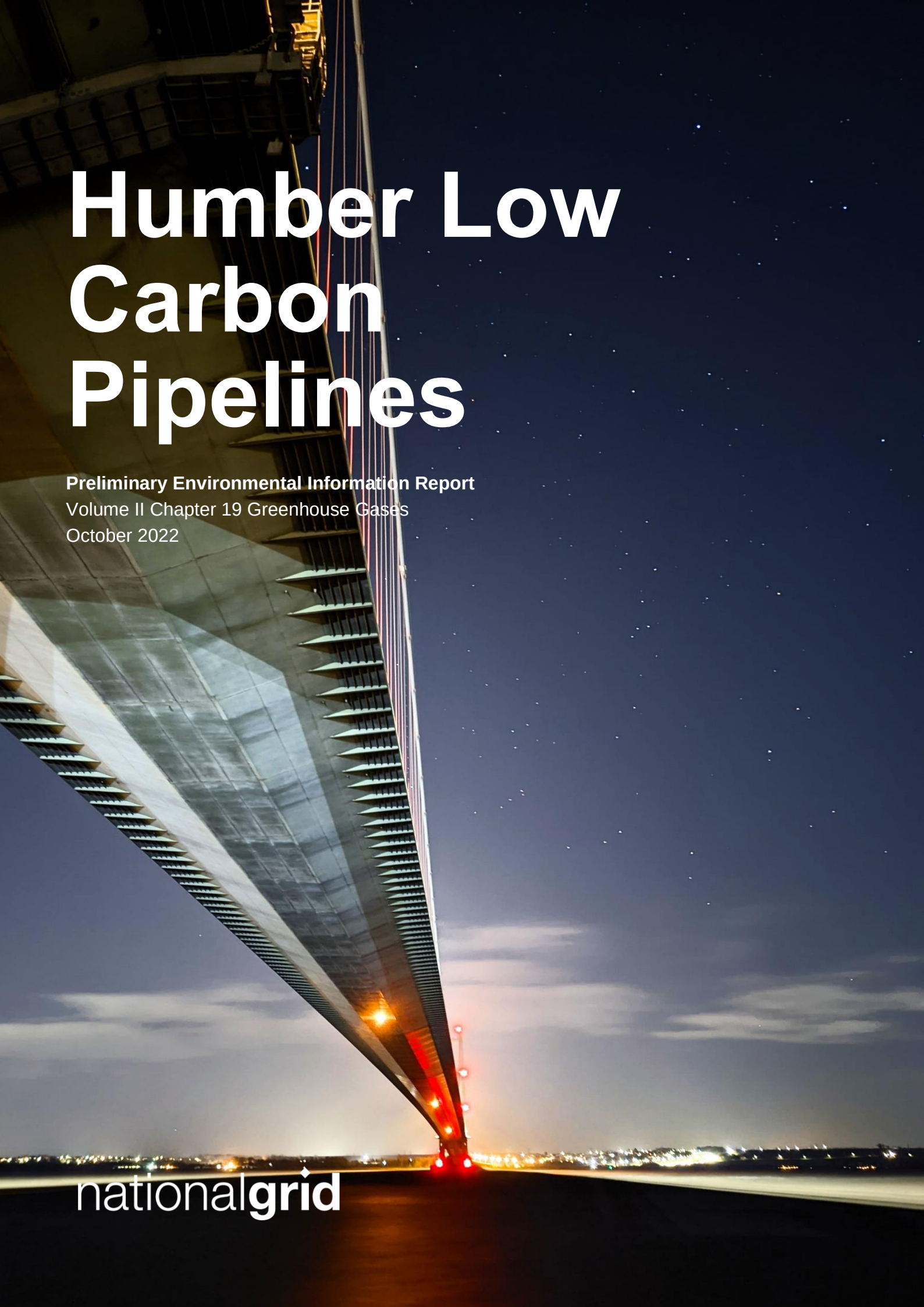

Humber Low Carbon Pipelines

Preliminary Environmental Information Report
Volume II Chapter 19 Greenhouse Gases
October 2022

nationalgrid

Contents

19. Greenhouse Gases

19.1 Introduction

19.1.1 This Chapter reports the results of the preliminary assessment of the potential impacts and effects of the Project on Greenhouse Gases (GHGs) and describes:

- Relevant, legislation, policy and guidance;
- Engagement undertaken to date;
- The proposed assessment methodology and associated significance criteria;
- Preliminary baseline conditions;
- Potential impacts of construction, operation, and decommissioning;
- Potential design, mitigation, and enhancement measures;
- Summary of the preliminary assessment of potential significant effects; and
- Next steps.

19.1.2 This assessment considers the simultaneous construction of a dual pipeline system (one for carbon dioxide and one for hydrogen), as well as the associated Above Ground Installations (AGIs). The majority of the carbon dioxide pipeline will be up to 600 mm (24”) nominal diameter and the hydrogen pipeline will be up to 900 mm (36”) nominal diameter. This is referred to as the Base Case in this Preliminary Environmental Information Report (PEIR). Also under consideration is the possibility of deploying a larger carbon dioxide pipeline, with a diameter up to 750 mm (30”) (with the hydrogen pipeline remaining the same diameter as within the Base Case). This is referred to in this PEIR as Sensitivity 1. Further details regarding the Base Case and Sensitivity 1, as well as the diameter and capacity of the pipelines are provided in Sections 2.3 and 2.4 of Chapter 2: Project Description (Volume II). This chapter assesses the impacts and effects associated with the Base Case. It is anticipated that the types of potential impacts for the Base Case and Sensitivity 1 will be the same, although the magnitude of impacts may differ. A full assessment of Sensitivity 1 will be undertaken and recorded within the Environmental Statement (ES) if the larger carbon dioxide pipeline diameter is taken forward into the Development Control Order (DCO) application.

19.1.3 This Chapter is intended to be read as part of the wider PEIR.

19.2 Legislation, policy and guidance

19.2.1 A summary of the international, national, and local legislation, planning policy and guidance relevant to the GHG assessment for the Project is set out below.

