ENVIRONMENTAL STATEMENT – VOLUME 1 – CHAPTER 15 GREENHOUSE GASES

Drax Bioenergy with Carbon Capture and Storage

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations (2009) - Regulation 5(2)(a)

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15.1. INTRODUCTION

15.1.1. This chapter reports the outcome of the assessment of likely significant environmental effects arising from the Proposed Scheme on climate, specifically greenhouse gas (GHG) emissions.

15.1.2. Considering a project's impact on climate is a requirement of the 2014 amendment to the Environmental Impact Assessment (EIA) Directive (2014/52). The Directive has been fully transposed into UK law in the EIA Regulations. The EIA Regulations require:

15.1.3. "The EIA must identify, describe and assess…the direct and indirect significant effects of the proposed development on…climate" (Regulation 5(2)).

15.1.4. "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 the vulnerability of the project to climate change" (paragraph 5 of Schedule 4).

15.1.5. Impacts during the construction and operational phases of the Proposed Scheme have been assessed. The effects of the decommissioning phase of the Proposed Scheme have been excluded from this chapter due to the Proposed Scheme's design life of 25 years and uncertainties around deconstruction techniques at the Proposed Scheme's end of life.

15.1.6. A full description of the Proposed Scheme is described in **Chapter 2 (Site and Project Description)** of this ES (document reference 6.1.2).

15.1.7. This chapter (and its associated appendices (**Volume 3**)) is intended to be read as part of the wider ES.

15.1.8. This chapter:

- **a.** Summarises the legislative and policy framework;
- **b.** Describes consultation undertaken to date;
- **c.** Describes the methodology followed for the assessment;
- **d.** Identifies the potential impacts as a result of the Proposed Scheme;
- **e.** Details the design, mitigation and enhancement measures that have been identified;
- **f.** Reports the assessment of the significant effects of the Proposed Scheme; and
- **g.** Details the monitoring that should be carried out for the Proposed Scheme.

15.1.9. The Proposed Scheme has the potential to affect climate change through additional or avoided GHG emissions in comparison to the baseline and the future baseline scenario as a result of:

During Construction:

a. Embodied GHG emissions within construction materials;

b. Transport of construction materials to Site;

c. Use of plant and equipment during construction (fuel and energy use);

d. Transport of construction waste; and

e. Land use change (disposal of organic material).

During Operation:

a. GHG emissions associated with the biomass supply chain;

b. Carbon captured through the carbon capture process;

c. Replacement and refurbishment of materials during operation;

d. Energy required for operation;

e. Solvent used for the carbon capture process; and

f. Land use change (changes to the landscape resulting in a loss or gain in carbon sequestration).

OPTIONALITY

15.1.10. For the purposes of this assessment, it is considered that the abnormal indivisible load (AIL) route options (described in **Chapter 2 (Site and Project Description)**, **paragraph 2.3.27)**, and construction programme options (described in **Chapter 2 (Site and Project Description), paragraph 2.3.4**) would not materially affect the assessment. The AIL route options do not alter the total material and waste transport distances as these distances have been calculated using an assumption from Royal Institution of Chartered Surveyors (RICS) (RICS, 2017) for the GHG assessment. The construction programme options do not affect the breakdown of GHG emissions against the UK carbon budgets as the construction and operational timeframes are the same in each option.

15.2. LEGISLATIVE AND POLICY FRAMEWORK

LEGISLATIVE FRAMEWORK

15.2.1. The applicable legislative framework is summarised as follows:

International

United Nations Framework Convention on Climate Change

15.2.2. The UK is a member of the United Nations Framework Convention on Climate Change (‘UNFCCC’) which drives international action on climate change. The UK has pledged to reduce emissions under the ‘Paris Agreement’ in 2015, as a part of a joint pledge by members of the EU. This provides an overarching commitment by the

UK as outlined in the UK's Nationally Determined Contribution (NDC) (UK Government, 2020). The NDC commits the UK to reduce economy-wide greenhouse gas emissions by at least 68% by 2030, compared to 1990 levels. The scope of this commitment comprises the energy sector (including transport); industrial processes and product use; agriculture; land-use, land-use change and forestry; and waste.

National

The Climate Change Act 2008, as amended 2019

15.2.3. The Climate Change Act (2008) established a legal requirement for an 80% reduction in the GHG emissions of the UK economy by 2050 in comparison to the 1990 baseline. In addition, in June 2019, through the Climate Change Act 2008 (2050 Target Amendment Order) 2019, the UK Government updated this commitment to net zero emissions by 2050.

15.2.4. The Climate Change Act also created the Committee on Climate Change, with responsibility for setting 5-year carbon budgets covering successive periods of emissions reduction to 2050. The carbon budgets are used in this chapter to assess the impact of the Proposed Scheme.

Environment Act 2021

15.2.5. The Environment Act provides a legal framework for environmental governance to allow the UK Government to set and meet long term targets in relation to managing and improving the natural environment. The Environment Act establishes the Office for Environmental Protection (OEP), a new statutory and independent environmental body to hold the UK Government to account on environmental law and Environmental Improvement Plan.

15.2.6. Greenhouse gas emissions are considered through this Act by the Resource Efficiency Requirements to be developed pursuant to section 53 and Schedule 7. These provisions enable the Secretary of State, as the relevant national authority, to make product-specific regulations setting requirements relating to a product's resource efficiency. This includes pollutants (such as greenhouse gases) released or emitted during its production. The provisions of the Act are not yet in force, and no regulations have yet been made.

POLICY FRAMEWORK

15.2.7. The applicable policy framework is summarised as follows:

National

The Overarching National Policy Statement for Energy (EN-1)

15.2.8. The National Policy Statement for Energy (EN-1) (Department of Energy and Climate Change, 2011), outlines the planning policy for the energy sector. The policy notes in paragraph 2.2.1 that *"…moving to a secure, low carbon energy system is challenging, but achievable."* Furthermore, the need for requiring major investment in note technologies is stated. In particular, it the Policy discusses:

a. The transition to a low carbon economy through reducing reliance on fossil fuels to reduce greenhouse gas emissions, and the energy sector's role in achieving that end;

b. The challenge of meeting energy security and carbon reduction objectives (set out in the Climate Change Act (2008), and Energy Act (2013));

c. The aim of reducing demand through energy efficiency; and

d. The role of smart technologies to balance supply and demand and therefore result in carbon savings.

15.2.9. Part 3 of the Policy discusses the need for new nationally significant energy infrastructure projects. In reference to decision making in paragraph 3.1.1, it states *"The UK needs all the types of energy infrastructure covered by this NPS in order to achieve energy security at the same time as dramatically reducing greenhouse gas emissions".* Paragraph 3.3.10 notes that to *"diversify and decarbonise electricity generation…it may include plant powered by the combustion of biomass".*

15.2.10. The implementation of CCS in the Policy is generally focused on fossil fuel power stations, rather than biomass units, however the Policy is generally supportive of CCS proposals and requires all new combustion generating stations to be 'Carbon Capture Ready'.

15.2.11. At the time of writing, the Government is in the process of updating the Energy NPSs. The draft Outline National Policy Statement for Energy (EN1) was published in September 2021 (Department for Business, Energy & Industrial Strategy, 2021).

Draft Overarching National Policy Statement for Energy (EN1)

15.2.12. The policy outlines the policy context for nationally significant energy infrastructure.

15.2.13. Section three of the draft policy sent out the need for new nationally significant energy infrastructure projects, including carbon capture and storage infrastructure. The policy states under paragraph 3.5.1 *"New carbon capture and storage (CCS) infrastructure will be needed to ensure the transition to a net zero economy. The Committee on Climate Change Committee states CCS is a necessity not an option". "CCS infrastructure will also be needed to capture and store carbon dioxide from hydrogen production from natural gas, industrial processes, the use of bioenergy (BECCS) and from the air (DACCS)."* Paragraph 3.5.3 continues to state that *"There do not appear to be any realistic alternatives to new CCS infrastructure for delivering net zero by 2050"* and paragraph 3.5.7 summarises the need for negative emissions as follows:

> "it will be difficult to completely decarbonise all sectors of the economy, with aviation and agriculture viewed as particularly challenging. Where sectors are not completely decarbonised, we will need negative emissions to offset the residual emissions in those sectors. Capturing and storing emissions from bioenergy or directly from the air using CCS infrastructure provides a source of negative emissions. There are other sources of negative emissions, such as afforestation, but all of these are limited in some way and negative emissions

using CCS infrastructure are viewed as essential for delivering our net zero target."

