Table of Contents

Diagrams

Tables

21. Climate Change

21.1 Introduction

21.1.1 This chapter of the Environmental Statement (ES) assesses the potential impacts of the construction, operation (including maintenance) and decommissioning of the Proposed Development in terms of climate change. As well as considering potential effects arising from the Proposed Development, this assessment also considers the potential impact of projected future climate change on the Proposed Development and surrounding environment.

21.1.2 The Proposed Development would be fitted with post combustion carbon capture technology that will be designed to be capable of capturing up to 95% of carbon emissions. As the final abatement technology for the capture plant has not been determined at this stage, for the purposes of this assessment a conservative estimate of 90% capture of carbon emissions from the generating station has been used in the reference case.

21.1.3 Conditioned and dehydrated carbon dioxide produced from the carbon capture plant would be compressed and after metering, discharged into the carbon dioxide (CO_2) gathering network that forms part of the Proposed Development for onwards transport to an offshore carbon store and not released to the atmosphere.

21.1.4 The CO_2 Gathering network is being developed to enable neighbouring industrial facilities to be able to capture and store CO_2 from their facilities, thereby reducing their emissions. However, these future industrial connection options and corresponding additional carbon reduction benefits do not form part of the Proposed Development and have not therefore been included in this assessment in order to present a conservative assessment.

21.1.5 In accordance with the requirements of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations') guidance from the Institute of Environmental Management and Assessment (IEMA) for climate change mitigation (IEMA, 2017) and climate change resilience and adaptation (IEMA, 2020) has been applied. This chapter addresses three separate aspects:

- **Lifecycle greenhouse gas (GHG) impact assessment** – the potential effects on the climate from GHG emissions arising from the Proposed Development, including how the Proposed Development would affect the ability of the government to meet its carbon reduction targets;
- **In-combination climate change impacts (ICCI) assessment** – the in-combination effects of a changing climate and the Proposed Development on receptors in the surrounding environment; and
- **Climate change resilience (CCR) review** – the resilience of the Proposed Development to projections for climate change, including how

the Proposed Development design would be adapted to take account for the projected impacts of climate change.

21.2 Legislation and Planning Policy Context

21.2.1 This Section identifies and describes legislation, policy and guidance of relevance to the assessment of the potential climate impacts associated with the construction, operation (including maintenance) and decommissioning of the Proposed Development.

21.2.2 Legislation, policy and other relevant guidance has been considered on an international, national and local level..

International

Kyoto Protocol

21.2.3 An international agreement linked to the United Nations Framework Convention on Climate Change (UNFCCC), which commits its Parties by setting internationally binding emission reduction targets. Under Article 4 of the Kyoto Protocol, the EU created an Effort Sharing Regulation that requires the setting of individual binding GHG emission reduction targets for each of its Member States. The current Effort Sharing Decision (ESD) commits the UK to a 37% reduction in GHG emissions for the period 2021 to 2030 (Regulation (EU) 2018/842, 2018). This ambition is addressed in Section 21.3.

Paris Agreement

21.2.4 The Paris Agreement is an agreement under the UNFCCC dealing with GHG emissions mitigation, adaptation and finance starting in the year 2020. It requires all signatories to strengthen their climate change mitigation efforts to keep the increase in global average temperature to well below 2°C this century above pre-industrial levels and to pursue efforts to limit the increase to 1.5°C (UNFCCC, 2016). This ambition is addressed in Section 21.3.

National

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

21.2.5 The 2017 Regulations state that an EIA (where relevant):

"must include a description of the likely significant effects of the development on the environment resulting from … the impact of the *project on climate(for example the nature and magnitude of greenhouse gas emissions) and vulnerability of the project to climate change*".

21.2.6 This requirement is addressed in Sections 21.3 and 21.5.

Climate Change Act 2008/Climate Change Act (2050 Target Amendment) Order 2019

21.2.7 The Climate Change Act 2008 (UK Government, 2008) set a legally binding target for the UK to reduce its greenhouse gas emissions from 1990 levels by at least 80% by 2050. This target is supported by a system of legally binding five-year 'carbon budgets' and an independent body to monitor progress, the Climate Change Committee (CCC). The UK carbon budgets restrict the amount of GHG emissions the UK can legally emit in a defined five-year period.

21.2.8 The Act was amended in 2019 to revise the existing 80% reduction target and legislate for a net zero emissions by 2050 (through the Climate Change Act 2008 (2050 Target Amendment) Order 2019) (UK Government, 2019).

21.2.9 In 2020, the 6th carbon budget was published by the Committee on Climate Change for consideration by Government and is the first budget to reflect the amended trajectory to net zero by 2050.

21.2.10 The existing UK carbon budgets are used to determine significance of GHG emissions from the Proposed Development, as described and used in Section 21.3.

UK Nationally Determined Contribution

21.2.11 Under Article 4 of the Paris Agreement, parties are required to communicate their intended domestic GHG mitigation targets. In 2020, the UK communicated its new Nationally Determined Contribution to the UNFCCC. Within this, the UK has committed to reducing GHG emissions by at least 68% by 2030 compared to 1990 levels (HM Government, 2020a).

Overarching National Policy Statement for Energy (EN-1)

21.2.12 Published by the Department of Energy and Climate Change (2011a), this describes the national policy for energy infrastructure in relation to climate impacts and adaptation; adverse effects and benefits; in relation to the EU Directive and ES requirements; and in relation to adaptation measures in response to climate projections; in relation to climate projections, flood risk and the importance of relevant mitigation.

21.2.13 EN-1 promotes Carbon Capture and Storage (CCS) as an emerging technology that the Government is aiming to facilitate and encourage, including for gas-fired generating stations. Paragraph 2.2.23 of EN-1 states that CCS is part of the UK's plans to "*reduce its dependence on fossil fuels, particularly unabated combustion*".

21.2.14 This Policy Statement further states the benefits of having a diverse mix of power generation, including energy supply security as fossil-fuel generation that can be brought online quickly to meet demand and can complement baseload supply from nuclear and renewables. However, these fossil-fuel power generators will need CCS to be low carbon.

21.2.15 EN-1 states that the consenting of new fossil-fuelled power stations at or over 300 MW have to be constructed Carbon Capture Ready (CCR), as described in Section 3.6 and 4.7 of EN-1.

National Policy Statement for Fossil Fuel Electricity Generating Infrastructure (EN-2)

21.2.16 Published by the Department of Energy and Climate Change (2011b), this describes the need for all new fossil fuel electricity generating plants to assess the viability for supporting carbon capture and storage technologies. This policy has been used to inform this Chapter and the wider submission.

Marine and Coastal Access Act (2009) and the North East Marine Plan (2020)

21.2.17 The Marine and Coastal Access Act (MCAA) (Marine Management Organisation, 2009) is the basis upon which the Marine Management Organisation (MMO) determine marine licensing applications.

21.2.18 As the Proposed Development includes works within part of the UK marine area (i.e. the Tidal River Tees), marine policy documents are relevant to consider. In this instance, as prescribed by the MCAA, the published draft North East Marine Plan (EMP) is the appropriate marine policy document (Marine Management Organisation, 2020).

21.2.19 Policy NE-INF1 supports appropriate land-based infrastructure which facilitates marine activity and vice versa. Policy NE-CCUS-2 supports CCUS proposals incorporating the re-use of existing oil and gas infrastructure. However, the Policy is clear that this does not mean that proposals that do not incorporate the re-use of infrastructure will be disadvantaged or rejected.

The National Planning Policy Framework

21.2.20 The revised National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2019a) sets out the Government's planning policies for England. While the NPPF does not set specific policies for Nationally Significant Infrastructure Projects (NSIP), its policies may be of relevance to decision making.

21.2.21 Policies of relevance to climate change include those meeting the challenge of moving to a low carbon economy, climate change, flooding and coastal change. The NPPF states that the planning system should support this transition by supporting low carbon energy and associated infrastructure.

National Planning Policy Guidance on Climate Change

21.2.22 Guidance published by the Ministry of Housing, Communities and Local Government (2019b), this describes how to identify suitable mitigation and climate adaptation measures to incorporate into the planning process. Stating: *"effective spatial planning is an important part of a successful response to climate change as it can influence the emission of greenhouse gases… Planning can also help increase resilience to climate change impact through the location, mix and design of development.*"

Biodiversity Strategy 2020 (2011)

21.2.23 A strategy for England's wildlife and ecosystem services (Department for Environment, Food and Rural Affairs (Defra), 2011) establishes principles for considering biodiversity and the potential effects of climate change. This assessment will reflect these principles and identify how the effects of the Proposed Development on the natural environment will be influenced by climate change, and how ecological networks will be maintained.

The Clean Growth Strategy (2018)

21.2.24 In 2017, the government published The Clean Growth Strategy (HM Government, updated 2018). This Strategy details the increased investment and collaboration in Carbon Capture Usage and Storage (CCUS)_in the UK to drive industrial innovation and its importance in long-term emissions reduction.

The Clean Growth Strategy: The UK Carbon Capture Usage and Storage (CCUS) Deployment Pathway- An Action Plan

21.2.25 The UK Government (2018) has identified CCUS as having a significant part to play in the UK's transition to a low carbon economy. CCUS has been identified as a least cost energy system decarbonisation pathway to 2050. In their Clean Growth CCUS action plan it is stated that:

'CCUS has economy-wide qualities which could be very valuable to delivering clean industrial growth. It could deliver tangible results in tackling some of the biggest challenges we face in decarbonising our economy, contributing to industrial competitiveness and generating new economic opportunities – a key part of our modern Industrial Strategy.'

21.2.26 Within this Action Plan, Teesside was identified as a key location for CCUS due to its heavy industry and chemical manufacturing. This strategy has been used to develop this Chapter and the wider submission.

Net Zero - Opportunities for the Power Sector (National Infrastructure Commission, 2020)

21.2.27 'Net Zero – Opportunities for the Power Sector' states that decarbonising the power sector is integral to achieving the goal of Net Zero by 2050. The National Infrastructure Commission (NIC) provides impartial advice to the government on infrastructure requirements, strategic drivers and solutions. The NIC terms of reference are set by government, and while NIC recommendations do not constitute government policy, the government is required to formally respond to the recommendations, and they may form the evidence base for future policy.

21.2.28 Core to the NIC recommendations (page 7) is that the conclusion that: "a highly renewable power system, combined with flexible technologies including hydrogen powered generation, could be substantially cheaper than alternatives that rely heavily on a fleet of nuclear power plants."

21.2.29 Page 18 of the NIC recommendations acknowledges that there will be a mix of technologies in Net Zero power systems, including unabated thermal (with low running hours) and at least 18 gigawatts (GW) of gas CCS capacity by 2050, generating 23 terawatt hours (TWh) of electricity. By 2050 it is expected that gas will primarily play a peaking role in the electricity system. Net Zero – Opportunities for the power sector' therefore highlights the important role of CCS in decarbonising the power sector by capturing carbon dioxide from new gas-fired generation.

Local

North and South Tees Industrial Development Framework

21.2.30 This Framework discusses the need to promote carbon capture and storage networks as an important opportunity for both the North and South Tees, and for the UK to meet its climate change reduction targets (Parsons Brinckerhoff Ltd & Genecon, 2009).

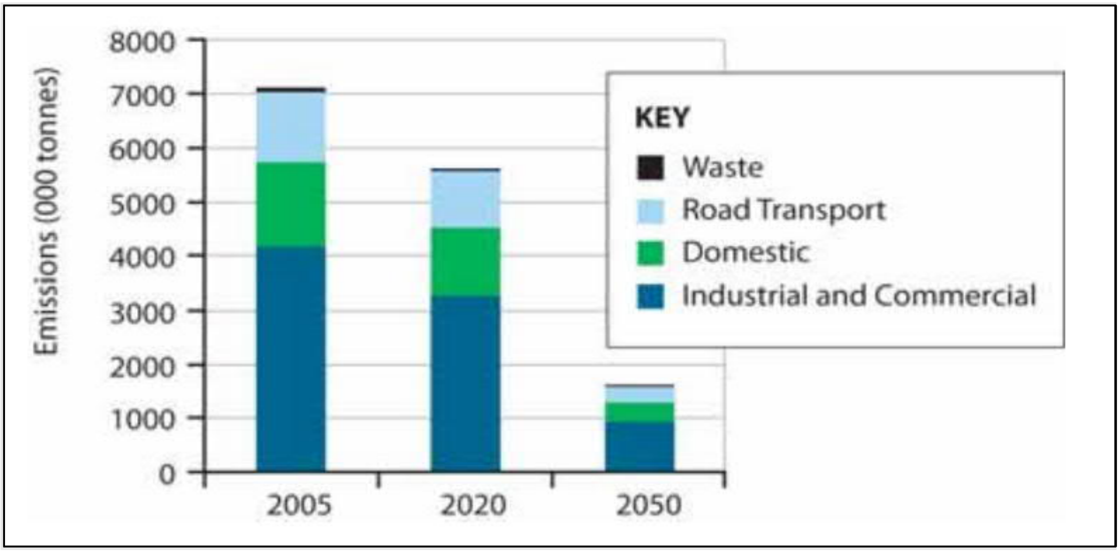
Tees Valley Climate Change Partnership

21.2.31 This Partnership published the Tees Valley Climate Change Strategy (Tees Valley Unlimited, 2010). The Partnership represents five local neighbouring local authorities and details its strategy for emissions reductions, climate change adaptation and resilience communities.

21.2.32 The combined Tees Valley GHG baseline was calculated as 7,125,000 tonnes of CO_2e in 2005 as shown in Diagram 21-1.

21.2.33 Diagram 21-1 also illustrates the Partnership's total emission reductions that would be needed to meet the previous UK Government target of an 80% reduction in emissions by 2050 compared to that in 1990. Tees Valley calculated that their emissions would need to be under 2,000,000 tonnes of CO_2e by 2050 to meet the previous UK target. As set out above, the Climate Change Act (2050 Target Amendment) Order 2019 revised that 80% reduction target to a net zero target (Paragraph 21.2.8). The Tees Valley Climate Change Partnership has yet to recalculate their emissions reduction target in light of the revised net zero target.

Diagram 21-1: Tees Valley GHG Emissions Baseline and Reduction Targets (Taken from Tees Valley Unlimited, 2010)



Redcar and Cleveland Borough Council

21.2.34 Redcar and Cleveland Borough Council (RCBC) declared a climate emergency in March 2019 and have declared an intent to be carbon neutral by 2030 (RCBC, 2019). This notably includes the support of a carbon capture storage and utilisation network for industry stating "[to achieve carbon neutrality by 2030] *This must include protecting our manufacturing industry and associated jobs by facilitating an industrial Carbon Capture Storage and Utilisation (CCSU) network in our Borough*".

21.2.35 The Council has adopted the Tees Valley Climate Change Strategy (Tees Valley Unlimited, 2010), described in paragraph 21.2.31).

21.2.36 The Council is also a member of UK100, a network of community leaders committed to "*100% clean energy production by 2050*".

21.2.37 RCBC's Strategic Flood Risk Assessment (JBA Consulting, 2016) is used as guidance for new developments to help avoid increased flooding risks from projections for sea level rise and increased rainfall. As the Council is defined as the Lead Local Flood Authority and a Local Planning Authority, Strategic Flood Risk Assessments must be developed as a base for new Local Plans and Sustainability Appraisals. This is described in more detail in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, Document Ref. 6.2)).

21.2.38 The Council's Local Plan (RCBC, 2018) describes the need for new developments to be "sustainable in design and construction, incorporating best practice in resource management, energy efficiency and climate change adaptation" (RCBC, 2018, pg. 42) with particular climate change adaptation measures to be incorporated in flood and water management design.

Stockton-on-Tees Borough Council

21.2.39 Stockton-on-Tees Borough Council (STBC) adopted the Tees Valley Climate Change Strategy in 2010, which is reported upon in more detail above.

21.2.40 In 2016, the Council adopted and published its Climate Change Strategy and Action Plan, active until 2021 (STBC, 2016). The Strategy details its low carbon vision for the area and the industrial sector being a priority area for emission reductions.