International Obligations

Paris Agreement 2015 (Ref. 19.1)

19.2.2 The purpose of the Paris Agreement is to strengthen the global response to the threat of climate change by holding the global temperature increase at 1.5°C above pre-industrial levels.

19.2.3 As a Party to the Paris Agreement, the UK Government must undertake rapid reductions in GHG emissions to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHG by the second half of this century. Parties must account for, and report on, their national GHG contributions every five years, including any mitigating measures that have been taken. This Project and the Connected Projects are expected to contribute significantly to emissions reductions and help in meeting the UK Government's net zero targets, therefore falling under the Paris Agreement.

Glasgow Climate Pact 2021 (Ref. 19.2)

19.2.4 The Glasgow Climate Pact's main elements are:

- The number of countries pledged to reach net zero emissions passed 140. This net zero target accounts for 90% of current global GHG emissions;
- An agreement to re-visit emission reduction plans in 2022 in order to try to keep the 1.5°C Paris Agreement target achievable; and
- A commitment to climate finance for developing countries.

19.2.5 The UK Government strengthened its commitments to rapid reductions in GHG emissions before the Glasgow Conference. On 20 April 2021, the UK Government announced that it will build on its Nationally Determined Contributions (NDC) commitments to 2030, by setting the world's most ambitious climate change target into law to reduce emissions by 78% by 2035 compared to 1990 levels.

19.2.6 The Project and the Connected Projects are expected to help in the UK Government's rapid decarbonisation, by helping to decarbonise industry which is considered one of the hardest sectors to reduce emissions in.

Legislation

The Climate Change Act 2008 (2019 Amendment) (Ref. 19.3)

19.2.7 This sets up a framework for the UK to achieve its long-term goals of reducing GHG emissions by 100% from 1990 baseline by 2050, with intermediate goals set by the UK Carbon Budgets, and to ensure steps are taken towards adapting to the impact of climate change. This Act introduces a system of carbon budgeting which constrains the total amount of emissions in a given time period and sets out a procedure for assessing the risks of the impact of climate change for the UK, and a requirement on the UK Government to develop an adaptation programme.

19.2.8 The UK Government has published a list of those bodies that must report under the reporting power. This includes transport bodies, energy and water utilities and environmental agencies.

19.2.9 The goal of net zero by 2050 is to be achieved through the large goal of decarbonisation of UK's industry, which this project is a large contributor to.

Climate Change Committee: UK Carbon Budgets 2020 (Ref. 19.4)

19.2.10 Under the Sixth Carbon Budget, published in December 2020, every tonne of GHG emitted between now and 2050 will count. Where emissions rise in one sector, the UK will have to achieve corresponding falls in another.

19.2.11 As big opportunities to reduce energy related emissions from the decarbonisation of the UK electricity grid are close to exhaustion in the current time, the start of the decarbonisation of the industry will provide the UK the required emissions reductions of the next decade.

Infrastructure Carbon Review 2013 (Ref. 19.5)

19.2.12 The Infrastructure Carbon Review sets out a series of actions for government, clients and suppliers to reduce carbon from the construction and operation of the UK's infrastructure assets, in line with the UK's climate change commitments.

Policy

Overarching National Policy Statement for Energy (EN-1) 2011 (Ref. 19.6)

19.2.13 This National Policy Statement (NPS) sets out national policy for the energy infrastructure. It has effect for the decisions by the Secretary of State on applications for energy developments that are nationally significant under the Planning Act 2008.

19.2.14 The NPS proposes that the implementation of Carbon Capture and Storage (CCS) is necessary to maintain energy supplies while continuing to reduce GHG emissions. Therefore, demonstrating the efficacy of CCS projects is a priority for UK energy policy, which requires the construction of essential infrastructure (including pipelines and storage sites) for the purpose of implementing CCS.

Draft Overarching National Policy Statement for Energy (EN-1) 2021 (Ref. 19.7)

19.2.15 This policy statement sets out that all proposals for energy infrastructure projects should include a carbon assessment as part of their ES (see Section 4.2 of the draft NPS). This should include:

- A whole life carbon assessment showing construction, operational and decommissioning carbon impacts;
- An explanation of the steps that have been taken to drive down the climate change impacts at each of those stages;
- Measurement of embodied carbon impact from the construction stage;
- How reduction in energy demand and consumption during operation has been prioritised in comparison with other measures;
- How operational emissions have been reduced as much as possible through the application of best available technology for that type of technology;
- Calculation of operational energy consumption and associated carbon emissions; and

- Where there are residual emissions, the level of emissions and the impact of those on national and international efforts to limit climate change, both alone and where relevant in combination with other developments at a regional or national level, or sector level, if sectoral targets are developed.

National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) 2011 (Ref. 19.8)

19.2.16 The NPS EN-4 is designed to provide policy guidance for activities and infrastructure that is specific to natural gas pipelines. However, it will be considered in the GHG assessment as much of the information presented in the NPS EN-4 can be applied to hydrogen and carbon dioxide pipelines as well.

19.2.17 Section 2.18: Gas Reception Facilities Impacts: Gas Emissions of the NPS EN-4, states that *"The applicant's assessment should include an assessment of gas emissions and any adverse effects due to the venting or flaring of gas."*

Draft National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) 2021 (Ref. 19.9)

19.2.18 The draft NPS EN-4 has been drafted in respect of, and has effect only in relation to, natural gas pipelines. However, it will be considered within the GHG assessment as it may contain information that is important and relevant to the Secretary of State's decision on applications for hydrogen and carbon dioxide pipelines.

19.2.19 The ES should include an assessment of the effects of gas emissions on air quality in accordance with Section 5.2 of NPS EN-1 and on greenhouse gas emissions in accordance with Section 5.3 of NPS EN-1.