15.2.14. Section five of the draft policy sets out the Applicant's assessment requirements which includes carbon assessment as part of the environmental statement covering construction, operational and decommissioning impacts, measures taken to reduce emissions and the impact of any residual emissions. Paragraph 5.3.7 sets out that "*Operational GHG emissions are a significant adverse impact from some types of energy infrastructure which cannot be totally avoided (even with full deployment of CCS technology).*" However, the Government accepts that *"operational GHG emissions are not reasons to prohibit the consenting of energy projects".*

15.2.15. In applying mitigation for GHG emissions the Policy, under paragraph 5.3.8, notes that "*a carbon assessment should be used to drive down GHG emissions at every stage of the proposed development and ensure that emissions are minimised as far as possible for the type of technology".* Paragraph 5.3.9 stresses that applicants should seek to embed nature based or technological solutions to mitigate or offset emissions.

National Policy Statement for Renewable Energy Infrastructure (EN-3)

15.2.16. The National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, 2011) builds on the National Policy Statement for Energy (EN-1). Section 2.5 of EN-3 is specific to biomass and waste combustion, noting the importance of this combustion process to meet renewable energy targets.

15.2.17. EN-3 discusses carbon capture readiness in paragraph 2.5.28 where relevant to new biomass plant at or over 300MW of generating capacity, where carbon capture should be incorporated into the development. Paragraph 2.5.38 identifies that *"CO_2 emissions may be a significant adverse impact of biomass/waste combustion plant. Although an ES on air emissions will include an assessment of CO_2 emissions, the policies set out in Section 2.2 of EN-1 will apply. The Infrastructure Planning Commission does not, therefore need to assess individual applications in terms of carbon emissions against carbon budgets"*.

Draft National Policy Statement for Renewable Energy Infrastructure (EN-3)

15.2.18. The Draft National Policy Statement for Renewable Energy Infrastructure (EN-3) (BEIS, 2021) builds on the Draft National Policy Statement for Energy (EN-1). Section 2.5 of EN-3 relates specifically to Biomass and Waste Combustion. Paragraph 2.5.1 states *"The combustion of biomass…for electricity generation plays an important role in meeting the UK's energy needs and supports the decarbonisation of the sector. It also has a potentially significant role in supporting delivery towards the UK's net zero target when combined with carbon capture and storage."*

15.2.19. Section 2.13 of EN-3 relates to air quality and GHG emission impacts. EN-3 makes reference to Section 5.2 of Draft EN-1, however in relation to biomass, it is noted that operational CO_2 emissions may be a significant adverse impact, and a carbon

assessment will be carried out as part of the Environmental Statement. As also set out in Draft EN-1 Section 5.3, *"the Secretary of State does not, therefore, need to assess individual applications for planning consent against operational carbon emissions and their contribution to carbon budgets, net zero and our international climate commitments."*

The National Planning Policy Framework (Ministry of Housing Communities & Local Government, 2021)

15.2.20. The National Planning Policy Framework (Ministry of Housing, Communities & Local Govenment, 2021) explains that achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives). One of the three objectives is an environmental objective (with the other two being economic and social), which includes the objective of *"mitigating and adapting to climate change, including moving to a low carbon economy"* (paragraph 8).

15.2.21. Section 14 of the NPPF provides national planning policy in respect of the need to meet the challenge of climate change, flooding and coastal change. Paragraph 152 of the NPPF provides that *"The planning system should support the transition to a low carbon future in a changing climate…. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure".*

15.2.22. Paragraphs 153 to 158 provide policies in relation to the need to plan for climate change. Paragraph 154 provides that "New development should be planned for in ways that: can help to reduce greenhouse gas emissions, such as through its location, orientation and design".

15.2.23. Paragraph 158 provides guidance for determining planning applications for renewable and low carbon development, where local planning authorities should: *"a) not require applicants to demonstrate the overall need for renewable or low carbon energy…; and b) approve the application if its impacts are (or can be made) acceptable".*

15.2.24. Whilst paragraph 5 of the NPPF confirms the framework does not contain specific policies for Nationally Significant Infrastructure Project, it is identified that the policies contained in the NPPF may include other matters that are relevant. Accordingly, the Secretary of State may determine that the policies of the NPPF in relation to climate change, in addition to those contained in local planning policy, discussed below, are relevant to their determination of the DCO Application for the Proposed Scheme.

Infrastructure Carbon Review, 2013

15.2.25. The report (HM Treasury, 2013) sets out measures for those involved in designing, constructing, operating and maintaining infrastructure assets to integrate and

consider lower carbon solutions. The report provides context of carbon in UK infrastructure, practical steps for reductions and supply chain considerations and recommended actions.

Net Zero Strategy: Build Back Greener

15.2.26. The Net Zero strategy (HM Government, 2021) sets out pathways for the UK to meet the national carbon budgets and achieve net zero within the UK. The Policy's net zero pathway includes responding to and adoption of new technologies such as:

a. Carbon capture and storage from power generation, hydrogen production and industrial processes. The technology also supports negative emissions from engineered greenhouse gas removals – Bioenergy with Carbon Capture and Storage (BECCS) and Direct Air Carbon Capture and Storage (DACCS); and

b. Biomass, combined with carbon capture and storage can remove carbon from the atmosphere and support low carbon electricity and hydrogen generation. Biomass and other waste can also support low carbon fuels for industry, buildings and transport. The Government is due publish a Biomass Strategy in 2022 that will set out how BECCS could be deployed.

15.2.27. Section 3vii of the strategy refers to greenhouse gas removals (GRR) to balance residual emissions and achieve net zero. Key commitments include:

a. *Setting an ambition to deploy "at least 5 MtCO2/year of engineered removals by 2030, in line with the Climate Change Committee and National Infrastructure Commission assessments.";*

b. *"Develop markets and incentives for investment in greenhouse gas removal methods"; and*

c. *"Explore options for regulatory oversight to provide robust monitoring, reporting and verification of GGRs".*

Biomass Policy Statement

15.2.28. The Biomass Policy Statement (BEIS, 2021) sets out the Government's strategic view on the role of biomass across the economy in the medium to long term, to support the delivery of net zero. A key principle includes using biomass with carbon capture utilisation or storage where feasible.

15.2.29. Section 2.7 of the Biomass Policy Statement relates to Bioenergy with Carbon Capture and Storage (BECCS) and the Government's commitment to recognising the role this can play in reducing carbon emissions. The policy statement (page 35) notes that:

a. *"If adopted early, GGR technologies could provide an opportunity to help meet our nationally determined contribution (NDC) in 2030, and Carbon Budgets 5 and 6." ;*

b. *"The Net Zero Strategy set an ambition of deploying at least 5 MtCO2 per year of engineered removals by 2030… of which BECCS could be a major route" ; and*

c. *"The CCC and the National Grid's 2020 Future Energy Scenarios also indicate that it is not possible to achieve net zero without BECCS".*

15.2.30. The Biomass Policy statement makes reference to the need that any BECCS development *"must be genuinely and credibly 'net negative'".* The policy further notes on page 37 that BECCS in the power sector could be a major GGR with retrofitting BECCS to large scale biomass plants. *"Power BECCS is expected to deliver a steady increase of engineered removals between the late 2020s and 2035."*

Local

Selby District Core Strategy Local Plan

15.2.31. The Site is located in the area of Selby District Council. The Selby District Core Strategy Local Plan (Selby District Council, 2013) makes reference to the national policies for greenhouse gas emission reductions. Paragraphs 7.21 to 7.23 note that both *"Drax and Eggborough power stations contribute significantly to the District greenhouse gas emissions and as this power generation accounts for most of the District's emissions." "Implementation of [the Government's energy] policy is demonstrated at Drax by the co-firing of biomass and the proposals to develop a biomass fuelled electricity generating plant." "The Government's aim to reduce carbon emissions through the promotion of 'clean coal technologies', such as carbon capture and storage (CCS) will be a key issue for Selby over the plan period and beyond."*

15.2.32. Policy SP17 (low carbon and renewable energy) makes reference to development schemes using the full range of available technology including improvements at existing fossil fuel energy generating plants to reduce carbon emissions.