21.2.41 The Council's Local Plan (STBC, 2019) describes the significant local opportunities to move towards a low carbon economy with carbon capture and storage

Other Guidance

Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment

21.2.42 This Guidance aims to help EU Member States improve the way in which climate change and biodiversity are integrated in EIAs undertaken across the EU (EU Commission, 2013). Although the UK is no longer a Member State of the EU, this guidance is still considered relevant in the context of EIAs undertaken in respect of developments in the UK.

EC Non-paper Guidelines for Project Managers: Making Vulnerable Investments Climate Resilient

21.2.43 These guidelines aim to help developers of physical assets and infrastructure incorporate resilience to current climate variability and future climate change within their projects (EU Commission, 2011). Although the UK is no longer a Member State of the EU , this guidance is still considered relevant in the context of EIAs undertaken in respect of developments in the UK.

Guidance for the Calculation of Land Carbon Stocks

21.2.44 EU Commission (2010) calculation methodology for calculating carbon stocks from land use. This guidance is applied in Section 21.3.

British Standards

21.2.45 The British Standards Institution BS EN ISO 14064-1:2019 and 14064-2:2019 (2019a and b, respectively) provides specifications for organisational-level and project-level guidance for the quantification and reporting of GHG emissions and removals. These are used within the GHG emissions calculation methodology, as described in Section 21.3.

IEMA Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (2017)

21.2.46 In the absence of any widely accepted guidance on assessing the significance of the impact effect of GHG emissions, guidance published by IEMA (2017) has been followed. This provides a framework for the consideration of greenhouse gas emissions in the EIA process, in line with the 2014 EU Directive (EU Directive 2014/52/EU). The guidance sets out how to:

- identify the GHG emission baseline in terms of GHG current and future emissions;
- identify key contributing GHG sources and establish the scope and methodology of the assessment;
- assess the impact of potential GHG emissions and evaluate their significance; and
- consider mitigation in accordance with the hierarchy for managing project related GHG emissions (avoid, reduce, substitute, and compensate).

21.2.47 This guidance is used within the GHG emissions calculation methodology, as described in Section 21.3.

IEMA Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation (2020)

21.2.48 The IEMA Guidance for assessing climate change resilience and adaptation in EIA (IEMA, 2020) has also been followed. It provides guidance for consideration of the impacts of climate change within project design. The guidance sets out how to:

- define potential climate change concerns and environmental receptors vulnerable to climate factors;
- define the environmental baseline with projections for changing future climate parameters; and
- determine the resilience of project design and define appropriate mitigation measures to increase resilience to climate change.

21.2.49 This guidance is used within the ICCI and climate change resilience methodology, as described in Sections 21.4 and 21.5.

GHG Protocol

21.2.50 The World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) GHG Protocol provides overarching guidance on developing GHG inventories and reporting standards (2015). This guidance is used within the GHG emissions calculation methodology, as described in Section 21.3.

2015 UK Greenhouse Gas Emissions, Final Figures (Department for Energy and Climate Change, 2017)

21.2.51 This provides the latest estimates of 1990-2015 UK GHG emissions by source and by end user sector.

21.2.52 In 2015, UK emissions of the seven GHG covered by the Kyoto Protocol were estimated to be 495.7 tonnes carbon dioxide (CO_2) equivalent ($MtCO_2e$). This was 3.8% lower than the 2014 figure of 515.1 $MtCO_2e$.

21.2.53 Carbon dioxide is the main GHG, accounting for 81% of total UK GHG emissions in 2015. The drivers for the decrease in emissions were in the energy supply sector (down 12.3%), the business sector (2.6%) and the waste management sector (7.1%). The decrease in the energy supply sector is due to the change in the fuel mix for electricity generation, with less use of coal and greater use of nuclear and renewables.

21.3 Greenhouse Gas Assessment

Assessment Methodology

Consultation

21.3.1 An EIA Scoping Report was prepared by AECOM and submitted to the Planning Inspectorate in February 2019. The EIA Scoping Report (see Appendix 1B, ES Volume III, Document Ref. 6.4) sets out the proposed approach to the EIA and is intended to facilitate discussions regarding the scope of the EIA.

21.3.2 In response to the EIA Scoping Report, the Planning Inspectorate prepared a Scoping Opinion (see Appendix 1A, ES Volume III, Document Ref. 6.4). Specific comments raised by the Planning Inspectorate in relation to GHGs are listed in Table 21-1 which demonstrates how these comments have been incorporated into this ES assessment.

Table 21-1: Summary of Comments raised in the Scoping Opinion (where relevant to GHG Emissions)

Scoping Opinion Section ID	Subject	Comments	Response/ where addressed in the ES
4.2.1	Assessment of climate change impacts from construction and decommissioning	The focus of paragraphs 6.25 - 6.27 of the Scoping Report is on operational impacts; it is not clear whether an assessment of climate change impacts from construction and decommissioning is proposed. The ES should explain how climate change impacts from construction and decommissioning of the Proposed Development (for example, greenhouse gas (GHG) emissions) have been considered and assess any likely significant effects.	Section 21.3: Assessment Methodology details the full life-cycle assessment approach. Section 21.3: Classification and Significance of Effect details the method in which significance will be determined.
4.2.2	GHG emissions	The ES should quantify the GHG emissions relating to the Proposed Development. The calculation methods used should be explained. The ES should state any assumptions made in calculating the predicted GHG emissions, any limitations to the calculations and any uncertainties this presents for the assessment of GHG emissions.	Section 21.3: Methodology, Determining Operational Effect, and Determining Decommissioning Effect details the GHG calculations methodology. Section 21.3: Likely Impacts and Effects details the calculated GHG emissions from project-related activities, on the basis of the stated inclusions and assumptions,

Scoping Opinion Section ID	Subject	Comments	Response/ where addressed in the ES
		Should the DCO allow for the generating station component of the Proposed Development to operate independently of the carbon capture and storage elements, a worst-case assessment of likely significant effects should be undertaken.	and the Limitations or Difficulties described.
4.2.3	Sensitive receptors	The sensitive receptors for the purposes of the climate change assessment should be set out and justified in the ES. The susceptibility or resilience of the identified receptors to climate change must be considered as well as the value of the receptor.	Section 21.3: Sensitive Receptors; this section details the sensitive receptors
4.2.4	Significance criteria	The Scoping Report does not set out how a significant effect would be determined for the purposes of the climate change assessment. This should be clearly set out in the ES. Any use of professional judgement to assess significance should be fully justified within the ES.	Section 21.3: Classification and Significance of Effects details the methodology in which significance criteria is determined.

21.3.3 The Applicants also undertook formal Section 42 and Section 47 consultation, which commenced at the same time as the publication of the Preliminary Environmental Information (PEI) Report. This statutory consultation ran from early July 2020 to September 2020. Comments were taken from 30 consultees, of which the Environment Agency and Forestry Commission provided comment on this climate change assessment. The comments relate to GHG emissions and the demonstration of how these comments have been incorporated into this ES assessment are described in Table 21-2 and Table 21-16 (Forestry Commission).

Table 21-2: Comments raised by the Stakeholders from the PEI Report Consultation Relating the GHG Emissions

Stakeholder	Summarised Comment	Addressed in ES Chapter
Environment Agency	Recommended installation of renewable energy sources to offset parasitic loads	Section 21.3: Mitigation and Enhancement Measures details the proposed measures to reduce GHG emissions

Baseline Environment

21.3.4 The baseline environment for the GHG assessment is a '*business as usual*' scenario where the Proposed Development is not undertaken. The baseline comprises existing carbon stock[1] and sources of GHG emissions within the boundary of the existing Site described in Chapter 3: Description of the Existing Environment (ES Volume I - Document Ref. 6.2). The Site covers approximately 462 hectares of which the PCC Site has an area of approximately 42.5 ha.

21.3.5 For the purposes of determining net changes in GHG emissions as a consequence of the Proposed Development, it is assumed that there are no activities on Site currently and that the area is fully under hardstanding. The baseline emissions are considered to be zero and all project emissions are considered as additional. Use of this precautionary principle approach provides a conservative assessment, as not all activities (and therefore GHG emissions) will be additional activities given the nature of existing land-use on-Site.

21.3.6 The methodology for calculating GHG emissions and removals is consistently used across the baseline, construction, and operational phases of the Proposed Development, as described below.

Project Environment

21.3.7 The alternative environment to the *'business as usual'* in which the Proposed Development is not undertaken is a *'do something'* scenario with the delivery of the Proposed Development, which includes its construction, operation and decommissioning.

Study Area

21.3.8 The GHG Study Area includes all GHG emissions from within the Site boundary area arising during all stages of the construction, operation and decommissioning of the Proposed Development. It will also include emissions arising from offsite activities which are directly related to the onsite activities, such as transport and where possible treatment of materials and waste disposal.

Sensitive Receptors

21.3.9 The identified receptor for GHG emissions is the global climate as the effects are not geographically constrained which means all development has the potential to result in a cumulative effect on GHG emissions. Therefore, for the purpose of the GHG emissions impact assessment, the global climate will be used as the sensitive receptor. The UK's relevant five-year carbon budget will be used as a proxy for the global climate.

Rochdale Envelope

21.3.10 A focused use of the Rochdale Envelope approach has been adopted to present a worst-case assessment of potential environmental effects of the different parameters of the Proposed Development that cannot yet be fixed. The parameters included within the Rochdale Envelope are described in

[1] A carbon stock is defined as a quantity of carbon stored within the area, usually in the form of soils and biomass

Chapter 4: Proposed Development (ES Volume I, Document Ref. 6.2). The Rochdale Envelope approach has specifically been used to estimate likely material quantities for the construction of the Proposed Development.

Methodology

21.3.11 The potential effects of the Proposed Development to the global climate are calculated in line with ISO14064 (BSI, 2019a and b) and the principles of the GHG Protocol (WRI & WBCSD, 2015).

21.3.12 Where activity data have allowed, expected GHG emissions arising from the lifecycle activities associated with the Proposed Development have been calculated by multiplying activity data by its relevant emission factor:

Activity data x GHG emissions factor = GHG volume

21.3.13 Activity data is a quantifiable measure of activity, such as operating hours or volumes of fuels used. Emission factors convert the activity data into GHG volumes. Activity data has been sourced from client data. Where specific data are not available, a mix of assumptions and industry benchmarks have been used to fill data gaps. Where this is not possible, then a qualitative approach to addressing GHG impacts has been followed, in line with the IEMA Guidance (2017).

21.3.14 Emission factors have been sourced from publicly available sources, Defra (BEIS 2021), and the University of Bath ICE (2019). Carbon emissions and sinks through land use change have been calculated by using the EU Commission's Guidelines for Land Carbon Stocks (2010).

21.3.15 In line with the ISO standard 14064 and the principles of 'The GHG Protocol' (WRI & WBCSD, 2015), when calculating GHG emissions, the seven Kyoto Protocol GHGs have been considered, specifically:

- carbon dioxide (CO_2);
- methane (CH_4);
- nitrous oxide (N_2O);
- sulphur hexafluoride (SF_6);
- hydrofluorocarbons (HFCs);
- perfluorocarbons (PFCs); and
- nitrogen trifluoride (NF_3).

21.3.16 These GHGs are broadly referred to in this chapter under an encompassing definition of 'GHG emissions', with the unit of tCO_2e (tonnes CO_2 equivalent) or $MtCO_2e$ (megatonnes of CO_2 equivalent).

Determining Construction Effects

21.3.17 Construction activities of the Proposed Development will involve earthworks and construction of a single CCGT unit with associated carbon capture train, a CO_2 Gathering Network and Compressor station, an offshore CO_2 Export Pipeline, and associated land-based connection infrastructure.

21.3.18 Site preparation and remedial works at the PCC Site are expected to be completed by Teesworks' demolition and civils contractor to create a suitable development platform for the Proposed Development. This will be undertaken prior to the Applicants' contractor taking over the PCC Site for the construction phase of the Proposed Development, but the assessment of these activities has been included within the EIA. Construction activities are described in more detail within Chapter 5: Construction Programme and Management (ES Volume I, Document Ref. 6.2).

21.3.19 Table 21-3 summarises the key anticipated GHG emissions sources associated with the Proposed Development and whether they have been scoped into the final assessment.

Table 21-3: Scope of Potential GHG Emission Sources from the Construction Stage

Lifecycle stage	Activity	Primary emission sources	Scoped in/out
Enabling works	Any enabling works	GHG emissions from any activities required onsite prior to construction	In
	Land clearance	Loss of carbon sink.	In
Production stage	Raw material extraction and manufacturing of products/materials. Transport of products/materials to site.	Embodied GHG emissions. GHG emissions from fuel consumption for transportation of materials.	In
Construction process stage	On-site construction activity. Transport of construction workers	Energy (electricity, fuel, etc.) consumption from plant and vehicles, generators on site, and construction workers commuting. GHG emissions from fuel consumption for transportation of construction workers	In
	Transportation and disposal of construction waste	GHG emissions from energy use and from fuel consumption for transportation of waste	In
	Provision and treatment of water	GHG emissions from the supply of potable water, and the disposal and treatment of wastewater	In

Determining Operational Effects

21.3.20 The methodology for determining operational GHG emissions is the same as that for the enabling works, production stage and construction process stage emissions. Table 21-4 summarises the key anticipated emissions sources and whether they have been scoped in or out of the final assessment.

Table 21-4: Scope of Potential GHG Emissions Sources from the Operational Stage

Lifecycle stage	Activity	Primary emissions sources	Scoped In/Out
Operation stage	Operation of the Proposed Development	GHG emissions from electricity generation when not captured by the carbon capture plant and energy use in buildings. GHG emissions from operation of the Compressor Station.	In
	Use of vehicles i.e. cars and motorcycles	GHG emissions from vehicle use from worker journeys to and from the Site	In
	Disposal and transportation of operational waste	GHG emissions from recycling/ disposal of process waste and domestic waste GHG emissions from fuel consumption for transportation of raw materials and waste	In
	Provision and treatment of water	GHG emissions from the supply of potable water, and the disposal and treatment of wastewater	In
	Building/infrastructure maintenance	GHG emissions from maintenance of buildings and infrastructure/assets in the operational stage	In

Determining Decommissioning Effects

21.3.21 The methodology for determining decommissioning GHG emissions is the same as for that for the enabling works, production stage, construction process stage and operational emissions. Table 21-5 summarises the key anticipated emissions sources and whether they have been scoped in or out of the final assessment.

Classification and Significance of Effects

21.3.22 IEMA (2017) guidance states that there are currently no agreed methods to evaluate levels of GHG significance and that professional judgement is required to contextualise the projects emission impacts.

21.3.23 In GHG accounting, it is considered good practice to contextualise emissions against pre-determined carbon budgets (IEMA, 2017). In the absence of sector-based or local emissions budgets, the UK Carbon Budgets can be used to contextualise the level of significance.

21.3.24 When considering the scope and boundary for inclusion of GHG emissions it is standard accounting practice to exclude minor sources as these are not material. Both the Department of Energy and Climate Change (2013) and the PAS 2050 Specification (British Standards Institution, 2011) allow emissions sources that contribute or remove less than 1% to the total inventory to be excluded as immaterial. Inventories that exclude these minor sources are still considered complete for verification purposes. This exclusion of emission sources that are <1% of a given emissions inventory is on the basis of a '*de minimis*' (relatively minimal) contribution.

21.3.25 On this basis, where GHG emissions from the Proposed Development are equal to or more than ±1% of the relevant annual UK Carbon Budgets the impact of the Proposed Development on the climate is considered of high significance. This is summarised in Table 21-6.

Table 21-5: Scope of Potential GHG Emissions Sources from the Decommissioning Stage

Lifecycle stage	Activity	Primary emissions sources	Scoped In/Out
Decommissioning	Raw material extraction and manufacturing of products/materials. Transport of products/materials to site.	Embodied GHG emissions. GHG emissions from fuel consumption for transportation of materials.	In
	On-site decommissioning activity. Transport of decommissioning workers	Energy (electricity, fuel, etc.) consumption from plant and vehicles, generators on site, and workers commuting. GHG emissions from fuel consumption for transportation of workers	In
	Transportation and disposal of waste	GHG emissions from energy use and from fuel consumption for transportation of waste	In
	Provision and treatment of water	GHG emissions from the supply of potable water, and the disposal and treatment of wastewater	In

21.3.26 There is currently no published standard definition for receptor sensitivity of GHG emissions. As per IEMA (2017) guidance, all GHG emissions are classed as having the potential to be significant as all emissions contribute to climate change. The global climate has been identified as the receptor for the purposes of the GHG assessment. The sensitivity of the climate to GHG emissions is considered to be 'high'. The rationale supporting this includes:

- any additional GHG impacts could compromise the UK's ability to reduce its GHG emissions and therefore the ability to meet its future carbon budgets; and
- the importance of meeting the Paris Agreement goal of limiting global average temperature increase to well below 2°C above pre-industrial levels (Paragraph 21.2.4). Additionally, a recent report by the IPCC highlighted the importance of limiting global warming below 1.5°C (IPCC, 2018).