National Planning Policy Framework (NPPF) 2021 (Ref. 19.10)

19.2.20 The NPPF sets out government planning policy for England and describes ways in which the challenge of climate change can be met. Chapter 10 of the NPPF highlights that planning plays a key role in mitigation against climate change. The Policy also includes the requirements for local authorities to adopt proactive strategies to mitigate and adapt to climate change in line with the provisions and objectives of the Climate Change Act 2008 and co-operate to deliver strategic priorities which include climate change. The policy also states that local authorities should:

- Adopt proactive strategies to mitigate and adapt to climate change taking full account of flood risk, coastal change and water supply and demand considerations;
- Limit inappropriate development in areas at risk of flooding, but where development is necessary, making it safe without increasing flood risk elsewhere;
- Support the move to a low carbon future, by supporting energy efficient improvements to existing buildings and set out requirements consistent with zero carbon building policy; and
- Help to increase the use and supply of renewable and low carbon energy.

19.2.21 The policy also avails radical reductions in GHG emissions, minimising vulnerability and providing resilience to impacts of climate change, and supports the delivery of renewable and low carbon energy and associated infrastructure. It also puts emphasis on driving and supporting sustainable development and good design.

Net Zero Strategy: Build Back Greener 2021 (Ref. 19.11)

19.2.22 The Net Zero Strategy was published in October 2021 by the UK Government's Department for Business, Energy and Industrial Strategy. It lays out the Government's plans to reduce emissions across the economy in seven main sections:

- Power;
- Fuel Supply and Hydrogen;
- Industry;
- Heat and Buildings;
- Transport;
- Natural Resources, Waste and F-Gases; and
- Greenhouse Gas Removals.

19.2.23 This Project along with Connected Projects are set to comply with the Government ambitions regards the following sections:

- Power- The Government is set to Implement the Dispatchable Power Agreement (DPA) to support the deployment of first of a kind power Carbon Capture, Usage and Storage (CCUS) plant(s);
- Fuel Supply and Hydrogen- the Government sets out an ambition for 5 GW UK low carbon hydrogen production capacity by 2030; and The UK Government have set up the Industrial Decarbonisation and Hydrogen Revenue Support (IDHRS) scheme to fund our new hydrogen and industrial carbon capture business models. The Government will be providing up to £140 m to establish the scheme, including up to £100 m to award contracts of up to 250 MW of electrolytic hydrogen production capacity in 2023 with further allocation in 2024; and
- Industry: Ambition to deliver 6 MtCO2 per year of industrial CCUS by 2030, and 9 MtCO2 per year by 2035; and set up the IDHRS Scheme to fund the new industrial carbon capture and hydrogen business models.

Yorkshire & Humber Climate Action Plan 2021 (Ref. 19.12)

19.2.24 The Plan contains a regional target of reduction to net zero by 2038 from baseline of year 2000 with intermediate targets of:

- 68% by 2025;
- 84% by 2030;
- 92% by 2035; and
- 100% by 2038.

19.2.25 The Project will help to achieve those net zero reduction targets in the region.

Guidance

The Green Construction Board Publicly Available Specification 2018:2016 Carbon Management in Infrastructure (PAS 2080:2016) (Ref. 19.13)

19.2.26 The first publicly available specification in the world that specifically addressed managing carbon in infrastructure. The purpose of the PAS 2080:2016 specification is to:

- Provide governance and leadership;
- Quantify GHG emissions;
- Integrate emissions management into infrastructure delivery processes;
- Provide targets, baselines, and monitoring methods;
- Assist with reporting and managing information;
- Spread responsibility across the asset value chain (designers, constructors, suppliers, managers); and
- Encourage continuing improvement.

19.2.27 PAS 2080:2016 provides a common framework for all infrastructure sectors and value chain members on how to manage whole life carbon when delivering infrastructure assets and programmes of work. PAS 2080:2016 promotes reduced carbon, reduced cost infrastructure delivery, more collaborative ways of working and a culture of challenge in the infrastructure value chain through which innovation can be fostered.

19.2.28 It includes requirements for all value chain members to show the right leadership and to establish effective governance systems for reducing whole life carbon through the use of a detailed carbon management process. All value chain members can claim conformity to the PAS 2080:2016 by demonstrating that the requirements in the PAS 2080:2016 that are relevant to them have been met.

Capture for Growth: A Roadmap for the World's First Zero Carbon Industrial Cluster 2019 (Ref. 19.14)

19.2.29 The Humber has ambition to become the first zero carbon industrial cluster in the world. Relevant steps are:

- Developing a hydrogen demonstrator and test facility in the Humber;
- Building a carbon dioxide transport and storage system across the region that industry can connect to;
- Safely storing carbon dioxide deep under the seabed in the Southern North Sea;
- Unlocking a cutting-edge hydrogen economy – providing a low carbon fuel to decarbonise industry, power, heat, transport and maritime across the North of England; and
- Creating the conditions for new industries which use the CCUS pipeline or low carbon hydrogen to develop in the region – creating new jobs and opportunities locally and across the country.

19.2.30 This Project would deliver on the Roadmap's targets to implement CCUS in the Humber region, and would allow local industry to explore and utilise hydrogen technologies.

Institute of Environmental Management & Assessment (IEMA) Guide: Assessing Greenhouse Gas Emissions and Evaluating their Significance 2022 (Ref. 19.15)

19.2.31 This provides guidance on assessment and mitigation of GHG emissions within an Environmental Impact Assessment (EIA) context and is the primary source of guidance for assessing GHG emissions. It includes a focus on proportionate and robust assessment. The IEMA guidance is based on the five IEMA Principles on Climate Change Mitigation and EIA:

- *"The GHG emissions from all projects will contribute to climate change; the largest inter-related cumulative environmental effect;*
- *The consequences of a changing climate have the potential to lead to significant environmental effects on all topics in the EIA Directive – e.g., population, fauna, soil etc.;*
- *The UK has legally binding GHG reduction targets – EIA must therefore give due consideration to how a project will contribute to the achievement of these targets;*
- *GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit, as such any GHG emissions or reductions from a project might be considered to be significant; and*
- *The EIA process should, at an early stage, influence the location and design of projects to optimise GHG performance and limit likely contribution to GHG emissions."*

19.2.32 The guidance states that *"the crux of significance therefore is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050. Five distinct levels of significance which are not solely based on whether a project emits GHG emissions alone, but how the project makes a relative contribution towards achieving a science-based 1.5°C aligned transition towards net zero."*

19.2.33 The GHG assessment will assess the impact of the Project by contextualising against local and national carbon targets.