15.2.33. An assessment of the relevant policies is detailed further in the **Planning Statement** (document reference 5.2)

15.3. CONSULTATION

15.3.1. **Table 15.1** provides a summary of the consultation undertaken in support of the preparation of this assessment.

Table 15.1 - Consultation Summary Table

Date and Method of Consultation	Consultee	Summary of Key Topics discussed and Key Outcomes
11 August 2021 and 14 December 2021 (email)	North Yorkshire County Council	Consultation letter on Climate (GHG) scope. No response received at time of writing.
11 August 2021 (email)	Selby District Council	Consultation letter on Climate (GHG) scope. Consultee (Environmental Health Team) advised that the GHG topic is

Date and Method of Consultation	Consultee	Summary of Key Topics discussed and Key Outcomes
		beyond his remit, and suggested consulting with the Planning Department. Email to Selby District Council Planning department issued 18 August 2021
18 August 2021 and 14 December 2021 (email)	Selby District Council (Planning Department)	Consultation letter on Climate (GHG) scope.
24 February 2022 (email); 3 March 2022 (consultation meeting) 3 March 2022 (email)	Selby District Council (Planning Department)	Email received from SDC Council with two main queries: 1. SDCs Low Carbon Project Officer suggesting that land use, land use change and forestry (LULUCF) cannot confidently be deemed to not be large and should be scoped into the assessment. 2. Further clarifications of the claims of BECCS being 'carbon negative' and scope of the DCO Application. A subsequent call was held with SDC to discuss the topics and provide further clarity around the scope of land use change and the Proposed Development. In an email dated 3 March 2022, SDC confirmed their understanding of the proposed LULUCF changes during construction, however without quantification of emissions, SDC suggested this should be in scope of the assessment. As noted in **Table 15.3** and **Table 15.4**, LULUCF has been included in the scope of the assessment. SDC welcomed the discussion on 'carbon negative' wording and operation and had no further queries.

15.3.2. An EIA **Scoping Opinion** (document reference 6.3.1.2) was received by the Applicant from the Planning Inspectorate (PINS) on behalf of the Secretary of State (SoS) on 26 February 2021, including formal responses from Statutory Consultees. The responses from PINS in relation to GHGs and how these requirements are addressed by the Applicant are set out in **Appendix 4.2**.

15.4. SCOPE OF THE ASSESSMENT

15.4.1. The scope of this assessment has been established through an ongoing Scoping process. Further information can be found in **Chapter 4 (EIA Methodology)** (document reference 6.1.4) of this ES.

15.4.2. This section provides an update to the scope of the assessment and updates the evidence base for scoping out elements following further iterative assessment.

ELEMENTS SCOPED OUT OF THE ASSESSMENT

15.4.3. The transport and final storage of captured carbon beyond the Carbon Dioxide Delivery Terminal Compound is outside the scope of this assessment as it will be covered by a separate consent, as described in in **Chapter 2 (Site and Project Description) (paragraph 2.2.47)** of this ES.

15.4.4. Biomass units 3 and 4 at Drax Power Station do not fall within the Proposed Scheme and are not having CCS applied. As such it is not anticipated that the implementation or not of the Proposed Scheme will impact on the operations of these units such that the GHG emissions between the baseline scenario and the Proposed Scheme scenario for these units are assumed to be the same.

15.4.5. The elements shown in **Table 15.2** are not considered to give rise to GHG emissions which are of a magnitude considered to be material (based on current guidance and professional judgement as set out in **Section 15.5 Assessment Methodology**). Therefore, they have not been considered within this assessment. The PAS 2080 (BSI, 2016) lifecycle stage classification have been included for reference.

Table 15.2 - Elements Scoped Out of the Assessment

Element scoped out	Justification
Disposal of waste at construction phase A5	Emissions from the disposal of waste are unlikely to be large, due to a large proportion of construction waste being inert. The Planning Inspectorate (PINS) on behalf of the Secretary of State (SoS) agreed to the scoping out of GHG emissions from the final disposal of construction waste in their **Scoping Opinion**. The transport of waste has been scoped in, as discussed in **Table 15.3** below.
Electricity used for lighting during operation	Lighting associated with the Scheme is not anticipated to be a large emission source as lighting is in place for the current Site and additional lighting is not considered to be

Element scoped out	Justification
B1	a material change. PINS, on behalf of the SoS, agreed to the scoping out of GHG emissions from lighting in their **Scoping Opinion**.
Maintenance during operation B2-5	Maintenance associated with the Scheme is not considered to be a large emissions source as only a small amount will be additional to the maintenance that already takes place. PINS, on behalf of the SoS, agreed to the scoping out of GHG emissions from operational maintenance activities in their **Scoping Opinion.**
Repair during operation B2-5	The Proposed Scheme is designed to be maintained rather than repaired, therefore subsequent repair emissions sources are not considered to be large. The **Scoping Opinion** from PINS on behalf of the SoS agreed to the scoping out of GHG emissions from operational repair activities.
End of Life C1-4	The effects of the decommissioning phase of the Proposed Scheme have been scoped out due to the Proposed Scheme's design life of 25 years and uncertainties around deconstruction techniques at the Proposed Scheme's end of life relating to the carbon intensity of fuels used within these deconstruction techniques. It is therefore not possible to proportionally assess impacts and effects during decommissioning, however given that decommissioning would not involve the construction of new infrastructure it would be anticipated that GHG emissions would be less than at construction phase. Given that decommissioning is anticipated to occur post 2050, the UK construction sector (for decommissioning works) is expected to be net zero. Furthermore, a Decommissioning Management Plan would be developed to ensure decommissioning activities are undertaken in a manner to minimise GHG emissions. The requirement for a Decommissioning Environmental Management Plan is secured by a Requirement in the DCO.

ELEMENTS SCOPED INTO THE ASSESSMENT

Construction Phase

15.4.6. The lifecycle stages (as per PAS 2080) shown in **Table 15.3** are considered to have the potential to give rise to GHG emissions which may be large during construction of the Proposed Scheme and have therefore been considered within this assessment:

Table 15.3 - Elements Scoped into the Assessment

Element scoped in	Justification
Product stage (manufacture and transport of raw materials to suppliers) A1-3	Raw materials required for the Proposed Scheme will result in embodied GHG emissions and have the potential to be large.
Transport of materials to Site A4	Construction phase GHG emissions from fuel / energy consumption due to the delivery of material to Site would generate GHG emissions.
Plant and equipment use during construction A5	Fuel / energy consumption of plant and equipment used during construction would generate GHG emissions.
Transport of waste A5	Fuel / energy used in vehicles transporting waste materials to or away from Site would generate GHG emissions.
Land use, land use change and forestry (LULUCF) at construction phase A5	A response from PINS on behalf of the SoS in their **Scoping Opinion (Appendix 1.2)** indicated that insufficient justification had initially been provided (at Scoping stage) and where significant effects are likely to occur, LULUCF should be assessed. Furthermore, in consultation with SDC, quantification of LULUCF emissions was requested. The construction phase GHG emissions from LULUCF comprise the change in emissions associated with the clearance of habitat during the construction phase of the Proposed Scheme.