21.3.27 This method to determine the significance of GHG emissions are summarised in Table 21-7.

Table 21-6: Magnitude Criteria for GHG Impact Assessment

Magnitude	Magnitude criteria description
High Increase	Estimated GHG emissions equate to or equal to or more than 1% of total emissions across the relevant five-year UK Carbon Budget period in which they arise
Low Increase	Estimated GHG emissions equate to less than 1% of total emissions across the relevant five-year UK Carbon Budget period in which they arise
Low Reduction	Estimated GHG emissions equate to a reduction of less than 1% of total emissions across the relevant five-year UK Carbon Budget period in which they arise
High Reduction	Estimated GHG emissions equate to a reduction of equal to or more than 1% of total emissions across the relevant five-year UK Carbon Budget period in which they arise

Table 21-7: Significance of Effects Matrix for GHG Emissions Impact Assessment

Magnitude of GHG emissions (as outlined in Table 21-6)	Sensitivity of Receptor
	High
Low Increase	Minor adverse significance
High Increase	Major adverse significance
Low Reduction	Minor beneficial significance
High Reduction	Major beneficial significance

UK Carbon Budgets

21.3.28 The UK carbon budgets are in place to restrict the volume of greenhouse gas emissions the UK can legally emit in a five-year period (UK Government, 2021). The UK is currently in the 3rd carbon budget period, which runs from 2018 to 2022, as detailed in Table 21-8. The 3rd to the 5th carbon budgets reflect the earlier UK target (80% reduction target by 2050). The 6th carbon budget, currently under consideration by the UK

Government, is the first budget to reflect the amended net zero target. As the Proposed Development will be active past 2050, the assessment also compares the emissions against the net zero by 2050 target.

21.3.29 Construction of the Proposed Development is likely to intersect the UK carbon budget periods running from 2022-2026 (UK 3rd and 4th carbon budget).

21.3.30 Commissioning will then follow, and an operational period of circa 25 years, anticipated to be from circa 2026 to 2051 (intersecting the UK 4th, 5th and 6th Carbon Budgets and beyond), intersecting the net zero target of 2050. At the end of this operational period, it is anticipated that the Proposed Development will have some residual life remaining and an investment decision would then be made based on the market conditions prevailing at that time. If the operating life were to be extended, the Proposed Development would be upgraded in line with the legislative requirements at that time. On this basis, decommissioning activities are not currently anticipated to commence before 2051.

Table 21-8: Current UK Carbon Budgets

UK Carbon Budget	Total Budget (MtCO_2e)
3rd (2018-2022)	2,544
4th (2023-2027)	1,950
5th (2028-2032)	1,725
6th (2033- 2037)*	965

* Published by the Climate Change Committee in November 2020 for the consideration of Government Ministers. This budget was agreed by Parliament in April 2021 and due to be enshrined in legislation in June 2021.

Development Design and Impact Avoidance

Construction

21.3.31 Aspects of GHG emissions will be managed through the final Construction Environmental Management Plan (CEMP) and related plans including the Site Waste Management Plan (SWMP) that controls construction activities to minimise any impact on the environment through relevant regulations, industry good practice and specific measures described within this ES. The appointed contractors will be required to develop and implement a CEMP to measure, monitor and report energy and water consumption and GHG emissions during construction. A framework CEMP (Appendix 5A, ES Volume III, Document Ref. 6.4) has been developed, and includes proposed measures to reduce GHG emissions through:

- fuel consumption on site in vehicles, equipment and plant through minimisation of idling, and switching off when not being used. Preference of lower carbon fuels such as HVO fuel, biodiesel or electric powered plant instead of traditional fossil fuels;
- water consumption in the on-site amenity blocks and construction activities (including dampening down as part of dust mitigation);

- minimisation of transportation of materials to the site, by implementing measures set out in ES Appendix 16C: Framework Construction Traffic Management Plan (ES Volume III, Document Ref. 6.4) and secured through a requirement in the draft DCO (Document Ref. 2.1);
- minimisation of carbon sink loss across the footprint of the Natural Gas Connection Corridor, Electrical Connection Corridor and CO_2 Gathering Network avoiding vegetated areas that act as carbon sinks;
- minimisation of emissions through worker commuting by:
  - encouraging group transport by the provision of minibuses;
  - provision of facilities for cyclists; and
  - and provision of information on public transport links (all of which will be described in ES Appendix 16B: Construction Workers' Travel Plan and secured through a requirement in the draft DCO (Document Ref. 2.1);
- setting minimum rates for material recycling and re-use, as be described in the Site Waste Management Plan, a framework of which is provided in Appendix 5A, ES Volume III, Document Ref. 6.4); and
- reducing construction works by re-using, replacing or upgrading the existing water connection infrastructure on Site, and using techniques such as the ‘no dig’ trenchless construction where practicable.

Operation

21.3.32 The purpose of this Proposed Development is to provide low carbon electricity through the use of a high efficiency gas-fired power station with carbon capture and off-shore carbon storage. By overall design, the Proposed Development also offers the opportunity to reduce the carbon emissions emitted from other industrial operators in the area and aid decarbonisation of the electricity supplied to the national grid. A carbon capture plant (CCP) fitted to the generating station will use a chemical process to absorb and capture up to approximately 95% (and a minimum of 90%) of the carbon dioxide in the flue gases. Captured CO_2 (carbon emissions) will be compressed and pumped into an offshore geological store and therefore prevented from eventual release to the atmosphere.

21.3.33 The Environmental Permit application will present a number of measures that the Proposed Development would include in order to improve energy efficiency and to reduce overall GHG emissions. The design of the Proposed Development will be based on European Best Available Technique (BAT) reference documents (‘BRefs’) for CCGT plants and the new Environment Agency BAT Guidance for carbon capture plants (2021). The GHG assessment within this Chapter has been based on high levels of thermal efficiency within the CCGT as an H-Class unit is proposed to be used.

21.3.34 To reduce emissions associated with operational worker commuting, sustainable forms of travel will be promoted including provision of cycle storage areas.

21.3.35 Process emissions would be managed and regulated through an Environmental Permit by the Environment Agency in accordance with the Industrial Emissions Directive and Energy Efficiency Directive.

21.3.36 Other embedded measures incorporated in the operational design are described in the ES, in particular Chapter 4: Proposed Development and Chapter 8: Air Quality (ES Volume I, Document Ref. 6.2).

Decommissioning

21.3.37 At this stage, limited specific additional mitigation measures have been identified for the decommissioning phase of the Proposed Development due to uncertainties in the activities that will be undertaken, future emission factors, and technologies available. A Decommissioning Environmental Management Plan (DEMP) will be produced to appropriate guidance and legislation at the time, and will likely include measures to reduce GHG emissions, for example encouraging the contractors to recycle the bulk of the plant, equipment and materials.

Likely Impacts and Effects

Description of Potential Effects

21.3.38 This Section presents preliminary findings of the GHG impact assessment for the construction and commissioning, operation and decommissioning of the Proposed Development. It identifies any likely significant effects that are predicted to occur and then highlights the mitigation and enhancement measures that are proposed to minimise any adverse significant effects.

Construction

21.3.39 In order to assess the magnitude of the climate change impacts as a result of GHG emissions associated with construction of the Proposed Development, the GHG emissions that would be associated with the project activities are calculated based on the assumptions listed below:

- The construction programme is anticipated to take 4 years (late 2022 - 2026) operating within the hours of 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturday;
- Numbers of construction workers and vehicle traffic have been estimated from Chapter 16: Traffic and Transportation (ES Volume I, Document Ref. 6.2);
- Worker commuting has been included in this estimate and is based upon worst-case assumptions including a vehicle occupancy rate of 1.35 workers per vehicle, 100% travel by car, with 80% commuting from 12 km from site and the remainder 35 km from site. These distances and splits have been conservatively adapted from that presented in Appendix 16A: Transport Assessment ES Volume III, Document Ref. 6.4). The Transport Assessment is also a conservative assessment as it does not include the full development design and impact avoidance measures detailed from Paragraph 21.3.31;

- Materials transport has been included in this estimate and is based upon an assumption of the use of laden HGVs travelling a one-way distance of 50 km, and includes a return trip;
- Embodied carbon from construction materials is partially included in this estimate. Using building floor area from the gas turbine hall, heat recovery steam generator, and steam turbine, estimates have been made using WRAPs Net Waste Tool. This excludes fit-out materials and other infrastructure of these buildings due to insufficient data or information at this stage in the design. Construction materials will also be needed for other elements including but not limited to the gas and cooling water connections, cooling water outfall, and access roads. These have been excluded due to the level of current design detail;
- Additional construction materials included in this estimate include mains water for domestic, sanitation and construction purposes. It is assumed that each person on-site uses 72 litres of water per day, half of the average daily water use in England and Wales (Water UK, 2020). Other construction water uses such as wheel-washing or dust suppression have been accounted for conservatively with an industry benchmark from the Strategic Forum for Construction Water Subgroup (2011);
- Waste transport and disposal is included in this estimate. Construction waste volume estimates have based on building floor area areas for the indicative Proposed Development layout (Chapter 4: Project Description (ES Volume I, Document Ref. 6.2)) and waste types published by Construction Resources and Waste Platform (CRWP, 2009). Water treatment volumes from domestic and sanitation uses are assumed to all be treated;
- Fuel-usage onsite has been included in this estimate. Using construction value, an approximate volume of emissions has been calculated using industry benchmarks (Glenigan, 2018). This figure is likely to be conservative in consideration of the Development Design and Impact Avoidance measures to use lower carbon fuels such as HVO fuel, biodiesel or electric powered plant instead of traditional fossil fuels; and
- Uses of grid electricity for temporary welfare and office facilities have been included in this estimate. Usage has been conservatively estimated on continuous use during construction hours using CIBSE Energy Benchmarks (2008) and is based upon peak workers for each year needing 0.5 m^2 of welfare space per person.
- As detailed in Table 21-9, using the listed inclusions and exclusions, the total construction-related GHG emissions from the Proposed Development are calculated to be 76,012 tCO_2e with the majority (84%) of emissions being associated with the embodied carbon of construction materials. Assuming that emission-related activities are similar during the 4-year construction period (2022 - 2026), annual emissions are expected to be approximately 19,003 tCO_2e.

Table 21-9: Construction GHG Emissions

Lifecycle stage	Project activity/Emission source	Emissions (tCO_{2e}) over 4-year construction period
Product	Embodied carbon of material and products	64,170
	Materials and product transport	2,974
Construction and Commissioning	Electricity usage	176
	Fuel usage onsite	3,755
	Waste disposal	65
	Worker commute	4,873
TOTAL		76,012
Annual estimation		**19,003**

Operation

21.3.40 In order to assess the magnitude of the climate change impacts through GHG emissions associated with operating the Proposed Development, the GHG emissions that would be associated with the project activities are calculated based on the assumptions listed below:

- the Proposed Development is expected to be available and manned 24 hours a day, 7 days per week for 25 years. Information regarding maintenance schedules is not currently available, however it is assumed that the plant will be offline for two weeks per year for annual maintenance and therefore running approximately 8,424 hours per year.
- Use of grid electricity has been partially included in this estimate. The majority of electricity consumption will arise from the continuous use of a 30 MW HP Compressor Station. During plant operation, the compressor will be a parasitic load and source power straight from the CCGT plant. During times of CCGT plant downtime i.e. when the plant is in dispatchable mode and not required to operate, or during periods of annual maintenance and after decommissioning of the generating station, the compressor will be powered from the grid. Other consumption including for buildings and maintenance is not included in this estimate as it is expected not to be material in comparison to energy consumption for the compressor.
- Cooling and process water is all assumed to be sourced from the Northumbrian Water raw water supply.
- Fuels and oils required on-site, other than natural gas, may include but are not limited to diesel required for the emergency diesel generator, lubricating oils and acetylene. One tonne of diesel per annum has been included within this estimate, and volumes of other fuels and oils are assumed to be a minor fraction.
- The majority of carbon emissions will arise from the CCGT plant's use of natural gas when operating in abated mode. The carbon capture system is designed to remove carbon dioxide from the flue gases. The carbon

capture abatement technology is capable of capturing up to approximately 95% of the carbon dioxide produced by the CCGT plant. The overall effectiveness of the carbon capture system varies depending on the operating mode applied and when the plant is operating in dispatchable mode, emissions of CO_2 during start-up may be higher and therefore capture efficiencies may be lower than 95%, although a capture rate of 90% will be achieved as a minimum. When the plant is operating in baseload a 95% capture rate is envisaged. Carbon emissions have been calculated based on material balance flow data provided for each mode, assuming at least 90% capture rates are achieved. Therefore, in order to provide a conservative assessment, baseload operation of the plant at 90% capture rate has been used as the reference case for the assessment.

- The abated CCGT unit will produce up to a net electrical output of 684 MW (which accounts for the reduction in electrical output from the CCGT as steam is diverted from the steam turbine for use in the CCP, as well as the parasitic load of the CCP and HP compressor), with a carbon intensity of approximately 41.2 tonnes CO_2 per GWh based on 90% capture of the CO_2. It is assumed that the carbon capture storage system and sequestration technology is operational and functioning as expected.
- The maximum electrical output from the proposed CCGT is up to 860MW as specified in Chapter 4: Proposed Development (ES Volume I, Document Ref. 6.2). However, taking into account the parasitic load of the plant itself, in the event that the carbon capture gathering network and CO_2 export system is not operating, the unabated CCGT unit would produce up to a net 840 MW electrical output, with a carbon intensity of approximately 335 tonnes CO_2 per GWh.
- Similarly, when the capture plant is installed, the electrical output of the CCGT drops further because the CCGT needs to be reconfigured to provide steam for the capture plant. The gross electrical output of the CCGT therefore drops from 860MW to 784MW for the 90% capture rate. When the capture plant is operational, the parasitic load of the plant reduces the net electrical output still further, as shown in Table 21-10.
- CO_2 will be used for purging of the electrical generators for maintenance purposes. The volumes of gas and the frequency of the activity is not known at this stage of design although these are likely to be a minor source of GHG emissions. These are therefore not included in this estimate.
- Electrical circuit breakers and other switchgear historically used sulphur hexafluoride (SF_6) as an arc quencher and noise suppressant. This gas has a very high global warming potential, but suppliers are increasingly producing SF_6-free equipment, or sealed-for-life units with extremely low leakage rates. For the purposes of this assessment it is assumed that leakage rates will be negligible.
- Emissions associated with some waste transport and disposal have been included in this estimate. Municipal waste estimates have been included

and are based upon annual per person waste statistics (Eurostat, 2020) and it is assumed half the volume is recycled. Industrial waste volumes such as spent amines have not been calculated and have not been included in this estimate. Water treatment volumes are included from domestic and sanitation uses and are assumed to all be treated offsite.

- Worker commuting has been included in this estimate using current estimates of required operational staff. This conservatively assumes that 100% of workers will travel by petrol car with an occupancy of 1 person per vehicle. Using current estimates of likely distribution of worker staff, it is assumed that 80% of workers will live within 12 km of the Site, and the remaining 20% will live within 35 km of the Site. All transits include a two-way journey.
- It is assumed that an additional circa 100 staff will be required onsite during the 14-day maintenance every year using the same car occupancy rates and location distribution.
- Embodied emissions associated with operational materials have been partially included in this estimate.
- Mains water for domestic and sanitation uses. It is assumed that each person on-site uses 72 litres of water per day, half of the average daily water use in England and Wales (Water UK, 2020).
- Materials required for operations are likely to include bulk solvent, sodium hydroxide and sulphuric acid, ammonia/ urea, triethylene glycol, hydrogen, biocides, antiscalants, sulphuric acid, sodium hydroxide, phosphoric acid, polyelectrolyte, molasses, cleaning chemicals, inert firefighting gases, carbon dioxide and mains water. Available volumes included in this estimate include sodium hydroxide, sulphuric acid, fresh solvent, and hydrogen.
- It has been assumed that materials required for operations (fuels and oils, other than natural gas, chemicals and parts) are generally available on average within 80 km of the Site including a return trip. Up to 20 incoming HGVs haves been included in this estimate.
- On closure of the CCGT, the CO_2 Gathering Network and Compressor Station would remain active for any other future users.