International Panel on Climate Change (IPCC) Sixth Assessment Report Working Group 1: The Physical Science Basis (AR6 WG1) 2021 (Ref. 19.16)

19.2.34 This provides a summary of global climate change research and sets out a global emissions budget. The report provides both a Technical Summary and a Summary for policy makers and aims to provide guidance for international climate change policies.

Environment Agency - Guidance on the management of landfill gas 2014 (Ref. 19.17)

19.2.35 This provides a summary of risk assessment methodologies for ground gases resulting from current and historic landfill sites. The guidance also provides a framework for Gas Management Plans and an overview of legislative requirements for management and monitoring.

19.3 EIA Scoping Opinion and engagement

19.3.1 A summary of the EIA Scoping Opinion from the Planning Inspectorate (PINS) and responses to this EIA Scoping Opinion are outlined below. Furthermore, all relevant engagement undertaken to date is outlined in this Section.

Response to the EIA Scoping Opinion

19.3.2 An EIA Scoping Opinion (Appendix 1.2: EIA Scoping Opinion (Volume III)) was received by the Applicant from PINS on 20 May 2022. Table 19.1 lists the comments that PINS and consultation bodies made in relation to Greenhouse Gases and shows how the Applicant is responding to these.

Table 19.1: Summary of EIA Scoping Opinion in relation to Greenhouse Gases

Section reference	Applicant's proposed matter	Inspectorate's / consultation bodies comments	Response
3.4.3	GHG emissions resulting from land use, land use change and forestry during construction (carbon life stage A5).	*The Scoping Report states that as the Proposed Development mainly comprises underground pipelines with minimal land impact, current emissions from land use and future emissions arising from a change in land use would be insignificant.* *Considering the nature and characteristics of the Proposed Development, the Inspectorate is content that GHG emissions from resulting land use, land use change and forestry during construction (carbon life stage A5) are not likely to result in significant effects and can be scoped out of the ES assessment.*	Agreement noted. This matter is not assessed further within the EIA.
3.4.4	GHG emissions resulting from maintenance and replacement and refurbishment of components during operation (carbon life stages B2 to B5).	*The Scoping Report states that maintenance will be infrequent and relatively minor in nature and is not considered to be a large emissions source. GHG emissions resulting from the replacement and refurbishment of components during the 40-year design life of the Proposed Development are expected to be insignificant.* *Considering the nature and characteristics of the Proposed Development, the Inspectorate is content that GHG emissions from maintenance and replacement and refurbishment of components during operation (carbon life stages B2 to B5) are not likely to result in significant effects and can be scoped out of the ES assessment.*	Agreement noted. This matter is not assessed further within the EIA.

Section reference	Applicant's proposed matter	Inspectorate's / consultation bodies comments	Response
3.4.5	GHG emissions arising from disturbance of landfill sites and other sources of ground gas.	*The Inspectorate notes from paragraphs 8.6.20 to 8.6.22 of the Scoping Report that landfills have been identified within the Scoping Route Corridor and that other potential sources of ground gas may also be present.* *Notwithstanding the Inspectorate's comments in Row ID 3.4.3 above, in the event that the pipeline route cannot avoid these sites, the potential to increase, or give rise to, GHG emissions from these sites during construction should be included in the assessment.*	Active landfills have been avoided and are not in the Proposed Order Limits. Historic landfills with uncertain location may be disturbed by the construction of the pipelines. Our approach to the assessment will be adjusted to account for this scenario. Initial consultation with experts on this topic has shown that an event of disturbance to historic landfills is not expected to release buried GHGs, as GHGs in untreated landfills are released continuously rather than trapped. A further investigation on the possible climate outcomes of digging into historic landfills will be conducted as part of the full ES. Please see Section 19.8 – Next steps, for further action on this enquiry.

Engagement undertaken to date

19.3.3 Table 19.2 provides a summary of the engagement undertaken to inform the assessment to date.

19.3.4 Engagement will be undertaken throughout the EIA process with Climate Change Officers, Sustainability Managers, and/or Low Carbon Project officers from the following:

- East Riding of Yorkshire Council;
- North Lincolnshire Council;
- Lincolnshire County Council;
- Selby District Council;
- West Lindsey District Council;
- North Yorkshire County Council; and
- Yorkshire & Humber Climate Commission.

19.3.5 Engagement will seek to agree matters such as scope, methodology, approach and any emphasis that needs to be given throughout the design or construction stages. In addition, engagement will include queries with regards to the following:

- Details of any future development that could also potentially produce substantial quantities of GHG emissions during the construction of the Project as the cumulative impacts on the local area from other major projects should be evaluated. Details on forecast GHG emissions and construction dates of other Projects would also be requested; and
- Details of any future development in the proximity of the Project that might affect it in terms of increasing climate change risks, such as drainage issues.

Table 19.2: Summary of engagement undertaken

Consultee	Date and method of engagement	Summary of issues raised	Response
Environment Agency	29/03/2022 Email	Email containing the draft Statement of Common Ground (SoCG).	The Environment Agency approved of the general content of the draft SoCG but also listed some minor comments and suggestions.
North Lincolnshire Council	08/07/2022 Workshop	Workshop to address the scope of the GHG chapter, request data, and address any concerns with proceedings.	It was noted that, one of the historic landfill sites the pipeline is set to go through in the Proposed Order Limits is the Keadby Ash Tip. Concerns were raised regarding carbon dioxide leakage, and emissions resulting from soil disturbance. This will be treated as other historic landfills. For the purpose of calculating the positively avoided emissions resulting from the projects, it is noted that data from specific GHG emitters could be obtained it needed.
West Lindsey District Council	08/07/2022 Workshop	Workshop to address the scope of the GHG chapter, request data, and address any concerns with proceedings.	No concerns or further feedback were raised.
Lincolnshire County Council	08/07/2022 Workshop	Workshop to address the scope of the GHG chapter, request data, and address any concerns with proceedings.	No concerns or further feedback were raised.
East Riding of Yorkshire Council	18/07/2022 Email	Email to stakeholder to obtain emissions data for the Proposed Order Limits within East Riding of Yorkshire.	The Council do not hold any specific emissions data but advised on potential data sources.