Operational Phase

15.4.7. The lifecycle stages (as per PAS 2080) shown in **Table 15.4** are considered to have the potential to give rise to GHG emissions (or avoidance of) which have the potential to cause likely significant effects during operation of the Proposed Scheme and have therefore been considered within this assessment:

Table 15.4 - Elements Scoped into the Assessment

Element scoped in	Justification
Biomass supply chain Emissions D	Biomass production and transport generates GHG emissions. The biomass generation units that are the subject of the Proposed Scheme are already fully consented and operational and the biomass supply chain emissions do not form part of the 'project' which forms the Proposed Scheme and for which consent is sought and are therefore not strictly required for assessment. However, the biomass supply chain relating to the fuel used for the biomass units when Carbon Capture has been applied to them in the Proposed Scheme has nonetheless been included in this assessment, following the GHG Protocol Corporate Value Chain (Scope 3) Standard and the UK government Biomass policy statement (BEIS, 2021) recommendations to include the whole-life cycle of biomass procurement.
CO_2 captured through the Carbon Capture process B1	GHG emissions captured by the Carbon Capture process are considered in this assessment.
Replacement and refurbishment B2-5	The replacement and refurbishment of equipment and / or structural components of the Proposed Scheme have the potential to generate GHG emissions from the product stage, transport of material and plant use during replacement.
Operational energy use B6	Electricity generated from biomass boilers is used for the Carbon Capture process. Under IPCC guidelines (IPCC, 2019) CO_2 emissions at the point of combustion of biomass for energy generation are considered as "zero". Other GHG's from the combustion of biomass (CH_4, N_2O) are captured in the operational assessment. This approach aligns within the *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, section 2.3.3.4* (IPCC, 2019).

Element scoped in	Justification
Solvent used for the Carbon Capture process B8	Solvent materials required for the operation of the Proposed Scheme would result in embodied GHG emissions.
LULUCF during operation B8	The reduction in carbon sequestration due to the land use change from the Proposed Scheme is not considered to be large. PINS, on behalf of the SoS, agreed in their **Scoping Opinion** to the scoping out of GHG emissions from operational LULUCF. However, in order to proportionally assess LULUCF (given that construction Phase LULUCF has been scoped in), the emissions during operation have also been scoped into the assessment. This comprises the change in emissions associated with the existence of the Proposed Scheme hindering or promoting the storage of carbon into organic matter (i.e. vegetation and soils of different habitats).

15.5. ASSESSMENT METHODOLOGY

15.5.1. The assessment approach aligns with the IEMA guidance (IEMA, 2022) and follows the lifecycle assessment approach outlined in PAS 2080 (BSI, 2016). The assessment has considered the net impact of the Proposed Scheme's GHG emissions (or avoided emissions) over the lifetime of the Proposed Scheme in comparison to the baseline scenario. It has considered GHG emissions throughout the in-scope lifecycle stages and sub-stages of the Proposed Scheme, as set out in **Table 15.3** and **Table 15.4** above. As noted in **Chapter 2 (Site and Project Description) (paragraph 2.2.47)** of this ES, the scope of this DCO excludes processes associated with the captured CO_2 which occurs after the Carbon Capture process (such as transport and permanent storage). These aspects will be consented separately.

15.5.2. The assessment of GHG emissions has been calculated through:

- **a.** The collection of available data / information on the scale of GHG emitting activities (e.g., tonnes of concrete, litres of fuel, kWh of electricity);
- **b.** GHG capturing activities for the baseline scenario and for the Proposed Scheme. In each case this will cover the Proposed Scheme lifecycle (minimum design life of 25 years); and
- **c.** Calculation of the GHG emissions made by applying suitable emissions factors (tCO2e/tCO2 per unit of GHG emissions generating activity).

15.5.3. The sources of activity and GHG emissions data within the baseline scenario, construction phase and operational phase, alongside the methodology are outlined below.

BASELINE SCENARIO ASSESSMENT METHODOLOGY

15.5.4. In the 'do nothing' baseline scenario, without the Proposed Scheme, GHG emissions occur constantly and widely as a result of human and natural activity. This includes GHG emissions related to energy consumption (fuel, power), industrial processes, land use and land use change. The GHG assessment only considers instances in which the Proposed Scheme results in additional or avoided GHG emissions in comparison to the baseline scenarios and its assumed evolution. The baseline conditions therefore focus on those GHG emissions sources subject to change between the baseline scenarios and the Proposed Scheme.

15.5.5. The baseline scenario involves no construction activities and therefore the construction baseline is zero emissions.

15.5.6. Drax Power Station currently has four operational biomass units (units 1 to 4). The two remaining coal units (units 5 and 6) stopped generating electricity commercially in March 2021 and will cease operations entirely prior to works to construct the Proposed Scheme commencing. The GHG emissions in the baseline scenario for this DCO considers two biomass units (Units 1 and 2) to which the Carbon Capture Plant is being applied. The continued operation of the two biomass units with no Carbon Capture (Units 3 and 4) that are not subject to the Proposed Scheme would not be impacted by the Proposed Scheme such that the baseline GHG emissions arising from those units described below are assumed to be the same in both the baseline and Proposed Scheme scenario.

15.5.7. Under IPCC guidelines (IPCC, 2019) CO_2 emissions at the point of combustion of biomass for energy generation are considered as "zero". Other GHGs from the combustion of biomass (CH_4, N_2O) are captured in the operational assessment.

15.5.8. The quantification of the baseline scenario GHG emissions requires the following information to estimate the baseline GHG emissions:

GHG Emissions from the Drax Power Station Site in Relation to the Combustion of Biomass Fuel for Electricity Generation

a. In the baseline scenario, the subsidies that currently apply to generation from biomass units are assumed to have expired at the end of March 2027 such that all of these units are generating commercially depending on the extent to which biomass generation is profitable, taking into account the price of power at that time and the cost of biomass fuel. It is not possible to predict these prices with any reasonable degree of accuracy more than five years out but for the purpose of the GHG baseline scenario the Applicant has taken an "optimistic yet realistic" view that each unit will generate for 4,000 hours per annum at an electrical

output of 1,282 MW[1] (mid-merit scenario). From this information, the annual GHG emissions from biomass combustion can be estimated. The actual running regime for the units could be significantly lower (or higher) depending on power market economics at the relevant time, however this is not considered in this assessment as the mid-merit scenario described above is considered to be a reasonable scenario sufficient to inform an assessment of the impacts of the Proposed Scheme against a baseline. Whilst an unlikely scenario, were Units 3 and 4 (the units without BECCS) to operate at full load then the GHG emissions in the baseline scenario would increase due to an increase in the supply chain emissions resulting from the additional biomass sourcing and combustion associated with those units. However, the increase in supply chain emissions in this scenario still results in significantly lower overall supply chain emissions than the GHG benefits derived from the carbon dioxide captured as part of the Proposed Scheme and so any change in the baseline scenario would not be of a sufficient magnitude to materially alter the findings of the assessment.

Whole Lifecycle GHG Emissions Intensity of Electricity Generated at Drax Power Station (Biomass Generation Only):

a. Whole lifecycle GHG emissions intensity of electricity generated (KgCO2e/kWh) has been independently verified by Bureau Veritas (Drax, 2020). It is expected that the whole lifecycle GHG emissions intensity of electricity generated will reduce over the life of the Proposed Scheme as global supply chains decarbonise but for the purpose of this assessment the Applicant has adopted a conservative assumption that the intensity will instead remain constant and not reduce on a KgCO2e/kWh basis; and

b. This intensity is multiplied by the total annual net electricity generated in the baseline scenario (kWh), to calculate the total supply chain GHG emissions for the baseline. (tCO2e).

The GHG Emissions Intensity for the Power used for the Parasitic Load (and the Amount of Power Required for the Parasitic Load):

a. The power used for the parasitic load (energy required to operate the biomass units) is from the electricity generated from biomass. Electricity generated from biomass boilers is used for the Carbon Capture process.

LULUCF Baseline Methodology

15.5.9. Carbon storage refers to the amount of carbon that is ‘locked up’ in biomass, including vegetation and soil. It is referred to as the stock of carbon and measured in tonnes of carbon (tC). Carbon can be locked up for hundreds of years (for example in the case of Ancient Woodlands). The assessment compared the habitats that are subject to change between the baseline and Proposed Scheme scenario. These comprise the habitats within the Order Limits (East Construction Laydown Area,

[1] The generation export capacity of a unit net of station works power and works power associated with biomass operations

Woodyard and Habitat Provision Area) and the area outside the Order Limits (Off-site Habitat Provision Area).