21.3.41 The material balance flow data for each operating mode includes information on final stack emissions of CO_2. For each operating mode, a gross power plant electricity output figure has been combined with the expected electricity demand of the CCP and other ancillary equipment to give a net power plant electricity output in megawatts. Combining the final stack emissions per operating hour with the net electricity output of the generating station with carbon capture plant gives an average emissions factor in tonnes CO_2e/GWh for each operating mode. These emissions factor have been compared with the current (2020) UK average emissions factor, and with UK government estimates of projected emissions factors for each of the years in the plant's operating lifetime.

Operational Modes

21.3.42 It is anticipated that on commissioning, the Proposed Development will initially operate in baseload mode i.e. generation that that generally runs continuously at high levels of power output throughout the year and whereby the CCGT plant is operated at stable power output levels. Continuous and stable CO_2 production and export is preferred during this period to minimise changes to injection rates to the offshore underground storage reservoir.

21.3.43 After a period of baseload operation, and after CO_2 within the wider gathering network has grown and stabilised, it is assumed that the Proposed Development will operate in dispatchable mode, i.e. being able to export power into the day-ahead market to match the anticipated intermittency of renewable power in the future power market. Operating in dispatchable mode could involve multiple start-up/shutdown cycles per year.

21.3.44 In the event that the CCP is not available, it could be necessary to operate the Proposed Development for a short period of time in in unabated mode, with exhaust gases from the CCGT being routed via the HRSG stack. However, there is no intention to operate the CCGT to generate electricity in unabated mode.

21.3.45 Operational Modes are discussed further within Chapter 4: The Proposed Development (ES Volume I - Document Ref. 6.2). The plant is expected to operate in dispatchable mode following a period of stable operation. Start-ups are expected to temporarily reduce the plant carbon capture efficiency below 95%, however a minimum average capture efficiency of 90% would still be achieved. For the purposes of the assessment, carbon emissions from dispatchable modes have been assumed at a stable capture efficiency. The minimum capture efficiency of 90% needs to include periods of start-up and shut-down and also, when the plant is not operating, the CO_2 emissions will also cease. It is therefore considered that the worst-case assessment for annual carbon emissions would be the plant running all year round in baseload operation with an average capture rate of 90%. On this basis, the three operating modes used to form the basis of this assessment are summarised below:

- Reference scenario 1: The CCGT will operate in abated mode for up to 8,424 hours per year (which includes downtime through maintenance) in baseload mode with an average 90% carbon capture rate. This represents the worst-case scenario in terms of carbon emissions;
- Scenario 2: as per the reference scenario for the first 4 years, after which the plant will operate in dispatchable mode, with up to 40 start-ups/ shutdowns; and
- Scenario 3: as per the reference scenario for the first 4 years after which the plant will operate in dispatchable mode, with up to 80 start-ups/shutdowns.

21.3.46 In all three scenarios, in Year 1 of operation it is assumed that the CCGT unit is working 20% fewer hours as any technical issues are addressed post commissioning. Year 1 is therefore expected to have reduced operating hours for both CCGT as well as the CCP, so overall the carbon emissions are lower in Year 1 than in later years. However for the purposes of this assessment, the Year 1 emissions have been conservatively calculated on the basis of full operating hours.

21.3.47 From years 5 to 25, in Scenario 1, it is assumed that the plant will continue in baseload mode (Scenario 1); or commence operating in dispatchable mode, with 40 start-up/shut downs per year option (Scenario 2); or 80 start-up/shutdowns per year (Scenario 3).

21.3.48 It is generally the case that there is a linear relationship between operating hours and direct operational plant GHG emissions for each mode, so for a reduced number of operating hours the total annual emissions can be adjusted accordingly. The only minor changes to a linear relationship are associated with start-up and shut-down cycles; given the limited duration of start-up activities and the average capture efficiency of 90% needing to include these periods, coupled with the cessation of CO_2 emissions when the plant is not operating, they are considered to not give rise to any increase in carbon emissions from those presented in this assessment.

21.3.49 Table 21-10 details the carbon and energy profiles of the reference case with 90% for each of these scenarios. Highlighted are the annual CO_2 emissions, annual power output and carbon intensities. The baseload operating mode (Scenario 1) results in the highest direct emissions figure of 5,929,380 tonnes of CO_2 to atmosphere over the lifetime (25 years) and a carbon intensity of 41.2 tonnes CO_2 per GWh produced.

21.3.50 Table 21-11 details the carbon and energy profiles of the reference case with 95% for each of these scenarios. This capture level may be achievable. Highlighted are the annual CO_2 emissions, annual power output and carbon intensities. The baseload operating mode (Scenario 1) results in the highest direct emissions figure of 2,964,690 tonnes of CO_2 to atmosphere over the lifetime (25 years) and a carbon intensity of 20.7 tonnes CO_2 per GWh produced. The gross electrical output of the CCGT at 95% capture rate (779MW) is slightly lower than that when achieving a 90% capture rate (784MW) because the higher capture rate requires increased steam demand from the CCGT, thereby reducing the steam available to generate electricity. As a conservative assessment, the worst-case emissions from the 90% capture rates are used in the following assessment of impacts and effects.

21.3.51 As detailed in Table 21-12, using the listed inclusions and exclusions, the total GHG emissions from the Proposed Development are calculated to be 6.7M tCO_2e with the majority (88%) of emissions associated with fuel usage onsite. Assuming that emission-related activities are similar during the 25-year Development, annual emissions are expected to be approximately 270k tCO_2e.

Table 21-10: Direct operational GHG Emissions from the Reference Case (90% Abated) power plant at (Scenarios 1 - 3)

	Reference Case 90% Capture					
	Baseload Years 1-25		Baseload Years 1-4, Dispatchable Mode from Years 5-25 with 40 Start-Up/Shutdowns		Baseload Years 1-4, Dispatchable Mode from Years 5-25 with 80 Start-Up/Shutdowns	
Years of Operation	Years 1-4	Years 5-25	Years 1-4	Years 5-25	Years 1-4	Years 5-25
Annual Operating Hours	8,424	8,424	8,424	5,688	8,424	5,112
Hourly unabated GHG emissions from power plant (kg CO_2e)	281,547	281,547	281,547	281,547	281,547	281,547
Hourly GHG emissions to atmosphere (kg CO_2e)	28,155	28,155	28,155	28,155	28,155	28,155
Annual GHG emissions to atmosphere (tonnes CO_2e)	**237,175**	**237,175**	**237,175**	**160,144**	**237,175**	**143,927**
Gross output from power plant (MW)	784	784	784	784	784	784
Electrical load from capture, compression and ancillary plant (MW)	100	100	100	100	100	100
Net output from abated power plant (MW)	684	684	684	684	684	684
Annual output from abated plant (MWh)	**5,758,857**	**5,758,857**	**5,758,857**	**3,888,459**	**5,758,857**	**3,494,691**
Carbon intensity (tonnes CO_2e/GWh)	**41.2**	**41.2**	**41.2**	**41.2**	**41.2**	**41.2**

Table 21-11: Direct operational GHG Emissions from the Reference Case (Enhanced 95% Abated) power plant at (Scenarios 1 - 3)

	Reference Case Enhanced 95% Capture					
	Baseload Years 1-25		Baseload Years 1-4, Dispatchable Mode from Years 5-25 with 40 Start-Up/Shutdowns		Baseload Years 1-4, Dispatchable Mode from Years 5-25 with 80 Start-Up/Shutdowns	
Years of Operation	Years 1-4	Years 5-25	Years 1-4	Years 5-25	Years 1-4	Years 5-25
Annual Operating Hours	8,424	8,424	8,424	5,688	8,424	5,112
Hourly unabated GHG emissions from power plant (kg CO_2e)	281,547	281,547	281,547	281,547	281,547	281,547
Hourly GHG emissions to atmosphere (kg CO_2e)	14,077	14,077	14,077	14,077	14,077	14,077
Annual GHG emissions to atmosphere (tonnes CO_2e)	**118,588**	**118,588**	**118,588**	**80,072**	**118,588**	**71,963**
Gross output from power plant (MW)	779	779	779	779	779	779
Electrical load from capture, compression and ancillary plant (MW)	100	100	100	100	100	100
Net output from abated power plant (MW)	679	679	679	679	679	679
Annual output from abated plant (MWh)	**5,719,896**	**5,719,896**	**5,719,896**	**3,862,152**	**5,719,896**	**3,471,048**
Carbon intensity (tonnes CO_2e/GWh)	**20.7**	**20.7**	**20.7**	**20.7**	**20.7**	**20.7**

Table 21-12: Operational GHG emissions (using reference 90% Scenario 1 plant emissions)

Lifecycle stage	Project activity/Emission source	Emissions (tCO_{2e}) over 25-year design life	Percentage of total
Operations	Electricity usage	73,725	1%
	Fuel usage onsite (CCGT emissions and other fuels)	5,929,478	88%
	Waste disposal	308,892	5%
	Worker commute	7,922	<1%
	Materials	392,506	6%
	Material transport	30,037	<1%
TOTAL		6,742,561	
Annualised operational emissions (based on 25-year life)		**269,702 (237,175 of which are from the operation of the CCGT)**	

21.3.52 The design life of the Compressor Station is expected to be operating for 40 years, potentially around 15 years beyond the design life of the plant. During this time, the emissions associated with grid electricity usage for this equipment are calculated to be a total of 1.1M tCO_2e over the 15 years, or an average of 72k tCO_2e per year.

GHG Avoidance

21.3.53 The GHG avoidance of the Proposed Development is centred on the carbon capture, carbon export pipeline and offshore sequestration technology being operational. The emissions from consumption of natural gas detailed above are for the reference case, with the carbon capture plant running as designed.

21.3.54 Unabated emissions for baseload operations would be substantially higher, with estimated annual emissions of 2.3$MtCO_2$ per year, or 59$MtCO_2$ over the 25-year design life (see Table 21-10). With carbon capture technology, at least 90% of emissions will be captured, geo-sequestered and not released into the atmosphere. As the Proposed Development will be capable of capturing up to 95% of carbon emissions, the captured GHG emissions are likely to be greater than those reported in this conservative assessment.

21.3.55 Further, the Proposed Development facilitates the potential capture and storage of CO_2 currently emitted from nearby operational industrial and energy facilities, which could significantly reduce the GHG emissions from the region. Currently, industries in Teesside account for over 5% of the UK's total industrial emissions. The Proposed Development will therefore be a vital positive contributor to the UK achieving net zero carbon emissions by 2050. However, as a worst-case scenario, the significant emission avoidance from neighbouring facilities is not included in this assessment.

21.3.56 Using the 30 MW compressor, the carbon capture infrastructure can manage up to 4 million tonnes of CO_2 per year. The worst-case scenario (Scenario 1, Table 21-10) captures 2.1 million tonnes per year of CO_2 from the CCGT plant, leaving over 1.9 million tonnes of CO_2 available capacity per year for neighbouring industrial facilities. Should the plant expand in the future, an 80 MW compressor would be able to manage up 10 million tonnes of CO_2 per year. Scenarios 2 and 3 (dispatchable mode) capture approximately 1.4 million tonnes of CO_2 from the plant and would therefore provide greater capacity (approximately 8.6 million tonnes) for nearby existing emitters industrial facilities.

21.3.57 An additional key benefit of the Proposed Development will be to supply low-carbon electricity to the UK electricity supply grid and therefore displace higher carbon intensity grid electricity (or other power generation sources). Table 21-13 presents the carbon intensity of national averages for electricity generation in the UK in 2018. The table details the carbon intensity associated with the combustion of the primary fuel source only.

21.3.58 Table 21-13 compares the carbon intensity of the Proposed Development (both with and without the carbon capture technology). Unabated, the carbon intensity of the Proposed Development (335.2 tCO_2 per GWh) is lower than the average gas-powered power generation (371 tCO_2 per GWh). Using the carbon capture technology, the abated plant will result in a carbon intensity of 41.2 tCO_2 per GWh at 90% capture, or 20.7 tCO_2 per GWh at 95% capture, which is significantly less than the grid average emissions in 2020 of 198 tCO_2 per GWh (BEIS, 2020a).

21.3.59 The UK electricity grid is in the process of being decarbonised as the UK transitions toward net zero by 2050. BEIS (2020a) provides grid intensity projections to 2100 at which point the UK grid average is expected to emit 28 tCO_2 for every GWh generated.

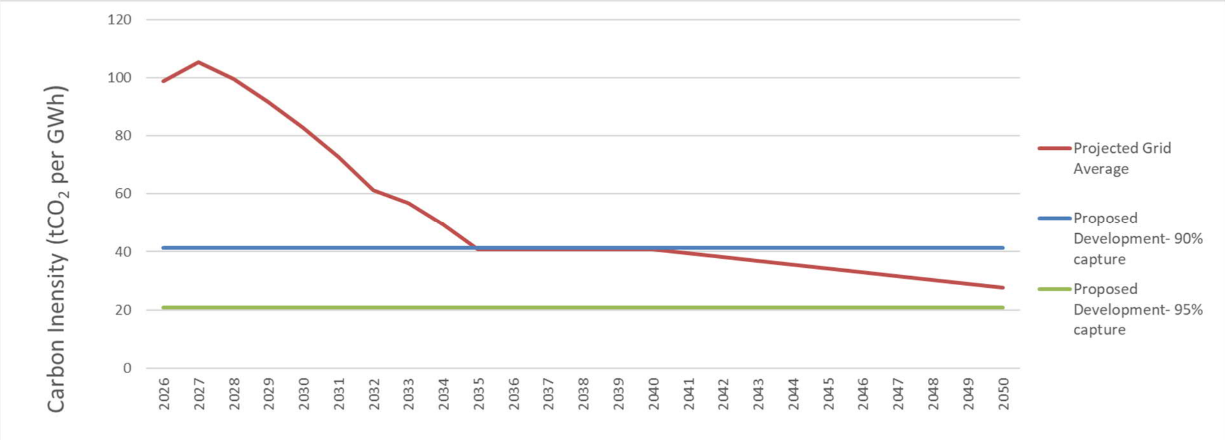
Table 21-13: Recent Carbon Intensities of UK Electricity Grid Generation Sources

Generation source by fuel type	Emissions (tonnes of CO_2 per GWh of Electricity generated)
Gas (BEIS, 2020a)	371
All fossil fuels (BEIS, 2020a)	446
All fuels, grid average (including nuclear and renewables) (BEIS, 2020a)	198
Proposed Development (net unabated - without carbon capture technology)	335.2
Proposed Development (net abated - with 90% carbon capture)	41.2
Proposed Development (net abated - with 95% carbon capture)	20.7

21.3.60 Diagram 21-2 presents the GHG intensity of energy generation from the Proposed Development at 90 and 95% capture alongside projected average grid intensity. Forecast average grid intensity is based on an anticipated mix of electricity generation sources including fossil fuel, nuclear and renewable energy. Average GHG intensity presented in this figure is based on BEIS emission intensity factors (2020a).

21.3.61 Diagram 21-2 shows the comparison between projected decarbonisation of the UK national grid from 2026 to 2050 (BEIS, 2019) and the emissions intensity for the reference 90 and 95% capture cases of the Proposed Development. The diagram shows that the carbon intensity of the Proposed Development at 90% capture is significantly lower than the current and projected future UK grid average until approximately 2035, and comparable to 2040. The 95% capture rate remains significantly less than the projected grid average to 2050. This forecast decrease in grid carbon intensity is predominantly due to an increased uptake of renewable energy, CCS, hydrogen and nuclear generation while the use of fossil fuels without carbon capture to generate energy declines.