19.4 Assessment methodology and significance criteria

Study Area

19.4.1 The Study Areas applied for the GHG assessment are not spatial, but rather parameters around what the assessment will consider. The Study Areas applied for the GHG assessment will be:

- Primary Study Area – construction emissions within the Proposed Order Limits;
- Secondary Study Area – emissions associated with the new pipelines, as well as benefits associated with the Project's operation; and
- Tertiary Study Area – emissions associated with the manufacturing of construction materials, transportation of those materials to and from the Project, and the disposal of materials.

Baseline data collection

Desk study

19.4.2 Baseline conditions of the Project were established during a desk study using the following sources:

- The pipeline specifications were extrapolated from the intended use, from which assumptions were made on the type and quantity of materials. The quantity of materials was multiplied by emissions factor data sourced from the Bath Inventory of Carbon & Energy (ICE) database (Ref. 19.18);
- As accurate plant data of usage of fuels, electricity and water is not available at this stage, for the PEIR emissions related to the construction plant have been estimated based on assumptions presented by the Royal Institute of Chartered Surveyors 2017 (RICS) (Ref. 19.19). The assumed cost of construction (£200 million)[1] was multiplied by the assumed emissions rate (1400 kgCO_2e/£100k) to calculate the total assumed plant emissions (Ref. 19.19);
- Calculations for emissions resulting from the transportation of materials and waste during construction and decommissioning were based on transport distance assumptions provided by RICS (Ref. 19.19).The resulting tonne kilometres (t/km) of materials to site and waste from site were then multiplied by the appropriate emission factor provided by Department for Business, Energy & Industrial Strategy (BEIS) (Ref. 19.20);
- Data on fugitive gas leaks was calculated by multiplying the length of the pipeline and estimated hours of operation against the appropriate emission factor provided by the American Petroleum Institute (API) (Ref. 19.21);
- Estimates for the emissions associated with waste disposal during the decommissioning stage were calculated by multiplying the mass of waste by the appropriate BEIS emission factor (Ref. 19.20). The mass of waste was estimated based on assumptions provided by RICS (Ref. 19.19); and

[1] Based on key performance indicator of £11,000 per diameter inch per pipe km

- The emissions associated with the construction, operational, and decommissioning stages were compared against the UK Carbon Budgets and their significance assessed based on IEMA guidance.

Site visits and surveys

19.4.3 No GHG surveys have been or will be undertaken. Desktop studies from other disciplines are considered to be sufficient at this stage.

Impact assessment methodology

19.4.4 Construction, operational and decommissioning phases of the Project will be considered for the GHG assessment, consistent with the principles set out in PAS 2080:2016 Carbon Management in Infrastructure (Ref. 19.13). The emissions associated with the construction and operation phases have been reported in the form of carbon footprinting, as tonnes of carbon dioxide equivalent (tCO_2e).

19.4.5 Direct and indirect emissions have been considered in line with GHG reporting and the total carbon footprint is reported in carbon dioxide equivalents (CO_2e). This allows for the emissions of the six key GHGs: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride; to be expressed in terms of their equivalent global warming potential in mass of CO_2e.

19.4.6 The assessment of GHG emissions associated with the Project have been considered through the following stages:

- Construction, including material supply, transportation, manufacturing and construction process:
    - The GHG emitted through the materials used to construct the Project, and the significance of the effects of this; and
    - The GHG emitted through the construction activities associated to the Project, calculated in line with PAS2080:2016 Carbon Management in Infrastructure (Ref. 19.13) methodology.
- Operation of the Project, including:
    - Energy use for regular operation;
    - Emissions associated with maintenance and refurbishment; and
    - Wider benefits from the Project.
- Decommissioning/end-of-life
    - Deconstruction operations;
    - Transport of waste from site;
    - Waste processing; and
    - Emissions related to disposal.

19.4.7 The significance of effects will be assessed by comparing the estimated GHG emissions arising from the Project with the UK Carbon Budgets for the corresponding timeframes, and the associated reduction targets. The overall negative carbon contribution of the Project, from construction and operation, has been compared to the overall positive

carbon contribution of the Project arising from its contribution to the industries it serves by lowering their industrial emissions.

19.4.8 GHG emissions are not geographically limited. They have a global effect rather than directly affecting any specific local receptor to which a level of sensitivity can be assigned. The receptor for GHG emissions is the global atmosphere. The receptor has a high sensitivity, given the severe consequences of global climate change and the cumulative contributions of all GHG emission sources.

Significance criteria

19.4.9 To determine the significance of the impacts of the Project on the global atmosphere by releasing greenhouse gases emissions, the assessment uses specific criteria within the IEMA Guide: Assessing GHG Emissions and Evaluating Their Significance (Ref. 19.15).

19.4.10 As the IEMA Guide states, when evaluating significance, all new GHG emissions contribute to a negative environmental impact. However, some projects will replace existing development or baseline activity that has a higher GHG profile, thereby contributing to a positive environmental impact. The significance of a project's emissions should therefore be based on its net impact over its lifetime, which may be positive, negative or negligible.

19.4.11 The significance of this impact must be measured against the global GHG emission budget set out by the IPCC. The AR6 WG1 report (Ref. 19.16) concludes that in order to keep global warming beneath the 1.5°C threshold, emissions must be kept below 344 $GtCO_2e$ comparative to early 2020 levels.

19.4.12 GHG emissions were assessed using tCO_2e per annum under the 'Do Minimum' and 'Do Something' scenarios. The difference between these two scenarios is calculated to demonstrate the impacts of the Project on GHG emissions during construction and operation phases. They are compared against the UK Carbon Budget set out in the Climate Change Committee's (CCC) UK Carbon Budgets (Ref. 19.4).