15.5.10. In order to estimate the carbon storage from the different habitats, the habitat type and area (aligning to the Phase 1 Habitat types as reported in **Chapter 8 (Ecology)** of this ES (document reference 6.1.8)), were considered along with appropriate values for carbon storage using a habitat carbon calculator. The calculator uses the literature following sources:

a. Carbon Storage and Sequestration by Habitat (Natural England, 2021); and

b. Woodland Carbon Code Calculator (Woodland Carbon Code, 2021)).

15.5.11. For most habitat types, there is a wide range of estimates of the carbon storage per unit area in the literature. From a review of available estimates combined with expert knowledge and professional judgement, the most appropriate values were identified. This approach was aligned with Natural England Carbon Storage and Sequestration by Habitat, which uses the median value in calculations.

15.5.12. From the above information, total baseline GHG emissions stored have been calculated from GHG emissions sources generated plus biomass supply chain GHG emissions. The data is provided in **Table 15.8, Section 15.7** below.

CONSTRUCTION PHASE ASSESSMENT METHODOLOGY

15.5.13. The quantification of construction GHG emissions have been calculated for the construction of the Proposed Scheme on the basis of the materials expected to be used and waste generated. A summary of the key materials required for the construction phase is provided in **Table 15.9** in **Section 15.9** below. The quantification process covered the following GHG emission sources with reference to PAS 2080 (BSI, 2016):

a. Embodied GHG emissions associated with the ‘cradle to gate’ of the construction materials (A1-3);

b. Transportation of materials to Site (A4);

c. Plant use on Site during construction (A5);

d. Transportation of construction waste away from Site (A5); and

e. Land use, land use change and forestry at construction phase (A5).

15.5.14. The carbon quantification tasks have been undertaken using best practice carbon management methods, professional judgement, and guidance including ISO 14064 (ISO, 2018), the GHG Protocol (GHG Protocol Initative Team, 2015), BS EN 15978 (BSI, 2011) and PAS 2080 (BSI, 2016). The construction carbon footprint is divided into four main categories: embodied carbon, transport of materials, plant equipment and transport of construction waste.

15.5.15. The carbon quantification task involved reviewing materials required for the Proposed Development and utilising Inventory of Carbon and Energy (ICE) (University of Bath, 2019) and CESMM4 databases (Institution of Civil Engineers, 2012), to use the most accurate densities and emission factors as possible.

A1-A3 – GHG Emissions 'Embodied' within the Construction Materials

15.5.16. GHG emissions 'embodied' within the construction materials are calculated as follows:

a. Quantity of material (t) X emissions factor (tCO_2e/t) = GHG emissions (tCO_2e).

15.5.17. However, for some construction materials, emissions factors are only available on a mass or volume basis. As such where only dimensions are available, volumes were calculated, or where mass is required, volumes were converted to mass using densities.

15.5.18. The quantity of materials for the Proposed Scheme is based upon the Proposed Scheme design. A summary of the material categories and their total quantity is provided in **Table 15.9, Section 15.9.**

A4 and A5 – Transport of Materials to Site and Transport of Construction Waste from Site

15.5.19. GHG emissions from the transport of materials and waste are calculated as follows:

a. Tonne kilometres (tonne.km) X emissions factor (tCO_2e/tonne.km) = GHG emissions (tCO_2e).

15.5.20. The quantification of transport GHG emissions requires tonne kilometres – a unit for transport of one tonne over one kilometre. This has been calculated by multiplying the mass of materials by distance. Transport distances of materials to Site and of construction waste from Site were estimated using assumptions from RICS (RICS, 2017) which provides an estimated distance by material type based on the anticipated manufacturing location (local, national, European or global). This was multiplied by emission factors sourced from BEIS (BEIS, 2021).

A5 - Plant Use on Site

15.5.21. Due to the uncertainty associated with calculating actual construction plant GHG emissions (such as quantity of fuel for construction equipment, electricity required), a sensitivity test was undertaken using RICS (RICS, 2017) guidance for building construction Site emissions and the estimated construction cost of the Proposed Scheme as follows:

a. Construction cost (£) X RICS Assumption (1400 kgCO2e/£100k) (tCO_2/£) = GHG emissions (tCO_2e).

A5 – Land use, land use change and forestry (LULUCF) at construction phase

15.5.22. The construction phase GHG emissions from LULUCF comprise of those released as a result of the change in land use from the baseline scenario during the construction phase. This considers loss of carbon storage from permanent and temporary loss of habitat and changes to carbon storage through reinstatement and improvement to habitat. The approach outlined in the baseline scenario methodology was used for the construction phase land use change calculation.

15.5.23. The construction phase emissions from LULUCF are reported as the difference between the Proposed Scheme scenario and the baseline scenario.

OPERATIONAL PHASE ASSESSMENT METHODOLOGY

15.5.24. The quantification of operational GHG emissions has been calculated using data for Drax Power Station. The quantification process assumes that the two BECCS biomass units (units 1 and 2) that would be subject to the carbon capture and storage process would operate continuously at baseload for all hours of the year (at 931 MW output in aggregate across the two BECCS units, 8,760 hours per year). This assumption has been used to calculate operational GHG emissions. This differs from the baseline scenarios where units 1 and 2 are assessed under a mid-merit operation scenario. Both units 3 and 4 are assumed to continue to operate at "mid-merit" in both the baseline and Proposed Scheme scenario and are in any event not affected by the implementation of the Proposed Scheme.

15.5.25. The operational GHG emissions covers the following emission sources with reference to PAS 2080 (BSI, 2016):

a. Biomass supply chain GHG emissions (D);

b. CO_2 captured through the Carbon Capture process (B1);

c. Replacement and Refurbishment (B2-5) (data to provide a quantitative assessment is not available at the current design stage. A qualitative assessment has therefore been undertaken);

d. Operational energy use (B6);

e. Solvent use for the Carbon Capture process (B8); and

f. LULUCF during operation (B8).

D – Biomass Supply Chain GHG Emissions

15.5.26. The biomass generation units that are the subject of the Proposed Scheme are already fully consented and operational. As such, the biomass supply chain GHG emissions are outside the direct scope of the DCO Application, however they represent a material source of GHG emissions relevant to the Proposed Scheme and so have been included as an emission source.

15.5.27. The supply chain of biomass sourcing involves several stages that cause the release of GHG emissions (Drax, 2020). These are categorised as follows and are accounted for in the baseline and operational GHG assessment:

a. Processing at origin;

b. Feedstock transport;

c. Drying;

d. Pelleting;

e. Transport to Port;

f. Shipping;

g. Rail to Drax; and

h. Combustion of CH_4 and N_2O.

15.5.28. The supply chain emissions are subsequently larger in the operational phase on a gross basis as the biomass units that are the subject of the Proposed Scheme (Units 1 and 2) are generating more frequently than in the baseline scenario and so consuming more sustainable biomass fuel.

B1 – CO_2 Captured through the Carbon Capture Process

15.5.29. Data for Drax Power Station has been used to identify the quantity of CO_2 captured as part of the Carbon Capture process. The Proposed Scheme is designed to achieve an approximate 95% efficient Carbon Capture rate of the CO_2 emissions from the two biomass units.

B2 – B5 – Replacement and Refurbishment

15.5.30. The major components of the Proposed Scheme have been designed for the lifetime of the plant with regular maintenance and replacement of minor component parts.

15.5.31. At the current design stage, detailed data to enable a quantitative assessment of replacement and refurbishment GHG emissions is not available, therefore a qualitative assessment has been conducted to identify the replacement and refurbishment aspects of the Proposed Scheme.

Operational Energy Consumption (B6)

15.5.32. Electricity generated from biomass boilers is used to power biomass combustion and the Carbon Capture Plant. Under IPCC guidelines (IPCC, 2019) GHG emissions from the combustion of biomass for energy generation is considered as “zero”.

15.5.33. A secondary electrical supply, to ensure uninterruptible power supply, has been incorporated into the Proposed Scheme Design, however, use of this power supply would be infrequent and in emergency situations only. The GHG emissions associated with the carbon intensity of the generation assets that are operating on the power grid at the point at which the power supply is being utilised are not considered to be material in the context of the Proposed Scheme and therefore have not been assessed. Furthermore, any GHG emissions from the secondary electrical supply are expected to reduce over the life of the Proposed Scheme as the energy industry decarbonises and unabated gas generation is replaced with renewable generation.