Diagram 21-2: Forecast UK Grid Intensity vs Proposed Development (reference case)



Decommissioning

21.3.62 In order to assess the magnitude of the climate change impacts through GHG emissions associated with decommissioning of the Proposed Development, the GHG emissions that would be associated with the Proposed Development decommissioning activities could include those associated with:

- demolition and excavation of all buildings and infrastructure, as required;
- disposal and treatment of all wastes; and
- return of the Site to an industrial brownfield use under hardstanding (i.e. no change in land use).

21.3.63 At this stage of the design, details regarding these activities have not been developed, however they are assumed to be commensurate with emissions generated during the construction stage (e.g. of the approximate magnitude of 76,012 tCO_2e).

Summary of Greenhouse Gas Impacts

21.3.64 The receptor for the GHG assessment is the global climate and the UK's carbon budgets are used as a proxy to assess the impacts to this receptor.

21.3.65 Emissions associated with the Proposed Development have been examined for their significance against the UK Carbon Budgets. These emissions are detailed in Table 21-14.

21.3.66 This assumes four years of construction occurring across the 3rd and 4th carbon budgets, two years of operations occurring during the 4th carbon budget, and five years during the 5th and 6th carbon budgets. The percentage contribution of emissions from the Proposed Development to the respective carbon budgets are less than 0.001%, 0.03%, 0.08% and 0.14%, respectively.

Table 21-14: Proposed Development GHG Emissions Compared to the UK Carbon Budget

UK Carbon Budget	Total Budget ($MtCO_2e$)	Potential Project Emissions ($MtCO_2e$)	Percentage Contribution of Emissions
3rd (2018-2022)	2,544	Less than 0.01 (two years of construction)	Less than 0.001%
4th (2023-2027)	1,950	0.6 (two years of construction; two years of operations)	0.03%
5th (2028-2032)	1,725	1.3 (five years operations)	0.08%
6th (2033-2037)	965	1.3 (five years operations)	0.14%

21.3.67 The receptor for the GHG assessment is the global climate but using the corresponding UK Carbon Budgets as a proxy. Total GHG emissions associated with the Proposed Development do not exceed 1% of the corresponding UK carbon budget limits. Therefore, the GHG emissions are considered as having a 'low increase' magnitude (Table 21-6) and therefore classified as 'minor adverse' significance (Table 21-7).

21.3.68 Once neighbouring industries are able to connect to the CO_2 Gathering Network and carbon can be captured from existing sources, it is envisaged that the project as a whole could result in a net reduction in carbon emissions from current levels. The objective of the Proposed Development and connected industrial users will have a beneficial effect on annual UK carbon emissions.

Mitigation and Enhancement Measures

21.3.69 The management of GHG emissions and the application of mitigation measures during construction will be secured through the CEMP. The use of the carbon capture plant will control GHG emissions during plant operation.

21.3.70 Section 21.3:Consultation detailed a request from the Environment Agency to use renewable energy sources to offset parasitic loads. As grid electricity is only planned to be used during maintenance periods (approximately 14 days every year) and the national electricity grid is rapidly decarbonising, it is considered that the benefits of this offsetting measure would not outweigh the costs.

Limitations or Difficulties

21.3.71 It must be noted that the most recent UK government projections of future grid carbon intensity were published in March 2019, prior to the UK's 2050 Net-Zero commitment. All such projections are subject to considerable uncertainty.

21.3.72 There is limited information on CO_2 emissions during start-up of the CCP and this will not be quantifiable until after the detailed design stage and verified through plant commissioning. A conservative assessment has been undertaken whereby it is assumed that the plant will operate for 8,424 hours per year at 90% capture efficiency; this is envisaged to lead to higher emissions than a dispatchable plant operating at lower load factors with start-up emissions.

21.3.73 The GHG assessment of construction impacts assumes that the measures outlined within the Development Design and Impact Avoidance section of this chapter would be incorporated into the design of the Proposed Development. These measures are considered standard best practice that are usually applied across construction sites in the UK. No additional mitigation has been identified as necessary for the construction phase of the Proposed Development.

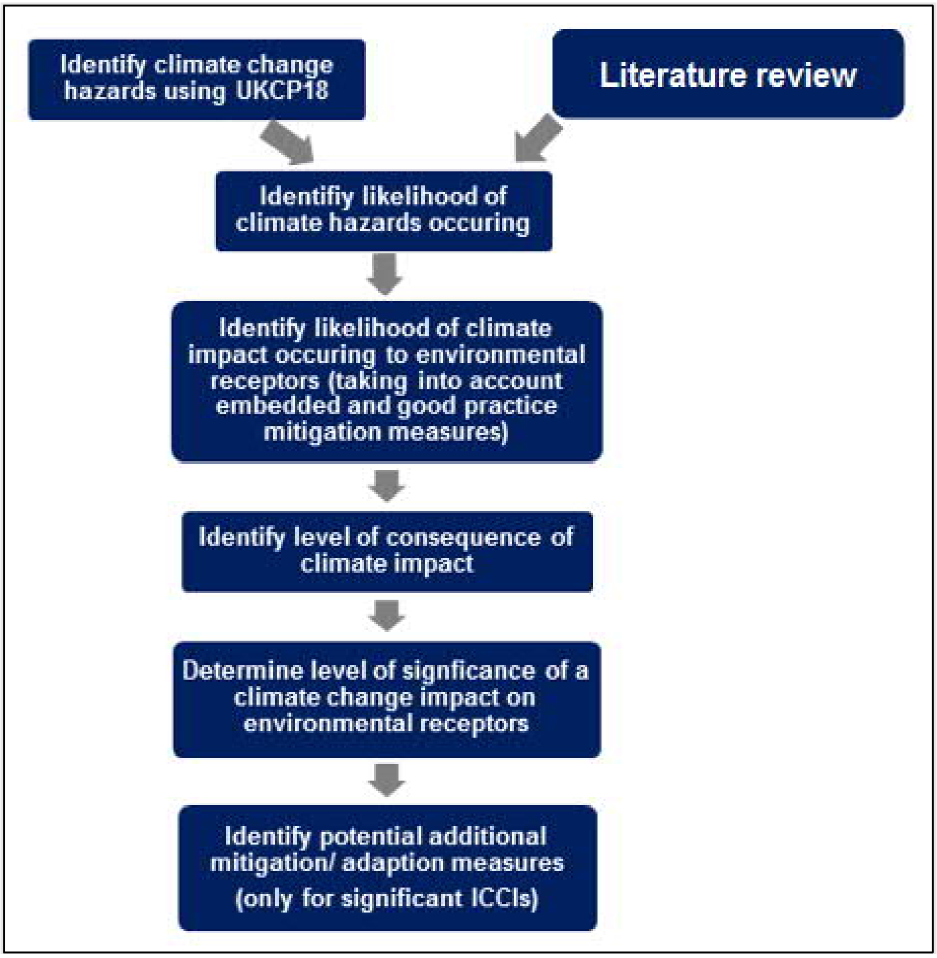
21.3.74 The current GHG assessment is limited to the availability of data and information. The inclusions and exclusions of data have been detailed in paragraphs 21.3.39 and 21.3.40.

21.4 In-Combination Climate Change Assessment

Assessment Methodology

21.4.1 An overview of the ICCI assessment methodology applied within this assessment is illustrated in Diagram 21-3.

Diagram 21-3: ICCI Assessment Methodology



Consultation

21.4.2 In response to the EIA Scoping Report, the Planning Inspectorate prepared a Scoping Opinion document (see Appendix 1B, ES Volume III, Document Ref. 6.4). Specific comments raised by the Planning Inspectorate in relation to ICCI are listed in Table 21-15 which demonstrates how these comments have been addressed in the ES.

Table 21-15: Summary of Comments raised in the Scoping Opinion (where relevant to the ICCI assessment)

Scoping Opinion Section ID	Subject	Comments	Response/where addressed in the ES
4.2.1	Assessment of climate change impacts from construction and decommissioning	The focus of paragraphs 6.25 - 6.27 of the Scoping Report is on operational impacts; it is not clear whether an assessment of climate change impacts from construction and decommissioning is proposed. The ES should explain how climate change impacts from construction and decommissioning of the Proposed Development (for example, greenhouse gas (GHG) emissions) have been considered and assess any likely significant effects.	Section 21.4: Assessment Methodology details the full life-cycle assessment approach Section 21.4: Classification and Significance of Effect details the method in which significance will be determined. ion 21.4: details the method in which significance will be determined.
4.2.3	Sensitive receptors	The sensitive receptors for the purposes of the climate change assessment should be set out and justified in the ES. The susceptibility or resilience of the identified receptors to climate change must be considered as well as the value of the receptor.	Section 21.4: Sensitive Receptors; this section details the overarching sensitive receptors.
4.2.4	Significance criteria	The Scoping Report does not set out how a significant effect would be determined for the purposes of the climate change assessment. This should be clearly set out in the ES. Any use of professional judgement to assess significance should be fully justified within the ES.	Section 21.4: Classification and Significance if ICCI Effect details the methodology in which significance criteria is determined.

21.4.3 The Applicant also undertook formal Section 42 and Section 47 consultation, which commenced at the same time as the publication of the Preliminary Environmental Information (PEI) Report. This statutory consultation ran from early July 2020 to September 2020. Comments were taken from 30 consultees, of which the Environment Agency and Forestry Commission provided comment on this climate change assessment. The comments relating to ICCI assessment and the demonstration of how these comments have been incorporated into this ES assessment are described in Table 21-16.

Table 21-16: Comments raised by the Stakeholders from the PEIR Consultation Relating to ICCI

Stakeholder	Summarised Comment	Addressed in ES Chapter
Forestry Commission	Encourage consideration of climate change impacts to woodlands such as temperature change, introduced species and disease.	Section 21.4: Mitigation and Enhancement Measures details the proposed measures to reduce the likelihood or severity of any ICCI

Baseline Environment

21.4.4 The current baseline for the ICCI Assessment and the CCR review presented in Section 21.5 is based on historic climate data obtained from the Met Office (2020) recorded by the closest meteorological station to the Proposed Development (Stockton-on-Tees, approximately 11 km from Site) for the period 1981-2010. The data is listed in Table 21-17.

Table 21-17: Historic Climate Data

Climatic Variable	Month	Value
Average annual maximum daily temperature (°C)	-	13.1
Warmest month on average (°C)	July	20.4
Coldest month on average (°C)	December and January	0.7
Mean annual rainfall levels (mm)	-	574.2
Wettest month on average (mm)	August	60.6
Driest month on average (mm)	February	32.9

21.4.5 The Met Office historic 10-year averages for the 'East and North East England' region identify gradual warming (although not uniformly so) between 1970 and 2019, with increased rainfall also. Information on mean maximum annual temperatures and mean annual rainfall is summarised in Table 21-18. In comparison to the historic climate data for Stockton-on-Tees, Stockton-on-Tees appears somewhat drier than the average for the region. As described by the Met Office (2016), rainfall is greater across the Pennines and *"decreases as land falls eastwards, such that the east coast is one of the driest parts of the UK with less than 600 mm in places such as Tees-side and the Northumbrian coast*."

21.4.6 The future baseline for the ICCI and CCR assessments is based on future UK Climate Projections 2018 (UKCP18) from the Met Office for the Stockton-on-Tees area (The Met Office, 2019a). This projection data provides probabilistic indications of how global climate change is likely to affect areas of the UK using pre-defined climate variables and time periods.

Table 21-18: Historic 10-year Averages for Temperature and Rainfall for the East and North East England

Climate Period	Climate Variable	
	Mean maximum annual temperatures (°C)	Mean annual rainfall (mm)
1970-1979	12.0	698.2
1980-1989	12.0	748.2
1990-1999	12.7	720.2
2000-2009	13.2	824.9
2010-2019	13.1	796.2

21.4.7 For the purpose of the assessment, UKCP18 probabilistic projections for pre-defined 20-year periods for the following average climate variables have been obtained and will be further analysed:

- mean annual temperature;
- mean summer temperature;
- mean winter temperature;
- maximum summer temperature;
- minimum winter temperature;
- mean annual precipitation;
- mean summer precipitation;
- mean winter precipitation; and
- sea level rise.

21.4.8 Projected variables are presented in Table 21-19 to Table 21-21. UKCP18 probabilistic projections have been analysed for the 25 km grid square in which the Site is located. These figures are expressed as temperature/ precipitation anomalies in relation to the 1981-2000 baseline. This baseline was selected as it provides projections for 20-year time periods (e.g. 2020-2039) for the parameters analysed within the assessment compared to the 30-year land-based projections that would be generated from the 1981 - 2010 baseline.

21.4.9 UKCP18 uses a range of possible scenarios, classified as Representative Concentration Pathways (RCPs), to inform differing future emission trends. These RCPs *"… specify the concentrations of greenhouse gases that will result in total radiative forcing increasing by a target amount by 2100, relative to preindustrial levels*." RCP 8.5 is considered to be the worst-case global scenario with the greatest concentration of GHGs in the atmosphere and has been used as the purposes of this assessment as a worst-case scenario.

21.4.10 Depending on project economics and phasing, construction of the Proposed Development is expected to take around four years starting in late 2022.

Power generation and carbon capture are then expected from 2026 for up to 25 years, after which time the compressor is expected to continue for an additional 15 years. Therefore, the ICCI and CCR assessments have considered a scenario that reflects a high level of greenhouse gas emissions at the 10%, 50% and 90% probability levels up to the 2069 projection to assess the impact of climate change over as much of the lifetime of the Proposed Development as possible.

Table 21-19: Projected Changes in Temperature Variables (°C), 50% Probability (10% and 90% Probability in Parenthesis)

Climate Variable	Time Period		
	2020-2039	2030-2049	2050-2069
Mean annual air temperature anomaly at 1.5 m (°C)	+1.0 (+0.4 to +1.6)	+1.3 (+0.6 to +2.1	+2.1 (+1.0 to +3.2)
Mean summer air temperature anomaly at 1.5 m (°C)	+1.0 (+0.2 to +1.8)	+1.3 (+0.3 to +2.3)	+2.4 (+0.7 to +4.2)
Mean winter air temperature anomaly at 1.5 m (°C)	+1.0 (0.0 to +1.9)	+1.3 (+0.1 to +2.5)	+1.9 (+0.5 to +3.5)
Maximum summer air temperature anomaly at 1.5 m (°C)	+1.1 (+0.2 to +2.1)	+1.5 (+0.3 to +2.7)	+2.6 (+0.8 to +4.6)
Minimum winter air temperature anomaly at 1.5 m (°C)	+1.0 (+0.0 to +2.0)	+1.3 (+0.2 to +2.4)	+1.9 (+0.5 to +3.3)

Table 21-20: Projected Changes in Precipitation Variables (%), 50% Probability (10% and 90% Probability in Parenthesis)

Climate Variable	Time Period		
	2020-2039	2030-2049	2040-2059
Annual precipitation rate anomaly (%)	+4.5 (-1.5 to +11.2)	+1.5 (-3.5 to +6.9)	+0.8 (-6.0 to +8.3)
Summer precipitation rate anomaly (%)	-2.0 (-16.8 to +14.7)	-5.1 (-19.9 to +11.3)	-16.4 (-36.6 to +5.5)
Winter precipitation rate anomaly (%)	+9.5 (-3.0 to +22.8)	+12.0 (-1.2 to +26.3)	+14.6 (-4.3 to +35.7)

21.4.11 Sea level rise may increase up to 14 cm when operations start (approximately 2026) and up to 33 cm when operations are completed, decommissioning of the CCGT initiates (from 2051) and approximately 2066 when the decommissioning of the compressor initiates. The ranges of projected sea level rise from the 1981-2000 baseline are detailed in Table 21-21.

Table 21-21: Projected 50% Probability of Sea Level Rise Under RCP 8.5 Relative to the 1981-2000 Baseline Period (10% And 90% Probability In Parenthesis)

	2022	2026	2051	2069
Sea level anomaly (m)	+0.08 (+0.06 to +0.11)	+0.11 (+0.08 to +0.14)	+0.26 (+0.19 to +0.33)	+0.39 (+0.29 to +53)

21.4.12 Sea temperature change projections are more variable, but under RCP 8.5 a rise in global sea surface temperature of 1.5°C by 2050 is predicted, and 3.2°C by 2100, relative to 1870–1899 temperatures. In UK waters, mean annual sea temperatures have risen by 0.8°C since 1870, and have shown a consistent warming trend from the 1970s onwards (Genner *et al*., 2017). According to Lowe *et al*., (2009), the seas around the UK are projected to be 1.5–4 ºC warmer by 2100.