Assumptions and limitations

19.4.13 To ensure transparency within the EIA process, the following limitations and assumptions have been identified:

- Calculations for embodied and transport emissions have been made based on external data provided by third parties. Assumptions have been made for the purpose of defining the existing baseline, and results are dependent on the accuracy of the data;
- It is assumed that the main body of the Project will be constructed out of UOE Pipe Steel. UOE Pipe is a method used for production of longitudinally welded large diameter pipes, with the name referencing the shaping technique (Ref. 19.18);
- Transport distance of materials and waste is assumed to be the default 50 km for the PEIR. Transport emissions for recovered materials have been calculated under the worst-case scenario assumption that all recoverable material would be recycled off-site;
- Construction and decommissioning plant emissions were calculated based on RICS emissions assumptions (1400 $kgCO_2e$/£100 k) (Ref. 19.19);

- Fugitive emissions were calculated using the conversion factors for natural gas pipelines (Ref. 19.21) as they are assumed to occur in a similar fashion. Operational hours are also based on assumptions made by the API (Ref. 19.21);
- The Project has an operational design life of 40 years; and
- The emissions rate for plant equipment was based on estimates provided by RICS (Ref. 19.19).

19.5 Baseline conditions

Existing baseline

19.5.1 In the baseline 'Do Nothing' scenario, GHG emissions go unmitigated and occur constantly and widely, resulting from transportation, land use, natural cycles, energy consumption and industrial processes.

19.5.2 The GHG assessment considers conditions where the Project impacts upon emissions, positively or negatively, and therefore focuses on sources of emissions that are subject to change as a result of the Project. For the purpose of this assessment, emissions that are subject to change as a result of the Project are defined as those resulting from Industrial and Commercial processes. The Yorkshire and the Humber region is the UK's largest GHG contributor, and was responsible for emitting 700.8 MtCO2e in 2020 (Ref. 19.22). The Humber Industrial Cluster alone contributes around 12.6 MtCO2e per annum (Ref. 19.23), thus acting as the baseline for annual GHG emissions in the Humber region.

19.5.3 The baseline scenario involves no construction activities. This therefore makes the existing baseline conditions for construction, operation and decommissioning of the pipelines, zero emissions.

Future baseline

19.5.4 The Yorkshire & Humber Climate Action Plan (Ref. 19.12) states that, at their current emissions rates, the region could use up their portion of the global carbon budget in just over five years. It is predicted that the implementation of blue-green infrastructure could enable a 54% reduction of current emissions by 2050. This places the future baseline emissions from intrinsically linked projects in the Humber Industrial Cluster sector at 5.8 $MtCO_2e$ per annum.

19.5.5 The baseline scenario involves no construction activities. This therefore makes the future baseline conditions for construction, operation and decommissioning of the pipelines, zero emissions.

19.6 Design development, impact avoidance and embedded mitigation

19.6.1 Due to the nature of the Project, mitigation of GHG emissions is an inherent part of the Project. Primary mitigation of the region's carbon impact would be achieved by transporting captured carbon dioxide from Connected Projects to the seabed deposit and allowing industry to use hydrogen instead of carbon-based fossil fuels.

19.6.2 Secondary mitigation measures – those that are intended to reduce embodied carbon during construction and operation – include the use of materials with a low whole-life carbon value, lean structural design, and energy efficiency measures. Current designs suggest the implementation of safe dispersal distances for venting in the AGIs. Secondary mitigation options would continue to be explored as the design process continues.

19.6.3 A Construction Environmental Management Plan (CEMP) would be prepared for the Project and will be secured through a requirement in the DCO and a Register of Commitments. An outline CEMP will also be provided in support of the DCO application. The CEMP would detail the environmental controls, environmental protections and environmental safety measures that will be adopted during construction. The CEMP would set out a series of standard best practice measures to control the environmental effects of the construction of the Project.

19.6.4 The following sections 19.5.5-7 set out the preliminary avoidance, mitigation and compensation measures taken to minimise GHG emissions throughout the three phases of the Project.

Construction

19.6.5 The magnitude of GHG emissions associated with the construction phase of the Project could be minimised by:

- Design optimisation in line with the carbon reduction hierarchy set out in clause 6.1.4 of PAS 2080:2016 (Ref. 19.13):
    - Reduce the elements and materials required for the construction phase of the Project;
    - Use alternative raw materials and resources, such as those with a higher proportion of recycled content; and
    - Use efficient construction processes, such as manufacture and assembly design.
- Stating clear preference in tender documents for more sustainable materials, products with reduced embodied emissions, and materials with higher proportion of recycled content, provided that use of such resources does not impede on the safety and integrity of the Project.
- Avoiding use of landfill sites as means of waste disposal, where possible. The use of locally sourced materials and local waste disposal facilities should also be prioritised to minimise transportation emissions.
- Using more efficient construction plant and transport vehicles, preferably those powered by electricity using alternative/low-emission fuel sources.
- Putting in place training policies and management protocols to avoid fuel spills and idling engines, and promote environmentally sensitive driving techniques.
- Prioritising suppliers and companies that have strong environmental, social and governance (ESG) ratings and/or sustainability performance certifications. Materials should ideally be supported with sustainable certification labels, or Environmental Product Declarations (EPD).

Operation

19.6.6 The magnitude of GHG emissions associated with the operation phase of the Project can be minimised by:

- Designing, specifying, and constructing the Project to maximise operational lifespan and minimise maintenance and refurbishment needs.
- Using best-practices in energy efficiency, and using low/no-carbon approaches, plant, and equipment when undertaking operation, maintenance, and refurbishment. This may include the use of more efficient and/or electrically powered plant and vehicles, more sustainable materials, and training for environmental sensitivity.
- Specifying long-lasting and energy efficient mechanical and electrical equipment.
- Implementing a leak detection and maintenance programme.