B8 - Solvent used for the Carbon Capture Process

15.5.34. The quantification of emissions from the manufacture and use of the solvent required for the carbon capture process has been calculated. The specific solvent used for the process is KS-21, produced by Mitsubishi Heavy Industries Engineering, Ltd.

15.5.35. The embodied carbon emissions have been quantified by subdividing the KS-21 solvent into the main chemicals required for its production, ethylene and ammonia. The CO_2 emissions of ethylene and ammonia were calculated based on emission factors published by the IPCC (IPCC, 2006).

15.5.36. The emission factors are 1.694 tco2/t and 1.46 tco2/t respectively. Therefore, the solvent emissions have been calculated as follows:

a. Volume of solvent used per annum X (NH_3 emissions factor + Ethylene emissions factor) = GHG emissions (tCO_2).

B8 – LULUCF during operation.

15.5.37. LULUCF during operation comprise the storage of carbon in the habitat types which are subject to change from the baseline (East Construction Laydown Area, Woodyard and Habitat Provision Area and Off-site Habitat Provision Area). For the Proposed Scheme, this relates to habitats that are reinstated, retained or improved. The approach outlined in the baseline scenario methodology was used for the operational phase land use change calculation.

15.5.38. The operational phase emissions from LULUCF are reported as the difference between the Proposed Scheme scenario and the baseline scenario.

ASSESSMENT OF SIGNIFICANCE

15.5.39. IEMA guidance (IEMA, 2022) discusses that the significance of a project's emissions should be based on its net impact over its lifetime, which may be positive, negative or negligible. The evaluation of significance should not just focus on the project's GHG emissions, or the magnitude of those emissions, but whether the project contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050. Significance categories are provided in the IEMA guidance:

a. Significant (moderate or major adverse effects): applies to a project that follows a 'business as usual' or 'do minimum' approach and is not aligned with the UK's net zero strategy or sector-based transition targets. The level of significance (moderate or major) would be applied using professional judgement;

b. Not significant (minor adverse effects): applies to a project that is compatible with budgeted, science-based 1.5°C trajectory (in terms of rate of emissions reduction) and which complies with up-to-date policy and 'good practice' reduction measures. The project may have residual GHG emissions but is considered to have a sufficient approach to contribute to net zero strategy and achieve a 78% reduction by 2035;

c. Not significant (negligible effects): applies to a project that achieves emissions mitigation that go beyond the reduction trajectory of existing and emerging policy; and

d. Significant (beneficial): applies to a project that causes GHG emissions to be avoided or removed from the atmosphere. Only projects that actively reverse (rather than only reduce) the risk of severe climate change should be considered to have a beneficial effect.

15.5.40. In order to provide context to the GHG emissions, and as set out in the IEMA guidance (IEMA, 2022) the estimated GHG emissions arising from the Proposed

Scheme are compared with the respective UK carbon budgets (**Table 15.5**), which have been set by the UK Government covering 2018 to 2037 (HM Government, 2009) (HM Government, 2011) (HM Government, 2016) (HM Government, 2021).

Table 15.5 – UK Carbon Budgets

Carbon Budget Period	UK Carbon Budget
Third: 2018-2022	2,544,000 $ktCO_2e$
Fourth: 2023-2027	1,950,000 $ktCO_2e$
Fifth: 2028-2032	1,725,000 $ktCO_2e$
Sixth: 2033-2037	965,000 $ktCO_2e$

15.5.41. In terms of context, the carbon budgets presented are useful, however, to provide additional context, a breakdown of GHG emissions for 2019 (the latest available data at the time of writing) within Selby, North Yorkshire, and the UK are presented in **Table 15.6** and **Table 15.7** (BEIS, 2021).

Table 15.6 – Emissions Sources (2019) for Selby, North Yorkshire and the UK

Emissions Sources	Selby ($ktCO_2$)	North Yorkshire ($ktCO_2$)	UK ($ktCO_2$)
Industry Electricity	35.1	164.3	14,887.4
Industry Gas	159.8	277.4	13,582.4
Industry 'Other Fuels'	60.6	273.7	16,768.5
Large Industrial Installations	20.2	23.1	31,431.5
Agriculture	15.2	207.1	6243.4
Industry Total	291.0	945.7	82,913.1
Commercial Electricity	24.6	192.5	17,964.5
Commercial Gas	14.4	129.3	12,917.4

Emissions Sources	Selby ($ktCO_2$)	North Yorkshire ($ktCO_2$)	UK ($ktCO_2$)
Commercial 'Other fuels'	1.1	9.9	356.4
Commercial Total	40.1	331.7	31,238.3
Public Sector Electricity	4.3	33.0	4,347.5
Public Sector Gas	4.6	87.4	8,073.4
Public Sector 'Other Fuels'	0.5	2.9	129.1
Public Sector Total	9.4	123.3	12,550.0
Domestic Electricity	31.8	235.3	22,106.8
Domestic Gas	76.2	573.5	61,639.7
Domestic 'Other Fuels'	34.5	250.1	10,785.6
Domestic Total	142.5	1,058.9	94,532.1
Road Transport (A roads)	149.3	807.2	49,580.9
Road Transport (Motorways)	104.2	572.7	27,602.4
Road Transport (Minor roads)	44.8	498.4	42,886.2
Diesel Railways	13.9	49.1	1,794.2
Transport Other	11.3	38.2	2,439.8
Transport Total	323.5	1,965.5	124,303.4
Land Use, Land Use Change and Forestry Net Emissions	-22.9	-161.2	-1,025.4
Grand Total	783.5	4,263.8	344,511.6

Table 15.7 – Total and Per Capita Emissions (2019) for Selby, North Yorkshire and the UK

	Selby	North Yorkshire	UK
Grand Total ($ktCO_2$)	783.5	4,263.8	344,511.6
Population ('000s, mid-year estimate)	90.6	618.1	66,796.8
Per Capita Emissions (t)	8.6	6.9	5.2

METHOD OF BASELINE DATA COLLECTION

Desk Study

15.5.42. All baseline data collection has been completed through desk study using data provided by the Applicant and published guidance as outline in the text throughout the chapter.

Site Visit and Surveys

15.5.43. No Site visits or surveys have been required to complete the GHG assessment.

Guidance and Data

15.5.44. The following guidance documents and data sources have been used during the preparation of this chapter:

a. Material and waste types and quantities required for the construction phase;

b. Operational data, where applicable for the baseline and Proposed Scheme, including boiler efficiency combustion GHG emissions, supply chain GHG emissions (verified by Bureau Veritas), Carbon Capture rates;

c. Emissions factors from Inventory of Carbon and Energy (ICE) (University of Bath, 2019), BEIS (BEIS, 2021) CESMM4 databases (Institution of Civil Engineers, 2012) (IPPC, 2006) and (GHG Protocol, n.d.);

d. Transport distances for construction materials and waste and building construction site GHG emissions data from RICS (RICS, 2017);

e. IPCC guidelines (IPCC, 2019) which details that GHG emissions from the combustion of biomass for energy generation is considered as “zero”;

f. Carbon storage and sequestration information for habitat types and LULUCF from Natural England (Natural England, 2021) and the Woodland Carbon Code (Woodland Carbon Code, 2021); and

g. UK carbon budgets (HM Government, 2009) (HM Government, 2011) (HM Government, 2016) (HM Government, 2021) and 2019 emission sources within Selby, North Yorkshire provide context to the Proposed Scheme emissions.

