 is 29.8 (IPCC, 2021). The impact of vented CH_4 would therefore be **298 tCO_2e** per annum, or **7,450 tCO_2e** over the anticipated 25-year operational lifetime of the development.

Electricity Consumption

12.1.92 The operation of the Project will cause scope 2 and 3 (indirect) emissions due to the consumption of electricity by onsite plant and building services.

12.1.93 Electricity consumption has been calculated using present day estimates as a conservative factor. Currently, the combined scope 2 and 3 carbon intensity of grid-average electricity consumption is 0.2913 $kgCO_2e$ per kWh (BEIS & DEFRA, 2021)

12.1.94 The developer estimates that operational electricity consumption by factory plant and for building services will be up to 137,432 MWh/annum. Based on this, expected scope 2 and 3 emissions from the Project's electricity consumption are **40,034 tCO_2e** per annum.

12.1.95 Using that figure, the magnitude of impact over the Project's expected 25-year operational lifetime would be **1,000,849 tCO_2e.**

12.1.96 However, it is likely that the carbon intensity of electricity generation in the UK will continue to decrease over time in line with decarbonisation and renewable energy policy. Using the BEIS's projected rate for decarbonisation of electricity supplied to industrial consumers (BEIS, 2021) with operational electricity consumption beginning at the Project's expected opening year of 2024, the total magnitude of impact could be substantially lower, at **128,985 tCO_2e**.

Transport

12.1.97 Transport GHG emissions generated by the operation of the Project arise due to transport of:

- manufacturing materials to the site via heavy goods vehicle (HGVs);
- waste from the site via HGVs;
- other deliveries and service access via light goods vehicles (LGV);
- staff commuting; and
- export of cable products via ship.

12.1.98 In line with Chapter 10: Traffic and Transport, it has been conservatively assumed that all materials deliveries are by road rather than rail and that employee commuting will be primarily via single occupancy private vehicle.

12.1.99 Transport distances for manufacturing materials will vary. Conservatively, a road transport scenario with delivery of materials by HGV from the port of Dover (814 km from site) has been used. This distance estimate also easily covers any materials sourced from UK suppliers closer to site. A distance of 60 km has been assumed for LGV service vehicles/deliveries and for HGV transport of waste for disposal, representative of the distance to suppliers and waste disposal sites in the Glasgow area.

12.1.100 Estimated operational transport emissions from raw material delivery HGVs, service LGVs and waste transport HGVs are **11,527 tCO_2e** per annum.

12.1.101 For emissions related to staff transport, as the developer intends to employ staff predominantly from the local area, an average staff travel range of 20 km has been assumed. Based on the staff numbers per shift and transport mode as set out in Chapter 10: Traffic and Transport, annual staff commuting emissions amount to **1,404 tCO_2e** per annum.

12.1.102 Manufactured cables will be collected by specialist cable laying vessels from the site, with a wide variety of potential journeys and destinations. Due to the variability of potential shipping journey distances and the specialist nature of cable laying vessels with variable cargo capacity and fuel consumption, it is not considered possible to estimate shipping transport emissions in this assessment.

12.1.103 The combined total operational transport emissions from the Project will then be **12,931 tCO_2e**, excluding shipping.

Total

12.1.104 Table 12.4 displays the total operational GHG emissions arising from the Project, per annum based on present day emission factors. It is recognised that GHG emissions from the electricity and transport sector continue to decarbonise, and as such, the provided total operational GHG emissions provided in Table 12.4 is a conservative estimate.

Table 12.4: Total Operational GHG Emissions.

Source	tCO_2e/annum
Methane	298
Electricity Consumption	40,034
Transport	12,931
Total	**53,263**

Sensitivity of Receptor

12.1.105 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_2-equivalents, has therefore been treated as a single receptor of high sensitivity (given the severe consequences of global climate change).

Significance of Effect

12.1.106 The nature and significance of effect has been characterised as set out in paragraphs 12.1.51 and 12.1.52, by considering the Project's operational GHG impacts in terms of the UK and local carbon budgets and with regard to the context of carbon reductions required by local and national climate-related policy, legislation and guidance.