21.4.13 Using the climate variable likelihood data for future baselines (Table 21-5) and the definitions for likelihood (Table 21-25 and Table 21-26), the likelihood of occurrence of potential climate hazards is detailed in Table 21-22.

Table 21-22: Potential Climate Hazards and Likelihood of Occurrence (from UKCP18 Projections)

Climate Variable	Potential Hazard	2020- 2039 Likelihood	2030- 2049 Likelihood	2050- 2069 Likelihood
Mean annual air temperature anomaly at 1.5 m (°C)	Increase in mean annual air temperature	Very likely	Very likely	Very likely
Mean summer air temperature anomaly at 1.5 m (°C)	Increase in mean summer air temperature	Very likely	Very likely	Very likely
Mean winter air temperature anomaly at 1.5 m (°C)	Increase in mean winter air temperature	Very likely	Very likely	Very likely
Maximum summer air temperature anomaly at 1.5 m (°C)	Increase in maximum summer air temperature	Very likely	Very likely	Very likely
Minimum winter air temperature anomaly at 1.5 m (°C)	Increase in minimum winter air temperatures	Very likely	Very likely	Very likely
Annual precipitation rate anomaly (%)	Decrease in annual precipitation rate	Unlikely	Unlikely	Possible
Summer precipitation rate anomaly (%)	Decrease in summer precipitation rate	Possible	Likely	Likely

Climate Variable	Potential Hazard	2020- 2039 Likelihood	2030- 2049 Likelihood	2050- 2069 Likelihood
Winter precipitation rate anomaly (%)	Increase in winter precipitation rate	Very likely	Very likely	Very likely
Sea level rise (m)	Increase in sea level	Very likely	Very likely	Very likely
Sea temperature rise (°C)	Increase in sea surface temperature	Very likely	Very likely	Very likely

21.4.14 The 2019 State of the UK Climate report (Kendon *et al*., 2020) states that there are 'no compelling trends in storminess when considering maximum gust speeds over the last five decades', therefore an increase in storm intensity is currently considered unlikely.

21.4.15 Kendon *et al*., (2020) states that there has been a decline in the longest sequence of consecutive dry days. However, projected drier summers are suggestive of a drying trend. Therefore, an increase in droughts is currently considered possible.

21.4.16 Research by Sanderson *et al*., (2017) into the historical trends of heatwave frequency in the UK found variable results, with some weather stations recording a decline in very long heatwaves and others an increase in short heatwaves. Accordingly, the likelihood of an increase in heatwaves is considered possible.

Project Environment

21.4.17 The project environment is a '*do something*' scenario with the delivery of the Proposed Development, which includes the construction and operation of the plant.

Study Area

21.4.18 The Study Areas used for the ICCI assessment is the as the Study Area defined in each of the topic chapter of the ES (Chapters 8-24 in ES Volume I, Document Ref. 6.2). This assessment aims to determine the influence of climate change and project-related impacts to the identified receptors in each of the assessments in those chapters.

Sensitive Receptors

21.4.19 The ICCI assessment considers the sensitive receptors identified by each Environmental discipline in their assessment, as defined in Chapters 8 to 24. The ICCI assessment is undertaken by individual technical disciplines in regard to the identified sensitive receptors in each assessment.

Determining Construction Effects

21.4.20 Construction of the Proposed Development has been assessed on the basis of a 4-year period. The assessment methodology has been described in the following Section.

Determining Operational Effects

21.4.21 The ICCI assessment considers the ways in which projected climate change will influence the significance of the impact of the Proposed Development on receptors in the surrounding environment. The scope of the ICCI assessment is detailed in Table 21-23.

21.4.22 The ICCI assessment considers the existing and projected future climate conditions for the geographical location and assessment timeframe. It identifies the extent to which identified receptors in the surrounding environment are potentially vulnerable to and affected by these factors. The receptors for the ICCI assessment are those that will be impacted by the Proposed Development. These impacts are assessed by the technical specialists responsible for preparing other technical chapters of this ES.

Determining Decommissioning Effects

21.4.23 As the decommissioning phase is likely to be shorter than the construction period and therefore less likely to be impacted by changes in climate, the ICCI assessment during the decommissioning assessment will follow a descriptive based approach only due to uncertainties around decommissioning activities and the sensitive receptors of the time.

Classification and Significance of Effects

21.4.24 An assessment of ICCI following the steps shown in Diagram 21-3 above will be conducted for the Proposed Development that identifies potential climate change impacts and considers their potential consequence and likelihood of occurrence.

21.4.25 Information on historic observations on climate change such as the UK Climate Change Risk Assessment (HM Government, 2017b) along with climate change projection data from UKCP18 will be used to identify potential chronic and acute climate hazards that may affect the geographical location of the proposed development.

21.4.26 The likelihood of each potential climate change hazard occurring has then been assessed. Likelihood is categorised into five levels depending on the probability of the hazard occurring. Table 21-24 presents the likelihood levels and definitions used. This is in line with the definitions presented in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (IPCC, 2014).

21.4.27 There is some amount of overlap in the criteria provided to allow for uncertainty and the qualitative approach of the assessment.

21.4.28 Identified climate hazards and the level of likelihood that they will occur are presented in Section 21.4:Baseline Environment.

21.4.29 The likelihood of an ICCI occurring is determined based on the likelihood of a climate hazard occurring (Table 21-25) combined with the sensitivity of the receptor as defined by the relevant environmental disciplines, using professional judgement. Consideration is given to any increase in the impact of the Proposed Development.

Table 21-23: Scope of the ICCI Assessment

Climate Parameter	Considered in ICCI Assessment	Rationale
Extreme weather event	In	An increase in the likelihood and severity of extreme weather events could lead to damage to ecosystem stability. In combination with sea level rise, the likelihood and severity of acute coastal impacts such as erosion, loss of habitats, destabilisation and damage to infrastructure could increase. These impacts may be exacerbated by the Proposed Development.
Precipitation change (flooding and droughts)	In	Climate change may lead to both an increase in substantial precipitation and drought events. The combination of the Proposed Development and its water requirements and climate change may cause increased risk of impacts.
Temperature and Humidity	In	Fluctuating levels of temperature may lead to: - Increase in likelihood and severity of heat waves which might have a negative impact on biodiversity and health; and - Increase in likelihood and severity of freezes which might have a negative impact on biodiversity and health.
Sea level rise	In	The Site is located in an area that is susceptible to sea level rise. The impacts of sea level rise on receptors may be exacerbated by the Proposed Development.
Sea temperature	In	The Proposed Development will produce thermal discharges which may be directed to sea via the outfall. The combination of this with increasing sea temperatures may cause increased risks to marine ecology and the physico-chemical environment.
Wind	Out	The Proposed Development is not expected to alter the wind environment and therefore is not expected to have any additional impact upon receptors identified by other environmental disciplines.

Table 21-24: ICCI Assessment – Level of Likelihood of the Climate Hazard Occurring

Level of Likelihood	Definition of Likelihood
Very likely	90-100% probability that the hazard will occur
Likely	66-90% probability that the hazard will occur
Possible, about as likely as not	33-66% probability that the hazard will occur
Unlikely	0-33% probability that the hazard will occur

21.4.30 In defining the likelihood of an in-combination climate impact occurring, embedded and good practice mitigation measures (primary and tertiary mitigation) are accounted for. Definitions of likelihood are set out in Table 21-25. Table 21-25 to support ICCI assessment but where the impact does not fit within discipline specific criteria to assess effects then expert judgement is used to qualitatively assess whether the likelihood of the impact occurring is very likely – very unlikely.

Table 21-25: ICCI Assessment – Level of Likelihood of the Climate Impact Occurring

Level of likelihood of climate impact occurring	Definition of likelihood
Likely	66-100% probability that the impact will occur during the life of the project
Possible, about as likely as not	33-66% probability that the impact will occur during the life of the project
Unlikely	0-33% probability that the impact will occur during the life of the project

21.4.31 Table 21-26 is then used to determine the overall likelihood of the ICCI.

Table 21-26: Level of Likelihood of the ICCI

		Likelihood of climate change hazard occurring				
		Very unlikely	Unlikely	Possible	Likely	Very likely
Likelihood of impact occurring (given embedded mitigation measures)	Unlikely	Low	Low	Low	Medium	Medium
	Possible	Low	Low	Medium	Medium	Medium
	Likely	Low	Medium	Medium	High	High

21.4.32 Once the likelihood of an in-combination climate impact occurring on a receptor has been identified, the discrete environmental assessment should consider how this will affect the significance of the identified effects.

21.4.33 The ICCI consequence criteria are defined in Table 21-27 and are based on the change to the significance of the effect already identified by the environmental discipline. To assess the consequence of an ICCI impact, each discipline will assign a level of consequence to an impact based on the criteria description in Table 21-27 and their discipline assessment methodology.

Table 21-27: ICCI assessment – Level of Likelihood of the Climate Impact Occurring

Consequence	Consequence criteria
High	The climate change parameter in-combination with the effect of the proposed development causes the significance of the effect of the proposed scheme on the resource/receptor, as defined by the topic, to increase from negligible, minor or moderate to major.
Medium	The climate change parameter in-combination with the effect of the proposed development causes the effect defined by the topic, to increase from negligible or minor to moderate.
Low	The climate change parameter in-combination with the effect of the proposed development, causes the significance of effect defined by the topic, to increase from negligible to minor.
Very low	The climate change parameter in-combination with the effect of the proposed development does not alter the significance of the effect defined by the topic.

Classification and Significance of ICCI Effects

21.4.34 The significance of potential effects is determined by the environmental disciplines using the matrix in Table 21-29. As a general rule, where an effect has been identified as moderate or major, this has been deemed significant. However, professional judgement is also applied where appropriate.

Table 21-28: ICCI Assessment – Significance Criteria

		Likelihood		
		Low	**Medium**	**High**
Consequence	**Very low**	Negligible	Negligible	Minor
	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

21.4.35 Where an ICCI is determined to be significant then appropriate additional mitigation measures (secondary mitigation) is identified.

21.4.36 Professional judgement is used to describe whether with additional mitigation in place, the ICCI remains significant or the residual effect has been reduced to not significant.

21.4.37 Where relevant, mitigation measures or mechanisms to reduce the potential significant effects arising from ICCI will be developed in discussion with environmental specialists.

Development Design and Impact Avoidance

Construction

21.4.38 Full details of embedded design measures that reduce the likelihood or severity of ICCI to receptors are detailed within Appendix 5A: Framework CEMP (ES Volume III, Document Ref. 6.4) and other technical disciplines, such as that detailed in Chapter 8: Air Quality, Chapter 9: Surface Water, Flood Risk and Water Resources, Chapter 11: Noise and Vibration and Chapter 14: Marine Ecology and Nature Conservation (all ES Volume I, Document Ref. 6.2). Examples of these measures include:

- Spoil management, and protection from high rainfall events;
- Suitable storage and bunding of pollutants to protect from high rainfall events or sea level rise. This will be further supported by the Water Management Plan;
- Permeable surface materials on laydown areas to prevent flooding in high rainfall events;
- Dust avoidance construction techniques, reducing chances of poorer air quality in stormy, low rainfall or drought conditions;
- Prohibition of open fire on site, reducing the chances of starting a wildfire in drought and heatwave conditions;
- Reducing human disturbance during heatwave conditions when windows are more likely to be open; and
- Adherence to ballast water, sediments and biofouling regulations to prevent the spread of invasive species by construction vessels which may be more prevalent in warmer sea temperatures.

Operation

21.4.39 Full details of embedded design measures that reduce the likelihood or severity of ICCI to receptors are detailed within other technical disciplines, such as that detailed in Chapter 8: Air Quality, Chapter 9: Surface Water, Flood Risk and Water Resources, Chapter 11: Noise and Vibration and Chapter 14: Marine Ecology and Nature Conservation (all ES Volume I, Document Ref. 6.2). Examples of these measures include:

- Suitable storage and bunding of pollutants to protect from high rainfall events or sea level rise. This will be supported by a Site Emergency Response Plan;
- An open drainage system that collects runoff from areas that are high risk of contamination, reducing the chances of causing further soils and water contamination during times of high rainfall events or sea level rise. This will be supported by a Surface Water Maintenance and Management Plan; and
- Reducing human disturbance during heatwave conditions when windows are more likely to be open. This will be supported by an Environmental Permit.

Decommissioning

21.4.40 At this stage, limited specific mitigation measures have been identified for the decommissioning phase of the Proposed Development. A Decommissioning Environmental Management Plan (DEMP) will be produced to appropriate guidance and legislation at the time and will likely be similar to that of the construction phase but reflect future climatic conditions at that point in time in the future.

Likely Impacts and Effects

Description of Potential Effects

21.4.41 Future climate change projections have been reviewed and the sensitivity of identified sensitive receptors to these hazards examined. Project risks to receptors are examined together with climate hazards to understand if the impact is exacerbated.

21.4.42 The potential impacts and effects of projections for climate change to the Proposed Development are detailed in Table 21-36 and are based upon those scoped in (see Table 21-23).

21.4.43 The types of impacts and effects that may occur are described in Section 21.5. Potential construction, operation and decommissioning ICCI's to receptors, their likelihood, consequence and significance are detailed in Table 21-29.

Summary of ICCI Impacts

21.4.44 Two potentially significant ICCI have been identified (shaded grey). They both relate to increasing winter rainfall combined with existing flood risk at the Site.

Mitigation and Enhancement Measures

21.4.45 The development of a Flood Emergency Response Plan supported by the results and recommendations of the Flood Risk Assessment has been deemed sufficient to address significant ICCIs.

21.4.46 Section 21.4: Consultation detailed a request from the Forestry Commission to encourage consideration of climate change impacts to woodlands. As there are no woodlands within the Site or within land the Applicants will retain control over, nor will effects of the Proposed Development extend to outside of the Site, no further mitigation measures have been proposed for woodlands.

Limitations or Difficulties

21.4.47 While modelled climate change projections represent anticipated changes to average weather conditions, they cannot predict the frequency and severity of acute events such as droughts, heatwaves and prolonged heavy rainfall. Therefore, the ICCI assessment is based upon UKCP18 predictions for general changes in climate conditions, and only a high-level assessment of acute events is included in this assessment.

21.4.48 The ICCI assessment is limited to the availability of data and information at the date this assessment was prepared.