Assessment Assumptions and Limitations

15.5.45. The following assumptions and limitations apply to this chapter:

Assumptions

a. The data for materials expected to be used construction have been interpreted using professional judgement and include key construction materials, plant and equipment. As such the quantities may vary from those detail in **Chapter 13 (Materials and Waste)** (document reference 6.1.13) of this ES;

b. The most accurate and representative emission factors for each of the construction materials have been used from recognised databases (ICE (University of Bath, 2019) CESMM4 (Institution of Civil Engineers, 2012)). Where exact emission factors were not available, then the most appropriate emission factor was chosen using professional judgement. BEIS (BEIS, 2021) Emissions factors were used for transport of material and selecting the vehicle type in line with RICS guidance (RICS, 2017);

c. Piping (aboveground) material has been assumed as steel;

d. Where the dimensions of construction materials was not provided, a literature review has been undertaken to identify appropriate assumptions. Where no source has been identified, professional judgement has been used;

e. On certain construction items, there was limited availability of metrics about the equipment and / or materials. In these instances, an estimation of the financial cost (£) of these items was made and utilising the GHG Protocol scope 3 evaluator (Quantis, 2019), an estimation of GHG emissions was generated;

f. The two main outcomes of the emission calculations spreadsheet are the embodied carbon and transport GHG emissions. If a mass of the item was unable to be obtained through volume / density metrics, then an estimation was made of the item in order to work out t/km. The following mass assumptions were made in the calculations:

i. Electrical Material Take Off (MTO): each item given a weight of 0.05 t;

ii. OSBL Sized Equipment List: The BFW Heater and Gas-Gas Exchanger given 5t, rest of equipment given 1 t;

iii. Estimated Instrument BOM;

iv. All valves given a mass of 0.01 t;

v. Analysers: 0.5 t;

vi. All other items: 0.0001 t; and

vii. Weights were determined through product suppliers or professional judgement.

g. Construction plant emissions have been calculated using an industry average emission rate for the estimated construction cost of the Proposed Scheme (from RICS guidance (RICS, 2017));

h. The data available to quantify construction GHG emissions includes both detailed data, and more high-level data, for Drax Power Station. Where the quantities from these sources differ, the higher value has been used as a conservative estimate;

i. Under the operational scenario, using data from Drax Power Station is it assumed that the two BECCS biomass units (Units 1 and 2) subject to the carbon capture and storage process, would operate continuously at baseload for all hours of the year (at 931 MW output in aggregate across the two BECCS units, 8,760 hours per year), representing a reasonable worst-case operating profile). Both Units 3 and 4 are assumed to continue to operate at "mid-merit" (4,000 hours) in both the baseline and Proposed Scheme scenario and are in any event not affected by the implementation of the Proposed Scheme;

j. The specific solvent type required for the operational carbon capture process is KS-21. The carbon embodiment has been predicted by subdividing to each component of the raw materials required for the production of the KS-21 solvent. The CO_2 emissions of ethylene and ammonia production, which are the raw materials for the solvent, were calculated based on emission factors published by the IPCC (IPCC, 2006).The total embodied GHG emissions associated with the production of these chemicals is assigned to the KS-21 solvent;

k. A biomass supply chain GHG emissions assessment has been carried out for Drax Power Station for the year of 2020 and has been verified by Bureau Veritas (Drax, 2020). In the GHG assessment for this ES, supply chain GHG emissions are lower in the baseline compared to the Proposed Scheme due to a lower load capacity across Units 1-4. In both scenarios, GHG supply chain emissions are likely to decrease if the amount of biomass used remains constant. The Applicant is seeking to reduce internal supply chain GHG emissions and many of the Applicant's suppliers are adopting carbon reduction measures to align with their respective country's climate change targets. It is however considered that using a constant annual supply chain GHG emission scenario is adopting a worst-case scenario approach, compared to forecasting decreases from a start year;

l. The Carbon Capture rate of the technology used for the Proposed Scheme has been designed to capture approximately 95% of all CO_2 from two biomass units. This figure has been used in the operational GHG emission calculation;

m. The data for assessing LULUCF emissions has been based on the area of vegetation type subject to change as part of the Proposed Scheme. The assessment is based on the planting design available at the time of writing and may be developed further to incorporate more planting in the final design. The LULUCF assessment undertaken is considered to represent a worst case scenario. A linear accumulation of carbon storage over time has been assumed for the purposes of the assessment. Appropriate values from literature sources were used to apply carbon storage and flux values to the vegetation types;

n. Two construction options are outlined for the Proposed Scheme (as described in **Chapter 2 (Site and Project Description), paragraph 2.3.4**). When assessing

the Proposed Scheme GHG emissions against the UK carbon budgets, the options set out for the construction programme both have construction works commencing in early 2024, one unit operational by end 2027 and the second unit operational by end 2029. As such, the timescales for assessment against the UK carbon budgets is the same for each option; and

o. As described in **Chapter 2 (Site and Project Description)**, the Applicant has full planning permission for the demolition of the redundant Flue Gas Desulphurisation (FGD) Plant and associated restoration works at Drax Power Station (2020/0994/FULM). The decommissioning and demolition works of Absorber Units 4, 5 and 6 are scheduled to take place prior to the start of the construction of the Proposed Scheme, whilst the demolition of Absorber Units 1, 2 and 3 are assumed to take place following the completion of the Proposed Scheme. The demolition of Units 1, 2 and 3 are assessed in **Chapter 18 (Cumulative Effects**) (document reference 6.1.18).

Limitations

a. No data is available at this current design stage to produce a quantitative assessment of GHG emissions associated with replacement and refurbishment of components of the Proposed Scheme during operation. A qualitative assessment has therefore been carried out, and the absence of quantitative data is not considered it materially affect the findings of this assessment;

b. A comparison of the Proposed Scheme GHG emissions against the UK's carbon budgets (including the 6th carbon budget) and Selby and North Yorkshire Emissions for 2019 has been provided in this ES which is the most recent publication of this data at the time of writing; and

c. As set out in **Section 15.5**, professional judgement and guidance from IEMA (IEMA, 2022) has been applied to assess significance.

15.6. STUDY AREA

15.6.1. The GHG assessment is not restricted by geographical area but instead includes any increase or decrease in GHG emissions as a result of the Proposed Scheme, wherever that may be. This includes:

a. Construction GHG emissions within the Order Limits but also related to the transport of materials to and from the Proposed Scheme and their manufacture (this may be distant from the Proposed Scheme location). In the case of LULUCF assessment, the Off-site Habitat Provision Area outside of the Order Limits was included within the assessment; and

b. Operational GHG emissions (increase or reduction in GHG emissions) which result from the operation of the electricity generation infrastructure.

15.7. BASELINE CONDITIONS

EXISTING BASELINE

15.7.1. GHG emissions in the current baseline scenario comprise biomass combustion from two biomass units (Units 1 and 2), the supply chain (e.g., for production and transport) as well as GHG sequestration (growth of biomass for fuels). As noted in **Section 15.5**, it is assumed that GHG emissions from Units 3 and 4 that are not subject to the Proposed Scheme would be the same in both the baseline and Proposed Scheme scenario.

15.7.2. The existing baseline also incorporates carbon storage from the organic matter (i.e. vegetation and soils of different habitats) in the East Construction Laydown Area, Woodyard, Habitat Provision Area, and the Off-site Habitat Provision Area.

15.7.3. **Table 15.8** represents the GHG emissions data for the baseline scenario. For full activity and emission factors data, please see **Appendix 15.1**.

Table 15.8 – GHG Emissions Generated Per Annum in the Baseline Scenario

Data Type	Value	Unit	Source
Operational Energy Use **B6**	0	tCO_2	Electricity generated from biomass boilers is used for the Carbon Capture process. Under IPCC guidelines (IPCC, 2019) CO_2 emissions at the point of combustion of biomass for energy generation are considered as "zero".
LULUCF **B8**	-10,863	tC stored	Calculation: (habitat type and area)
Biomass supply chain GHG Emissions (baseline) **D**	558,778	tCO_2e	Calculation: (total baseline electricity generated (net) * supply chain GHG emissions rate/10^6) (Drax, 2020) – see **Appendix 15.1**.
Total Baseline GHG emissions	547,915	tCO_2e	Total baseline GHG emissions equal the total supply chain GHG emissions arising from the production and sourcing of biomass and carbon stored by organic

Data Type	Value	Unit	Source
			matter (i.e. vegetation and soils of different habitats) at Drax Power Station.

15.7.4. The following diagram (**Plate 15.1**) provides a schematic view of the sources of GHG emissions along the supply chain of biomass procurement, in the baseline scenario.

15.7.5. It utilises the percentage breakdown for Drax Power Station (Drax, 2020) and applies this to the total supply chain GHG emissions, 558,778tCO$_2$e.