Carbon Budgets

12.1.107 The Project's operational-stage emissions have been considered in the context of the UK's fourth carbon budget, which is for the five-year period of 2023-2027 encompassing the likely first year of operation in 2024.

12.1.108 The fourth UK carbon budget totals 1,950,000,000 tCO_2e for the five year period, allowing for on average **390,000,000 tCO_2e** to be emitted per annum. The impact of the Project's operational GHG emissions (53,260 tCO_2e) then accounts for **0.0137%** of the UK's annual carbon budget per annum during this period.

12.1.109 Additionally, the Tyndall Centre for Climate Change Research (2022) has developed suggested local authority level carbon budgets up to 2100. The Project's operational GHG impacts were considered in terms of North Ayrshire's Tyndall Centre-derived carbon budget.

12.1.110 The Tyndall Centre carbon budgets are more stringent than the UK national budgets (as advised by the CCC): the carbon budget for North Ayrshire would result in achieving zero or near zero carbon by 2043. The Tyndall Centre carbon budget figures expressed below are for energy-related CO_2 emissions, which includes fuel use.

12.1.111 The Tyndall Centre has recommended a carbon budget of **1,700,000 tCO_2e** across the 5-year period of 2023-2027 for North Ayrshire, allowing for **340,000 tCO_2e** per annum.

12.1.112 The conservative estimate of the Projects operational GHG emissions of **53,263 tCO_2e** per annum would then account for **15.7%** of North Ayrshire's yearly recommended carbon budget in its first year of operation, 2024.

12.1.113 As can be seen from paragraph 12.1.111, the Project's operational GHG emissions do not constitute a material proportion of the UK's national carbon budget. However, as shown in paragraph 12.1.115, the Project's operational emissions would represent a material contribution to the local authority scale carbon budget, if unabated.

Climate Policy, Legislation and Guidance

12.1.114 As laid out in the Climate Change Policy & Legislation Review, both local and national policy is focussed on a need to rapidly reduce carbon emissions, including through improving energy efficiency, increasing the use of renewable or low-carbon electricity and increasing the share of sustainable transport modes.

Effect

12.1.115 Based on the available information at this stage of design, no embedded mitigation measures are incorporated to reduce GHG emissions from the principal sources, electricity consumption, goods transport and staff commuting. While the Project will not make a material contribution to the UK's

carbon budget, it could constitute approximately 15% of a net zero compatible budget at the Ayrshire level.

12.1.116 Using the definitions in paragraphs 12.1.51 and 12.1.52, the impact of GHG emissions from the operational phase of the Project on the **high sensitivity** receptor would result in **significant adverse** effect.

12.1.117 However, as described at Chapter 14: Socio-economics that North Ayrshire lacks substantial manufacturing industry employment opportunities. The Project would provide approx. 900 full time equivalent manufacturing and related jobs directly with more expected in the supply chain. The Project's carbon expenditure as a proportion of the local budget should be seen in that context.

12.1.118 Furthermore, while the effect of the Project is adverse, the transmission cable manufacturing capacity provided is expected to facilitate increased deployment of renewable and low carbon energy generation. In that broader context, the Project is in line with SPP's (Scottish Government, 2020) key principle of new developments supporting the change to a low carbon economy, particularly through the development of electricity generation from a diverse array of renewable energy technologies.

Further Mitigation

12.1.119 The largest course of GHG emissions is predicted to be due to electricity consumption. Although the carbon intensity of the electricity used is likely to reduce over time due to national measures to expand renewable energy generation, development-specific mitigation is also recommended. The applicant should explore the feasibility of low carbon and renewable energy generation options to reduce the impact of the Project's operational energy consumption. This should include consideration of potential onsite renewable energy generation such as solar PV panels on the roofs of buildings. However, recognising that with the scale of electricity demand, low/zero carbon on-site generation is very unlikely to be sufficient, the developer should procure low/zero carbon electricity in operation.

12.1.120 In regard to mitigation of transport emissions, a sustainable worker travel plan should be implemented as mentioned in Chapter 10: Traffic and Transport.