Table 21-29. Potential ICCIs and Relevant Embedded Measures

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Project phase	Receptor Sensitivity to Climate Hazard	Description of Potential ICCI	Embedded Design Measures	Likelihood of an impact occurring to this receptor	Likelihood of an ICCI impact occurring	Consequence of impact occurring	ICCI Significance Level	Significance	Additional mitigation measures
Increase droughts	Possible	Air quality	Construction	Medium	Increased construction dust	Consequence is minimised through the measures incorporated into the (Framework CEMP e.g. reduce dust emissions through the effective transportation and storage of materials), including the proposed monitoring regime.	Unlikely	Low	Low	Negligible	No	None
Sea level rise	Very Likely	Marine Mammals	Constructi on	Very High	Loss of suitable haul-out areas within Seal Sands and the wider Tees Estuary for seals	None considered	Unlikely	Medium	Low	Minor	No	None
Increase in annual rainfall	Possible	Flood Risk - downstream receptors	Operation	High	Frequency and duration of flooding from all sources	Climate change influence expected flows will be accommodated in the design of drainage infrastructure to ensure appropriate storage for anticipated flows (e.g. in attenuation ponds in the surface water drainage system).	Unlikely	Low	High	Moderate	No	None

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Project phase	Receptor Sensitivity to Climate Hazard	Description of Potential ICCI	Embedded Design Measures	Likelihood of an impact occurring to this receptor	Likelihood of an ICCI impact occurring	Consequence of impact occurring	ICCI Significance Level	Significance	Additional mitigation measures
							Flood Emergency Response Plan. Drainage Strategy					
Increase to winter rainfall	Very Likely	Tees Bay waterbody	Operation	High	See- increase to annual rainfall: flood risk	See- increase to annual rainfall: flood risk.	Unlikely	Medium	Medium	Moderate	No	None
Increase to winter rainfall	Very Likely	Flood Risk	Operation	High	See- increase to annual rainfall: flood risk	See- increase to annual rainfall: flood risk.	Unlikely	Medium	High	Major	Yes	None
Sea level rise	Very Likely	Marine Mammals	Operation	Very High	Loss of suitable haul-out areas within Seal Sands and the wider Tees Estuary for seals	None considered	Unlikely	Medium	Low	Minor	No	None
Sea level rise	Very Likely	Marine Mammals	Decommissioning	Very High	Loss of suitable haul-out areas within Seal Sands and the wider Tees Estuary for seals	DEMP will be developed and agreed with the Environment Agency and other stakeholders. This shall consider in detail all potential environmental risks of the Site and	Possible	Medium	Low	Minor	No	None

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Project phase	Receptor Sensitivity to Climate Hazard	Description of Potential ICCI	Embedded Design Measures	Likelihood of an impact occurring to this receptor	Likelihood of an ICCI impact occurring	Consequence of impact occurring	ICCI Significance Level	Significance	Additional mitigation measures
						would be expected to consider baseline conditions at that time.						
Increase in annual rainfall	Possible	Flood Risk - downstream receptors	Decommissioning	High	Frequency and duration of flooding from all sources	Climate change influence expected flows will be accommodated in the design of drainage infrastructure to ensure appropriate storage for anticipated flows (e.g. in attenuation ponds in the surface water drainage system). Flood Emergency Response Plan. Drainage Strategy. DEMP.	Unlikely	Low	High	Moderate	No	None
Increase to winter rainfall	Very Likely	Flood Risk	Decommissioning	High	See- increase to annual rainfall: flood risk	See- increase to annual rainfall: flood risk	Unlikely	Medium	High	Major	Yes	None

21.5 Climate Change Resilience Review

Assessment Methodology

Consultation

21.5.1 An EIA Scoping Report (see Appendix 1A, ES Volume III, Document Ref. 6.4) was prepared by AECOM and submitted to the Planning Inspectorate in February 2019. The EIA Scoping Report sets out the proposed approach to the EIA and is intended to facilitate discussions regarding the scope of the EIA.

21.5.2 In response to the EIA Scoping Report, the Planning Inspectorate prepared a Scoping Opinion (see Appendix 1B, ES Volume III, Document Ref. 6.4). Specific comments raised by the Planning Inspectorate in relation to climate change are listed in Table 21-30. Table 21-30 demonstrates how these comments have been addressed in the ES.

Table 21-30: Summary of Comments raised in the Scoping Opinion (where relevant to the CCR Assessment)

Scoping Opinion Section ID	Subject	Comments	Response/ how addressed in the ES
4.2.1	Assessment of climate change impacts from construction and decommissioning	The focus of paragraphs 6.25 - 6.27 of the Scoping Report is on operational impacts; it is not clear whether an assessment of climate change impacts from construction and decommissioning is proposed. The ES should explain how climate change impacts from construction and decommissioning of the Proposed Development (for example, greenhouse gas (GHG) emissions) have been considered and assess any likely significant effects.	Section 21.5: Assessment Methodology details the full life-cycle assessment approach Section 21.5:Classification and Significance of Effect details the method in which significance will be determined.
4.2.3	Sensitive receptors	The sensitive receptors for the purposes of the climate change assessment should be set out and justified in the ES. The susceptibility or resilience of the identified receptors to climate change must be considered as well as the value of the receptor.	Section 21.5: Sensitive Receptors; this section details the overarching sensitive receptors
4.2.4	Significance criteria	The Scoping Report does not set out how a significant effect would be determined for the purposes of the climate change	Section 21.5: Classification and Significance of Effects details the methodology in which

Scoping Opinion Section ID	Subject	Comments	Response/ how addressed in the ES
		assessment. This should be clearly set out in the ES. Any use of professional judgement to assess significance should be fully justified within the ES.	significance criteria is determined.
4.2.5	Climate change risks and adaptation	The ES should describe any potential impacts from changes in rainfall, flood risk, temperature, humidity and wind speed (including resilience to such impacts) with reference to the UKCP18 and the anticipated lifespan of the Proposed Development. If significant effects are likely, these should be assessed.	Section 21.5: Likely Impacts and Effects details potential climate change impacts and considers their potential consequence and likelihood of occurrence. Potential impacts from climate change associated with flood risk specifically are addressed within Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, Document Ref. 6.2) and Appendix 9A: Flood Risk Assessment (ES Volume III, Document Ref. 6.4). The assessment has been informed by UKCP18 (see Section 21.5: Assessment Methodology).

21.5.3 The Applicant also undertook formal Section 42 and Section 47 consultation, which commenced at the same time as the publication of the Preliminary Environmental Information (PEI) Report. This statutory consultation ran from early July 2020 to September 2020. Comments were taken from 30 consultees, of which the Environment Agency and Forestry Commission provided comment on this climate change assessment. The comments relating to CCR assessment and the demonstration of how these comments have been incorporated into this ES assessment are described in Table 21-31..

Table 21-31: Comments raised by the Stakeholders from the PEIR Consultation Relating to CCR

Stakeholder	Summarised Comment	Addressed in ES Chapter
Environment Agency	Commitments to rainwater harvesting systems are welcomed.	Section 21.5: Mitigation and Enhancement Measures details the proposed measures to increase climate change resilience
	The impacts of hotter summers and freezing winters on the cooling system should be considered.	
Forestry Commission	Suggestions of woodland adaptation to climate change through: - replanting species selection - using seeds from varying origins and provenances - encouraging natural regeneration - providing protection from damaging animals	

Baseline Line Environment

21.5.4 The baseline environment for the CCR review is the same as the ICCI assessment presented in Section 21.4 above.

Project Environment

21.5.5 The project environment is a '*do something'* scenario with the delivery of the Proposed Development, which includes the construction and operations of the plant.

Study Area

21.5.6 The Study Area for the CCR review is the Proposed Development itself.

Sensitive Receptors

21.5.7 Sensitive receptors include workers, occupiers, users and associated infrastructure, as outlined in more detail below.

Determining Construction Effects

21.5.8 As the construction phase (4 years) would be much shorter in duration than the operational phase (25 years), and would be undertaken within the next ten years, future climate change is less relevant to the assessment of construction impacts and effects.

21.5.9 Accordingly, the CCR review for the construction phases will follow a descriptive based approach only.

Determining Operational Effects

21.5.10 The CCR assessment has considered the strategic aims and objectives encompassed within national and local planning policy (Section 21.1), such as the Overarching National Policy Statement for Energy (EN-1), The NPPF, the National Planning Policy Guidance on Climate Change, the Tees Valley Climate Change Strategy, and the RCBC Local Plan. These documents detail the broader aims of minimising the adverse impacts of climate change, whilst requiring new development to take climate change considerations into account within design. Ways in which resilience of the Proposed Development to climate change can be enhanced have been assessed and mitigation measures have been identified.

21.5.11 The CCR assessment considers resilience against both gradual climate change, and the risks associated with an increased frequency of extreme weather events as per the UK Climate Projections 2018 (UKCP18) (The Met Office, 2018a).

21.5.12 The identification and assessment of climate change resilience within EIA is an area of emerging practice. There is no single prescribed format for undertaking such assessments; therefore, the approach adopted to undertaking and reporting the assessment has drawn on good practice from other similar developments and studies and is aligned with existing guidance such as that of IEMA (IEMA, 2020).

21.5.13 This assessment of climate change resilience is undertaken for the Proposed Development to identify potential climate change impacts, and to consider their potential consequence and likelihood of occurrence, taking account of the measures incorporated into the design of the Proposed Development.

21.5.14 The types of receptors considered vulnerable to climate change, are:

- construction phase receptors (i.e. workforce, plant and machinery);
- the Proposed Development assets and their operation, maintenance and refurbishment (i.e. pavements, structures, earthworks and drainage, technology assets, etc.); and
- end-users (i.e. staff and commercial operators etc).

21.5.15 The potential climate change impacts identified in the CCR assessment are determined based on the UKCP18 projections. Climatic parameters that will be included in the CCR assessment are detailed in Section 21.4, Table 21-23.

21.5.16 Further data will be obtained, where available, for other climate variables and types of extreme acute weather events, namely:

- heavy rainfall events;
- droughts (extended periods of low precipitation);
- heat waves (high temperatures);
- frosts/freezes (low temperatures);
- humidity;
- wind speed;
- storm surges;
- lightning; and
- fog.

21.5.17 The scope of the CCR assessment is set out in Table 21-32.

Table 21-32: Scope of the CCR Review

Climate Parameter	Considered in CCR Review	Rational
Extreme weather event	In	The Proposed Development may be vulnerable to extreme weather events such as storm damage, coastal erosion and storm surge to structures and assets.
Precipitation	In	The Proposed Development may be vulnerable to changes in precipitation, for example, pressure on water supply during periods of reduced rainfall, and damage to structures and drainage systems during periods of heavy precipitation.
Temperature	In	Increased temperatures may increase cooling requirements of the proposed scheme and could impact on structural integrity of buildings and materials.
Sea level rise	In	The Site is located in an area that is susceptible to sea level rise.
Sea temperature	Out	The Proposed Development is not likely to be affected by the small increase in sea temperature during its operational life.
Wind	Out	The impacts of wind on receptors in the surrounding environment are likely to be no worse relative to baseline conditions.

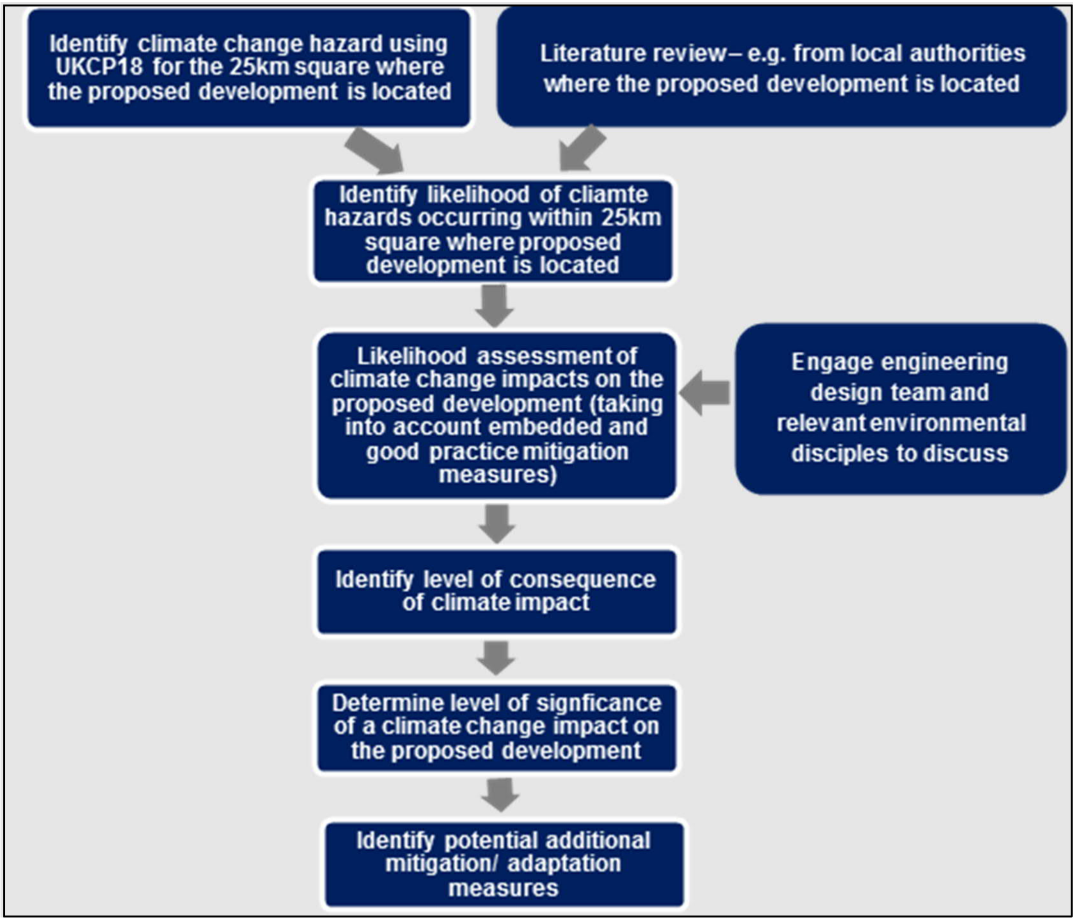
21.5.18 The CCR assessment identifies potential climate change impacts and considers their potential consequence and likelihood of occurrence. The following key terms and definitions relating to the CCR assessment are used:

- **Climate hazard** – an acute weather or chronic climate related event, which has potential to do harm to environmental or community receptors or assets, for example, increased winter precipitation;
- **Climate change impact** – an impact from a climate hazard which affects the ability of the receptor or asset to maintain its function or purpose; and
- **Consequence** – any effect on the receptor or asset resulting from the climate hazard having an impact.

21.5.19 The assessment includes all infrastructure and assets associated with the Proposed Development. It assesses the resilience against both gradual climate change and the risks associated with an increased frequency of severe weather events as per the UKCP18 climate change projections.

21.5.20 The methodology for the CCR assessment is summarised in Diagram 21-4.

Diagram 21-4: CCR Assessment Methodology



21.5.21 For the operational phase of the Proposed Development, once potential impacts have been identified, the likelihood and consequence of each impact occurring to each receptor (where relevant) are assessed for the selected future time frame for operation.

21.5.22 Criteria used to determine the likelihood of an event occurring, based on its probability and frequency of occurrence, are detailed in Table 21-33. The consequence of an impact has been measured using the criteria detailed in Table 21-34.

Table 21-33: Description of Likelihood for Climate Change Hazard

Likelihood Category	Description (probability and frequency of occurrence)
Very likely	90-100% probability that the hazard will occur.
Likely	66-90% probability that the hazard will occur.
Possible, about as likely as not	33-66% probability that the hazard will occur.
Unlikely	0-33% probability that the hazard will occur.
Very unlikely	0-10% probability that the hazard will occur.

The event is defined as the climate event (such as heatwave) and the hazard (such as overheated electrical equipment) occurring in combination

Table 21-34: Measure of Consequence for Climate Change Resilience

Consequence of Impact	Description
Very high	Permanent damage to structures/assets; Complete loss of operation/service; Complete/partial renewal of infrastructure; Serious health effects, possible loss of life; Extreme financial impact; and Exceptional environmental damage.
High	Extensive infrastructure damage and complete loss of service; Some infrastructure renewal; Major health impacts; Major financial loss; and Considerable environmental impacts.
Medium	Partial infrastructure damage and some loss of service; Moderate financial impact; Adverse effects on health; and Adverse impact on the environment.
Low	Localised infrastructure disruption and minor loss of service; No permanent damage, minor restoration work required; and Small financial losses and/or slight adverse health or environmental effects.
Very low	No damage to infrastructure; No impacts on health or the environment; and No adverse financial impact.

21.5.23 Engagement is undertaken with relevant environmental disciplines and the engineering design team to discuss the CCR assessment and identify mitigation measures for incorporation into the design of the Proposed Development.

21.5.24 Measures to adapt the Proposed Development are identified where potential climate change consequences are identified as being significant.

21.5.25 The significance is determined by:

Likelihood of climate hazard occurring × consequence to receptor if climate hazard occurs

Determining Decommissioning Effects

21.5.26 Although the impacts of climate change are likely to be more acute during the decommissioning phase, this phase is expected to be shorter in duration than construction.

21.5.27 Accordingly, the CCR assessment for the decommissioning phases will follow a descriptive based approach only.

Classification and Significance of Effects

21.5.28 The identification of likely significant effects on receptors has been undertaken using professional judgement by combining the measure of likelihood with the predicted consequence of impact, as shown in Table 21-35.