Decommissioning

19.6.7 The magnitude of GHG emissions associated with the decommissioning phase of the Project can be minimised by:

- Maximising potential for reuse, repurposing, recycling, and/or recovery of materials and elements at end-of-life through design, specification and dismantling practices.
- Prioritising local waste disposal facilities to minimise transportation distance. Recoverable materials should be recycled on-site at all opportunities to reduce transport emissions.
- Designing to avoid disposal of materials via landfill when decommissioned.
- Using best-practices in energy efficiency, and using low/no-carbon approaches, plant, and equipment. This may include the use of more efficient and/or electrically powered plant and vehicles, and training for environmental sensitivity.

19.7 Preliminary assessment of likely impacts

Construction

19.7.1 The total estimated GHG emissions arising from embodied carbon, ground gas, transportation of materials to site and construction plant use have been quantified and presented in Tables 19.3, 19.4 and 19.5. The available data is limited at the current design stage and is subject to the accuracy of third-party sources. A quantitative assessment of emissions will be undertaken for the ES where data is available.

19.7.2 The total estimated GHG emissions arising from embodied carbon, transportation of materials to site, and construction plant use are currently estimated to be approximately 116,816 tCO2e.

Table 19.3: Estimated Embodied Emissions

Material	Embodied Carbon (tCO_2e)
Steel	112,152

Table 19.4: Estimated Emissions for the Transport of Materials to Site

Material	Transport to Site (tCO_2e)
Steel	1,778

Table 19.5: Estimated Plant Use Emissions During Construction

Item	Total (tCO_2e)
Construction Plant	2,886

19.7.3 Based on the results presented in Tables 19.3, 19.4, and 19.5 the magnitude of embodied emissions and GHG emissions arising during construction is not predicted to be significant.

Operation

19.7.4 The total operational GHG emissions based on the current design have been quantified and presented in Table 19.6. The available data is limited at the current design stage and is subject to the accuracy of third-party sources.

19.7.5 Data on operational energy use and materials required for maintenance and refurbishment are not available at the current design stage. We have therefore estimated these emissions based on the following assumptions. It is assumed that energy consumption would arise from the operation of monitoring equipment, lighting, pumping and further emissions from embodied carbon of materials used for maintenance and refurbishment.

19.7.6 Calculations for fugitive gas leak were considered to be insignificant, and have therefore been excluded from the total estimated operational GHG emissions.

19.7.7 The total GHG emissions arising from operational energy and maintenance works is expected to be approximately 13,460 tCO2e.

Table 19.6: Estimated Operational GHG Emissions per annum

Item	Total (tCO_2e)
Operational Energy	2,320
Maintenance works	6,320
Total	**8,640**

19.7.8 Based on the results presented in Table 19.6 the magnitude of embodied emissions and GHG emissions arising during operation is predicted to be not significant.

Decommissioning

19.7.9 The total GHG emissions resulting from decommissioning plant use, transportation of waste for disposal, and disposal of waste has been quantified and presented in Tables 19.7, 19.8 and 19.9. The available data is limited at the current design stage and is subject to the accuracy of third-party sources.

19.7.10 The total GHG emissions arising plant use, transportation of waste for disposal, and disposal of waste is estimated to be approximately 4,835 tCO2e.

19.7.11 Data on the decommissioning stage for this Project is uncertain and therefore relies on data extrapolated from the construction phase. However, due to the nature of the Project, it is expected that decommissioning activities would be net zero by the end of design life. Therefore, all estimates are based on worst-case scenario.

Table 19.7: Estimated Plant Use Emissions During Decommissioning

Item	Total (tCO_2e)
Decommissioning Plant	2,886

Table 19.8: Estimated Emissions for the Transport of Waste (Steel) for Disposal

Disposal Method	Transport to Site (tCO_2e)
Landfill	71

Table 19.9: Estimated GHG Emissions from the Disposal of Waste

Disposal Method	Emissions (tCO_2e)
Landfill	1,878

19.7.12 Based on the results presented in Tables 19.7, 19.8 and 19.9, the magnitude of embodied emissions and GHG emissions arising during operation is predicted to be not significant.

19.8 Mitigation and enhancement measures

19.8.1 No secondary mitigation or enhancement measures are currently proposed associated with the GHG assessment. Due to the nature of the Project, the preliminary avoidance and embedded mitigation measures set out in Section 19.6 are expected to be sufficient in addressing the impacts detailed in Section 19.7.

19.9 Summary of the preliminary assessment of potential significant effects

19.9.1 Table 19.10 below summarises the preliminary assessment of potential significant effects associated with the Project.

Table 19.10: Summary of the preliminary assessment potential significant effects

Resource/receptor	Stage	Sensitivity of resource/receptor	Description of the potential impact/change	Mitigation measure	Potential significant effects
Global atmosphere	Construction	High	Construction phase GHG emissions	Construction emissions should be minimised through design optimisation and environmentally sensitive practices reflecting the IEMA GHG Management Hierarchy (Ref. 19.15).	Not significant
Global atmosphere	Operation	High	Operational phase GHG emissions	Operational emissions should be minimised by specifying long-lasting, high efficiency materials that require minimal maintenance and refurbishment, and using best practice in energy efficiency when carrying out maintenance and refurbishment works.	Not significant
Global atmosphere	Decommissioning	High	Decommissioning phase GHG emissions	Decommissioning emissions should be reduced by minimising the volume of waste being disposed of at landfill; and maximising the	Not significant

Resource/receptor	Stage	Sensitivity of resource/receptor	Description of the potential impact/change	Mitigation measure	Potential significant effects
				potential for repurpose/reuse at the Project site.	

19.10 Next steps

19.10.1 Embodied emissions resulting from construction materials should be recalculated once the full material quantities and type are finalised. Embodied emissions should include materials other than steel. Plant emissions should also be recalculated once plant type has been identified. Transport emissions for construction materials should be updated once material sourcing has been undertaken to account for actual transport distance. Operational Energy and maintenance should be updated once final design and operation protocol is available.

19.10.2 Fugitive emissions should be adjusted based on actual hours of operation, and efforts should be made to use a conversion factor that is more appropriate for hydrogen and carbon dioxide.