12.1.121 A sustainable logistics strategy should also be developed to consider maritime delivery to Hunterston Port, or use of the railhead and other closer ports if possible. For example, materials sourced from outside the UK could potentially be delivered to ports such as Liverpool with rail access, and subsequently transported to the freightliner rail head at Coatbridge in Glasgow, from which materials could be delivered to there from the site via road. Broadly, maritime and rail transport will have lower carbon intensity per tonne of materials HGV transport, though the specific scenario and impacts of trans-shipment would need to be considered.

12.1.122 In detailed design, consideration should be given to the feasibility of flaring rather than venting methane. This would depend on the concentration. Flaring methane would allow CH_4 to be oxidised to CO_2, which has a GWP of 1 as opposed to 29.8 for CH_4. This could result in methane related emissions from the Project being reduced to 10 tCO_2e per annum, as opposed to 298 tCO_2e per annum. Due the Project only emitting 10t per annum of methane, a relatively small amount, it would not be appropriate to attempt to capture and reuse it.

Residual Effect

12.1.123 With implementation of the proposed mitigation measures, the Project's operational-stage climate change impacts through direct and indirect greenhouse gas emissions have the potential to be significantly reduced compared to a typical business-as-usual approach and could therefore contribute to the goals set out in local and national policy for decarbonisation, in line with the Scotland's trajectory towards net zero.

12.1.124 In that case, the Project could potentially avoid significant adverse effects and have a negligible residual effect.

Future Monitoring

12.1.125 No future monitoring of operational phase GHG emissions is considered to be required.

Accidents and/or Disasters

12.1.126 It not considered likely that there will be any operational-stage accidents and/or disasters that would cause significant GHG emissions.

Potential Changes to the Assessment as a Result of Climate Change

12.1.127 Assessment of climate risks has been scoped out of the EIA, as these are not likely to be significant to the Project during its operational lifetime. Climatic changes would not affect the rate of GHG emissions from the Project.

Assessment of Cumulative Effects

12.1.128 All developments that emit 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 predicted but are considered when considering the impact of the Project by defining the atmospheric mass of GHGs as a high sensitivity receptor.

Inter-relationships

12.1.129 The assessment of inter-related effects with climate change is provided in each topic chapter of this EIA Report. The main area where there is a potential for inter-related effects is considered to be hydrology and flood risk. The Flood Risk Assessment in Appendix 8.1 has assessed potential changes in rainfall frequency and intensity, which include allowances for the impact of climate change. Climate change may also have inter-related effects with ecology and landscape, though changing the vulnerability of species/habitats and the resilience of landscape planting. However, as this is a brownfield industrial site, these inter-related effects are not significant.

Summary of Effects

12.1.130 The potential impact of greenhouse gas (GHG) emissions due to the Project, resulting in an effect on the global atmospheric GHG concentration that contributes to climate change, has been assessed and reported in this chapter.

12.1.131 The construction stage of the Project would result in both direct and indirect GHG emissions: these would arise from the embodied carbon emissions associated with the construction materials used, the GHG emissions arising from the transportation of construction materials to site and GHG emissions from onsite construction plant. Total construction stage emissions, based on benchmark data, have been estimated to be in the order of 127,688 tCO_2e, resulting in an **adverse** effect that is significant.

12.1.132 The operation of the Project has the potential to cause direct and indirect GHG emissions from the consumption of electricity, transportation of materials and waste to and from the site, staff commuting, and venting of methane. Operational stage GHG emissions have been estimated to be 53,263 tCO_2e per annum based on present-day emission factors, resulting in an **adverse** effect that is significant.

12.1.133 Further mitigation has been recommended for the construction and operational phases, which has the potential to significantly reduce total GHG emissions compared to a typical business-as-usual approach and could therefore contribute to the goals set out in local and national policy for decarbonisation, in line with the Scotland's trajectory towards net zero. In that case, the Project could potentially avoid significant adverse effects and have a negligible residual effect.

12.1.134 While the effect of the Project will be adverse, the transmission cable manufacturing capacity provided is expected to facilitate increased deployment of renewable and low carbon energy generation. This lies outside the boundary of the EIA scope, but it should be noted that in that broader context, the operation of the Project is likely to significantly aid Scotland and the UK in transitioning to a low carbon economy.

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