Table 21-35: Significance Criteria for Climate Change Resilience Assessment

		Likelihood of climate change hazard occurring				
		Very unlikely	**Unlikely**	**Possible**	**Likely**	**Very likely**
Consequence	**Very low**	Negligible	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Minor	Minor	Minor	Minor
	Medium	Negligible	Minor	Moderate	Moderate	Moderate
	High	Negligible	Minor	Moderate	Major	Major
	Very high	Negligible	Minor	Moderate	Major	Major

21.5.29 The assessment of potential impacts and the Proposed Development's vulnerability takes into account the mitigation measures that have been designed into the Proposed Development, as discussed in Section 21.5- Development Design and Impact Avoidance. The assessment also identifies and accounts for existing climate change resilience measures either already in place or in development for infrastructure and assets, for example, mitigation measures for potential flooding impacts on the Proposed Development

Development Design and Impact Avoidance

21.5.30 This section presents the findings of the CCR assessment for the construction, operation and decommissioning of the Proposed Development.

21.5.31 Components of the Proposed Development that have been considered in this assessment include all infrastructure, plant and machinery, all workers, staff or visitors on-site, and materials.

21.5.32 This Section identifies any likely significant effects that are predicted to occur and then highlights any mitigation and enhancement measures that are proposed to minimise any adverse significant effects.

Construction

21.5.33 Full details of embedded design measures that reduce the vulnerability of the Proposed Development are contained within the CEMP and other assessments, such as Chapter 9: Surface Water, Flood Risk and Water Resources and Chapter 10: Geology, Hydrogeology and Contaminated Land (ES Volume I, Document Ref. 6.2). Examples of these measures include:

- Storage of topsoil and other construction materials stored outside of the 1 in 100-year floodplain to protect materials from high rainfall and flooding events or sea level rise;
- Suitable storage and bunding of pollutants to protect from high rainfall events or sea level rise. This will be further supported by the Water Management Plan and a Site Emergency Response Plan;
- Laydown and welfare areas will be laid will permeable membranes to protect the Site from high rainfall and flooding events or sea level rise; and
- The Contractor will monitor weather forecasts and receive Environment Agency flood alerts and plan works accordingly, protecting workers and resources from any extreme weather conditions such as storms, flooding or heatwaves.

Operation

21.5.34 Full details of embedded design measures that reduce the vulnerability of the Proposed Development are contained within other technical disciplines, such as Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, Document Ref. 6.2). Examples of these measures include:

- Suitable storage and bunding of pollutants to protect from high rainfall events or sea level rise. This will be supported by a Site Emergency Response Plan;
- Cabling will be buried underground, insulating against overheating in times of heatwaves;
- Installation of a suitable surface water drainage network and management system, Sustainable drainage systems (SuDS), to protect the Site from high rainfall events or sea level rise. This will be supported by a Surface Water Maintenance and Management Plan;
- Flood Resistance and Resilience Measures to be implemented, including:
  - critical equipment assets to be raised above estimated peak flood level of 5.74 mAOD (see Appendix 9A: Flood Risk Assessment, ES Volume III, Document Ref. 6.4). Critical equipment would include electrical equipment, transformers, main boiler feed pumps, condensate extraction pumps, primary air fan and induced draught fan;
  - Flood Emergency Response plan to be developed in consultation with the Environment Agency;
  - adherence to Environment Agency flood warnings and alerts;
  - defined emergency access and egress routes; and
  - maintenance of the drainage system will be incorporated in general site management and remains the responsibility of the operator.

Decommissioning

21.5.35 At this stage, limited specific mitigation measures have been identified for the decommissioning phase of the Proposed Development. A DEMP will be produced to appropriate guidance and legislation at the time and will likely be similar to that of the construction phase but reflect future climatic conditions at that point in time in the future.

Likely Impacts and Effects

Description of Potential Effects

21.5.36 The potential impacts and effects of projections for climate change to the Proposed Development are detailed in Table 21-36 and are based upon that scoped in to the assessment (see Table 21-32).

21.5.37 Potential climate change impacts, the likelihood and consequences to the construction, operation and decommissioning of the Proposed Development, together with the adaptation methods to increase the resilience of the Proposed Development are detailed in Table 21-36.

Summary of CCR Impacts

21.5.38 A range of climate change hazards and their potential impact upon the Proposed Development have been identified. The embedded design measures are deemed sufficient to reduce the likelihood or consequence of an impact occurring as a result of these projected climate hazards. As such, no significant resilience risks have been identified.

Mitigation and Enhancement Measures

21.5.39 The management of impacts and the application of mitigation/adaption measures during construction will be enforced through the CEMP.

21.5.40 Section 21.5: Consultation detailed a suggestion from the Environment Agency to consider rainwater harvesting systems. This level of design has not been considered at this stage in the design but will be evaluated for its inclusion at the Front End Engineering Design stage.

21.5.41 Section 21.5: Consultation detailed suggestions for woodland climate change adaptation measures from the Forestry Commission. As there are no woodlands within the Site boundary or within land the Applicant will retain control over, no further measures have been proposed for woodlands. Further assessment is found in Chapter 12: Terrestrial Ecology and Nature Conservation and Chapter 17: Landscape and Visual Amenity (ES Volume I, Document Ref. 6.2).

Table 21-36: Potential Climate Change Impacts and Relevant Embedded Adaptation/Resilience Measures

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
CONSTRUCTION PHASE									
Increase in annual temperature	Very Likely	All receptors	See-Increase in summer temperature	See-Increase in summer temperature	Very Unlikely	Very low	Negligible	No	None
Increase in summer temperature	Very Likely	Construction plant and vehicles	Overheating of electrical equipment	Detailed in CEMP: The Contractor will monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather conditions	Very Unlikely	Very Low	Negligible	No	None
		Staff, visitors on-site	Increased heat stress/ heat exhaustion for workers. Poorer air quality from dust, wildfires. Commuting issues from wildfires		Unlikely	Medium	Minor	No	None
Increase in winter temperature	Very Likely	All receptors	None considered	None considered	Very Unlikely	Very low	Negligible	No	None
Increase in annual rainfall	Possible	All receptors	None considered	None considered	Very Unlikely	Very low	Negligible	No	None

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
Decrease in summer rainfall	Likely	All receptors	None considered	None considered	Very Unlikely	Very Low	Negligible	No	None
Increase to winter rainfall	Very Likely	Assets, facilities, roads	Viability of and access to sites (such as heavy rain resulting in surface water flooding of local roads, sources of power supply or inundation of sites).	Detailed in CEMP: • Storage of topsoil and other construction materials stored outside of the 1 in 100-year floodplain to protect materials from high rainfall and flooding events • Suitable storage and bunding of pollutants to protect from high rainfall events. This will be further supported by the Water Management Plan and a Site	Possible	Medium	Moderate	No	None

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
				Emergency Response Plan • Laydown and welfare areas will be laid with permeable membranes to protect the Site from high rainfall and flooding events • The Contractor will monitor weather forecasts and receive Environment Agency flood alerts and plan works accordingly, protecting workers and resources from any extreme weather conditions such as					

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
				storms, flooding					
Increase to heat waves	Possible	Assets, facilities, roads	See-Increase in summer temperature	See-Increase in summer temperature	Unlikely	Low	Minor	No	None
		Staff, visitors on-site	See-Increase in summer temperature	See-Increase in summer temperature	Unlikely	Medium	Minor	No	None
Increase droughts	Possible	All receptors	None considered	None considered	Very Unlikely	Very Low	Negligible	No	None
Increase in storm intensity	Unlikely	Assets, facilities, roads	Damage to structures/ equipment and resulting in repairs costs or reduced functionality, and/or unacceptable safety risks.	Detailed in CEMP: The Contractor will monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather conditions	Unlikely	Low	Minor	No	None
Sea level rise	Very Likely	Assets, facilities, roads	See- Increase to winter rainfall	See- Increase to winter rainfall	Very Unlikely	Medium	Negligible	No	None

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
OPERATIONAL PHASE									
Increase in annual temperature	Very Likely	All receptors	See-Increase in summer temperature	See-Increase in summer temperature	Very Unlikely	Very low	Negligible	No	None
Increase in summer temperature	Very Likely	Assets, facilities, roads	Overheating of electrical equipment Heat damage, deformation, cracking and thermal expansion of building surfaces and pavements	• Cabling will be buried underground, insulating against overheating in times of heatwaves • All buildings would be designed to UK standards and specifications	Possible	Medium	Moderate	No	None
		Staff, visitors on-site	Impacts on the thermal comfort of building users Increase in ambient temperature of buildings,	•Detailed design of air conditioning units for offices would include an allowance for future rise	Unlikely	Medium	Minor	No	None

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
			leading to higher air conditioning requirements and impacts on the thermal comfort of building users. Poorer air quality from dust, wildfires. Commuting issues from wildfires	in ambient temperature. •All buildings would be designed to UK standards and specifications					
		Function of facility	Reduced efficiency of CCGT	The power plant is designed to operate over a large range of ambient conditions and the plant efficiency difference is less than 1% from high to low. Temperature changes would not have a	Possible	Low	Minor	No	None

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
				noticeable impact.					
Increase in winter temperature	Very Likely	All receptors	None considered	None considered	Very Unlikely	Very low	Negligible	No	None
Increase in annual rainfall	Possible	All receptors	None considered	None considered	Very Unlikely	Very low	Negligible	No	None
Decrease in summer rainfall	Likely	Assets, facilities, roads	Water shortages Drying out of pavement structures Deterioration of structures or foundations due to decrease in soil moisture levels Insufficient water for plant cooling	• Alternative water abstraction points from the Tees in times of drought, reducing chances of shortages for plant function • Integration of water circuits- steam will be extracted, condensed and re-used •Buildings would utilise water efficient fixtures	Possible	Medium	Moderate	No	None

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
				•All buildings would be designed to UK standards and specifications					
Increase to winter rainfall	Very Likely	Built terrestrial assets, staff facilities and access routes to sites Staff, contractors and visitors	Surface water flooding and standing waters Deterioration of structures or foundations due to increase in soil moisture levels Damage to building surfaces/ exposed utilities from increased drying/wetting and increase frost penetration Damage to infrastructure through	• Suitable storage and bunding of pollutants to protect from high rainfall events. Supported by a Site Emergency Response Plan • Installation of a suitable sustainable surface water drainage network and management system (SuDS) to protect the Site from high rainfall events. Supported by a	Unlikely	Medium	Minor	No	None

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
			coastal erosion, storm surge and coastal destabilisation.	Surface Water Maintenance and Management Plan. • Flood Resistance and Resilience Measures to be implemented, including i) critical equipment assets to be raised above estimated peak flood level (e.g. electrical equipment, transformers, main boiler feed pumps, condensate extraction pumps, primary air fan and induced draught fan); ii) Flood Emergency					

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
				Response plan to be developed in consultation with the Environment Agency; iii) make use of Environment Agency flood warnings and alerts; iv) define emergency access and egress route; and v) ensure maintenance of the drainage system will be incorporated in general site management and remains the responsibility of the operator. •The Flood Risk Assessment (FRA,					

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
				Appendix 9A, ES Volume III, Document Ref. 6.4) considers climate change considerations of the 'mid-range' and 'high end' future scenarios including increases in extreme rainfall, flood flow and flash flood times •All buildings would be designed to UK standards and specifications					
Increase to heat waves	Possible	Assets, facilities, roads	See-Increase in summer temperature	See-Increase in summer temperature	Unlikely	Medium	Minor	No	None
		Staff, visitors on-site	See-Increase in summer temperature	See-Increase in summer temperature	Unlikely	Medium	Minor	No	None

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
		Function of facility	See-Increase in summer temperature	See-Increase in summer temperature	Possible	Low	Minor	No	None
Increase droughts	Possible	All receptors	See- Decrease in summer rainfall	See- Decrease in summer rainfall	Very Unlikely	Very Low	Negligible	No	None
Increase in storm intensity	Unlikely	Marine assets	Physical damage to marine assets	• All infrastructure would be designed to UK standards and specifications, including contingency in design for extreme water levels and waves	Very Unlikely	Very High	Negligible	No	None
		Assets, facilities, roads	Damage to structures/ equipment and resulting in repairs costs or reduced functionality, and/or	•The FRA (Appendix 9A, ES Volume III, Document Ref. 6.4) considers climate change considerations of the 'mid-	Very Unlikely	Very High	Negligible	No	None

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
			unacceptable safety risks.	range' and 'high end' future scenarios including increases in extreme rainfall, flood flow and flash flood times •All buildings would be designed to UK standards and specifications					
Sea level rise	Very Likely	Assets, facilities, roads Staff, contractors and visitors	See- Increase to winter rainfall	See- Increase to winter rainfall	Unlikely	Medium	Minor	No	None
		Marine assets	Physical damage to or loss of function to marine assets	• All infrastructure would be designed to UK standards and specifications, including	Very Unlikely	Very High	Negligible	No	None

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
				contingency in design for extreme water levels and waves					
DECOMMISSIONING PHASE									
Increase in annual temperature	Very Likely	All receptors	See-Increase in summer temperature	See-Increase in summer temperature	Very Unlikely	Very low	Negligible	No	None
Increase in summer temperature	Very Likely	Deco. plant and equipment	Overheating of electrical equipment	To be detailed in a DEMP • Likely to be similar to CEMP	Very Unlikely	Very Low	Negligible	No	None
Increase in winter temperature	Very Likely	All receptors	None considered	None considered	Very Unlikely	Very low	Negligible	No	None
Increase in annual rainfall	Possible	All receptors	See-Increase in winter rainfall	See-Increase in winter rainfall	Very Unlikely	Very low	Negligible	No	None
Decrease in summer rainfall	Likely	All receptors	None considered	None considered	Very Unlikely	Very Low	Negligible	No	None
Increase to winter rainfall	Very Likely	Assets, facilities, roads	Viability of and access to sites (such as heavy	To be detailed in a DEMP • Likely to be	Possible	Medium	Moderate	No	None

Climate Hazard Type	Climate Hazard Projection	Sensitive Receptor	Description of Potential Impact	Embedded Design Measure	Likelihood of Impact Occurring	Consequence of Impact Occurring	Resilience Risk Level	Significance	Additional Mitigation or Monitoring Measures
			rain resulting in surface water flooding of local roads, sources of power supply or inundation of sites).	similar to CEMP					
Increase to heat waves	Possible	Deco. plant and equipment	See-Increase in summer temperature	See-Increase in summer temperature	Very Unlikely	Very Low	Negligible	No	None
Increase droughts	Possible	All receptors	None considered	None considered	Very Unlikely	Very Low	Negligible	No	None
Increase in storm intensity	Unlikely	Assets, facilities, roads	Damage to structures/ equipment and resulting in repairs costs or reduced functionality, and/or unacceptable safety risks.	To be detailed in a DEMP • Likely to be similar to CEMP	Unlikely	Low	Minor	No	None
Sea level rise	Very Likely	Assets, facilities, roads	See- Increase in winter rainfall	To be detailed in a DEMP • Likely to be similar to CEMP	Unlikely	Medium	Minor	No	None

Limitations or Difficulties

21.5.42 The CCR assessment of construction impacts assumes that the measures outlined within the Development Design and Impact Avoidance section of this chapter would be incorporated into the design of the Proposed Development. These measures are considered standard best practice that are usually applied across construction sites in the UK. No additional mitigation has been identified as necessary for any stage of the Proposed Development.

21.5.43 While modelled climate change projections represent anticipated average weather conditions, they do not capture the full range of possible future severe weather events (i.e. droughts, heatwaves and prolonged heavy rainfall).

21.5.44 The CCR assessment is limited to the availability of data and information at the date this assessment was prepared.

21.6 Residual Effects

GHG Assessment

21.6.1 No significant residual effects for GHG emissions have been identified.

21.6.2 As envisaged, if neighbouring industries connect to the CO_2 gathering network in the future and carbon can be captured from these existing sources, it is anticipated that the project as a whole could result in a net reduction in carbon emissions from current levels. Without including the offset of carbon emissions from off-site industry there will be some residual GHG emissions from the Proposed Development, mostly associated with the electricity requirement for the Compressor Station. However, this will result in a minor effect and is **Not Significant.** As set out in the assessment of operations (Section 21.3 The design life of the Compressor Station is expected to be operating for 40 years, potentially around 15 years beyond the design life of the plant. During this time, the emissions associated with grid electricity usage for this equipment are calculated to be a total of 1.1M tCO2e over the 15 years, or an average of 72k tCO2e per year.

21.6.3 GHG Avoidance), with the inclusion of carbon capture technology the Proposed Development will provide a low carbon source of energy generation.

ICCI and CCR Assessment

21.6.4 No residual ICCI or CCR impacts have been identified.

21.7 References

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