19.10.3 The potential beneficial effects may also be included at a later stage. These will include carbon reduction from avoided emissions by carbon sequestration and removal through the carbon pipeline, and use of hydrogen instead of natural gas. This is expected to significantly reduce GHG emissions associated with the Humber Industrial Cluster and enable the adoption of hydrogen technologies.

19.10.4 A further assessment may also be included of the release of GHGs from historic landfill sites as a result of disturbance from the Project. Initial analysis has shown that the impact of this disturbance is likely to be negligible (Ref. 19.24).

19.11 References

- Ref. 19.1 Paris Agreement (2015). Available at: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement (Accessed: 28 June 2022).
- Ref. 19.2 Glasgow Climate Pact (2021). Available at: https://unfccc.int/documents/310475 (Accessed: 28 June 2022).
- Ref. 19.3 The Climate Change Act 2008 (2019 Amendment). Available at: https://www.legislation.gov.uk/ukdsi/2019/9780111187654 (Accessed: 28 June 2022).
- Ref. 19.4 Climate Change Committee (2020) *UK Carbon Budgets*. Available at: https://www.theccc.org.uk/publicationtype/0-report/03-carbon-budget/ (Accessed: 28 June 2022).
- Ref. 19.5 UK Government (2013) *Infrastructure Carbon Review*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/260710/infrastructure_carbon_review_251113.pdf (Accessed: 21 July 2022).
- Ref. 19.6 Department of Energy and Climate (2011) *Overarching National Policy Statement for Energy (EN-1).* Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf (Accessed: 28 June 2022).
- Ref. 19.7 Department of Energy and Climate (2021) *Draft Overarching National Policy Statement for Energy (EN-1).* Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015233/en-1-draft-for-consultation.pdf (Accessed: 28 June 2022).
- Ref. 19.8 Department of Energy and Climate (2011) *National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4)*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37049/1941-nps-gas-supply-oil-en4.pdf (Accessed: 28 June 2022).
- Ref. 19.9 Department of Energy and Climate (2021) *Draft National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4)*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015237/en-4-draft-for-consultation.pdf (Accessed: 28 June 2022).
- Ref. 19.10 Ministry of Housing, Communities & Local Government (2021) *National Planning Policy Framework*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf (Accessed: 28 June 2022).
- Ref. 19.11 Department for Business, Energy and Industrial Strategy (2021) *Net Zero Strategy: Build Back Greener*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf (Accessed: 28 June 2022).
- Ref. 19.12 Yorkshire & Humber Climate Commission (2021) *Yorkshire & Humber Climate Action Plan*. Available at: http://yorksandhumberclimate.org.uk/sites/default/files/Climate%20Action%20Plan.pdf (Accessed: 28 June 2022).
- Ref. 19.13 The Green Construction Board (2016) *Publicly Available Specification 2080:2016 Carbon Management in Infrastructure*. Available at:

https://www.carbontrust.com/what-we-do/assurance-and-certification/pas-2080-carbon-management-in-infrastructure (Accessed: 28 June 2022).

- Ref. 19.14 Zero Carbon Humber Partnership (2019) *Capture for Growth: A Roadmap for the World's First Zero Carbon Industrial Cluster*. Available at: https://www.zerocarbonhumber.co.uk/wp-content/uploads/2019/11/Capture-for-Growth-Zero-Carbon-Humber-V4.9-Digital.pdf (Accessed: June 28 2022).
- Ref. 19.15 Institute of Environmental Management & Assessment (2022) *Assessing Greenhouse Gas Emissions and Evaluating their Significance*. Available at: https://www.iema.net/resources/blog/2022/02/28/launch-of-the-updated-eia-guidance-on-assessing-ghg-emissions (Accessed: 28 June 2022).
- Ref. 19.16 International Panel on Climate Change (2021) *Sixth Assessment Report: The Physical Science Basis*. Available at: https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/ (Accessed: 28 June 2022).
- Ref. 19.17 Environment Agency (2014) *Guidance on the management of landfill gas*. Available at: https://www.gov.uk/government/publications/management-of-landfill-gas-lftgn-03 (Accessed: 07/07/2022)
- Ref. 19.18 University of Bath (2019) *Inventory of Carbon and Energy*. Available at: https://circularecology.com/embodied-carbon-footprint-database.html (Accessed: 29 June 2022).
- Ref. 19.19 Royal Institute of Chartered Surveyors (2017) *Whole Life Carbon Assessment for the Built Environment*. Available at: https://www.rics.org/globalassets/rics-website/media/news/whole-life-carbon-assessment-for-the--built-environment-november-2017.pdf (Accessed: 29 June 2022).
- Ref. 19.20 Department for Business, Energy and Industrial Strategy (2020) *Government Greenhouse Gas Conversion Factors for Company Reporting*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/901692/conversion-factors-2020-methodology.pdf (Accessed: 29 June 2022).
- Ref. 19.21 American Petroleum Institute (2021) *Compendium of Greenhouse Gas Emissions Methodologies for the Natural Gas and Oil Industry*. Available at: https://www.api.org/-/media/Files/Policy/ESG/GHG/2021-API-GHG-Compendium-110921.pdf?la=en&hash=4B6E056EC663A4DE6133ED2A6F2F9865D7D33FA9 (Accessed: 29 June 2022).
- Ref. 19.22 Department of Food, Environment and Rural Affairs (2020) *UK Local Authority GHG Emissions 2020 Dataset*. Available at: https://www.data.gov.uk/dataset/723c243d-2f1a-4d27-8b61-cdb93e5b10ff/uk-local-authority-and-regional-greenhouse-gas-emissions (Accessed: 25 July 2022).
- Ref. 19.23 Humber Local Enterprise Partnership (2022) Humber Local Energy Strategy: Final Report. Available at: https://www.humberlep.org/wp-content/uploads/2020/02/Humber-LEP-Energy-Strategy-1.pdf (Accessed: 11 July 2022).
- Ref. 19.24 Wilson, S., Card, G., and Haines, S. (2009) Ground Gas Handbook. Available at: https://vdoc.pub/documents/ground-gas-handbook-4umpanb5knb0 (Accessed: 05 July 2022).

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