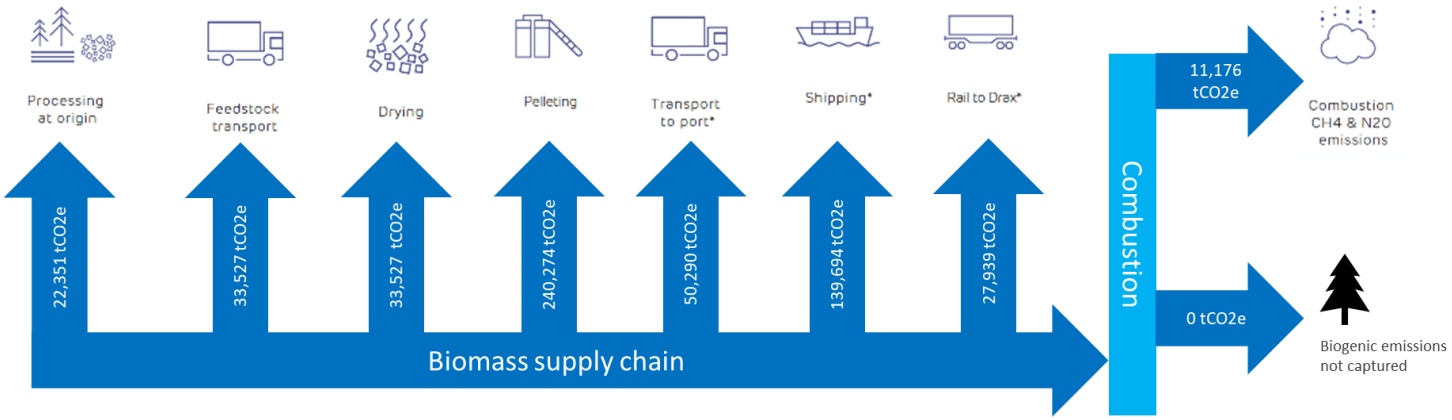

Plate 15.1 - Biomass Supply Chain GHG Emissions Diagram

FUTURE BASELINE

15.7.6. The future construction baseline is zero GHG emissions as this scenario involves no construction activities.

15.7.7. In the future baseline scenario, Drax Power Station will continue to operate four biomass units, two of which form the scope of this assessment as set out in the baseline Scenario Assessment Methodology (**Section 15.5**). The operational GHG emissions in the future baseline scenario, therefore, assess those from biomass fuels for electricity generation, as well as their supply chain (**Plate 15.1**). The details of the operation of the units in the future baseline (without the Proposed Scheme) would be dependent on market conditions (primarily the market price of electricity and sustainable biomass fuel) and the financial viability to invest and maintain the plant.

15.8. SENSITIVE RECEPTORS

15.8.1. The impacts of GHG emissions relate to their contribution to global warming and climate change which are global and cumulative in nature. GHG emissions result in the same global effects wherever and whenever they occur and, therefore, the

receptor is the global atmosphere which has a high sensitivity given the consequences of global climate change.

15.9. PRELIMINARY ASSESSMENT OF LIKELY IMPACTS AND EFFECTS

15.9.1. This section details the preliminary assessment of significant effects taking account of primary mitigation, as described in **Chapter 2 (Site and Project Description)** but in the absence of secondary mitigation. Secondary mitigation for the Proposed Scheme is described in **Section 15.10** below.

CONSTRUCTION PHASE

15.9.2. **Table 15.9** below presents the construction phase embodied GHG emissions for the Proposed Scheme.

Table 15.9 – Estimated Construction Phase Embodied GHG Emissions from the Proposed Scheme

Category	Quantity	Unit	Embodied (A1-A3) (tCO_2e)	Transp. (A4) (tCO_2e)	Plant (A5) (tCO_2e)	Construction Waste Transp. (A5) (tCO_2e)	Total (tCO_2e)
Equipment	397	Items	13,626	18	14,000	839	13,644
Piping Combined	91,100	M	8,515	297			8,811
Piping Manual Valves	718	Nr	206	0.3			206
Concrete	179,311	m^3	20,592	812			21,404
Piling	8,223	Nr	7,209	725			7,934
Steel	12,810	T	23,958	799			24,756
Instruments	4,806	Nr	1,313	7			1,320
Electrical Cable – Combined	132,963	M	438	0.4			438
Equipment Insulation	7,080	m^2	1,054	6			1,060
Paint	39,270	m^2	5	2			7
Other*	N/A	N/A	6,919	3,149			10,907
Total	N/A	N/A	83,834	5,814	14,000	839	104,488

* ‘other’ includes soil, aggregate, asphalt, plastics. Data for these aspects were provided in a variety of units, hence not detailed in **Table 15.9**.

15.9.10. **Table 15.10** shows the land use change emissions during the construction phase.

Table 15.10 – Land use change emissions during construction phase (2024-2029)

Baseline scenario potential carbon storage (tC)	Proposed Scheme scenario potential carbon storage (tC)	Difference in carbon storage (tC)
-2,102	-1,890	212

15.9.11. The overall construction phase emissions which are made up of embodied emissions (total (tCO_2e) as detailed in **Table 15.9**) plus carbon storage loss (difference in carbon storage loss as detailed in **Table 15.10** are 104,700 tCO_2e. The construction phase would result in an increase in GHG emissions compared to the baseline scenario.

15.9.12. Based on the current design information and using the criteria set out in the IEMA guidance (IEMA, 2022) and professional judgement, the construction phase GHG emissions for the Proposed Scheme (as detailed in **Table 15.9** and compared to the UK carbon budgets in **Table 15.13**) would result in a **moderate, significant adverse** effect.

OPERATIONAL PHASE

15.9.13. **Table 15.11** presents the in-scope operational phase GHG emissions for the Proposed Scheme.

Table 15.11 – Estimated Operational GHG Emissions from the Proposed Scheme

Emissions Source	Emissions (tCO_2e / year of the Proposed Scheme)
Biomass supply chain GHG Emissions (Operational) - D	1,223,723
CO_2 captured through the Carbon Capture process - B1	-9,206,989*
Replacement and Refurbishment Emissions - B2-5	0**
Operation energy use - B6	0
Solvent used for the Carbon Capture process - B8	6,939

Emissions Source	Emissions (tCO_2e / year of the Proposed Scheme)
LULUCF - B8	707***
Net total	**-7,975,620**

* The figure reported for CO_2 captured through the Carbon Capture process (B1) (-9,206,989) is based on the assumption that units 1 and 2 are operating at their theoretical maximum operational frequency and so operating continuously at baseload for all hours of the year (at 931 MW output in aggregate across the two BECCS units, 8,760 hours per year).

This figure does not take account of planned and unplanned outages of generation or capture facilities that should be expected in a 'real world' scenario, and the Applicant estimates that taking these into account would reduce the estimated figure to approximately -8 million tonnes CO2 per annum. In that event, the net total would reduce to -6,768,631 tonnes CO_2e per annum and continue to represent a significant beneficial effect.

**Quantitative data in relation to replacement and refurbishment emissions (B2-5) is not available the current design stage to robustly quantify the GHG emissions relevant to this lifecycle stage. Available data indicates that the major components of the Proposed Scheme are designed for the overall life of the plant and replacement is not anticipated.

Replacement and refurbishment of minor components would occur as part of the maintenance schedule for the Proposed Scheme This would incorporate elements such as:

- Blower parts replacement (every 4 years)
- Pump bearings replacement (every 2-4 years)
- Gasket replacement (every 2 years)
- O2 removal unit catalyst parts (every 4 years).

Using professional judgement and taking into account the nature and scale of the Proposed Scheme, the GHG emissions from replacement and refurbishment activities are not expected to materially affect the lifecycle GHG emissions.

*****LULUCF operational emissions**

Baseline scenario potential carbon storage (tC)	Proposed Scheme scenario potential carbon storage (tC)	Difference in carbon storage (tC)
-8,760	-8,053	707

15.9.14. Overall, the operational phase emissions are -7,975,620 tCO_2e per year. The operational phase would result in a decrease of GHG emissions compared to the baseline scenario through the removal (sequestration) of CO_2 emission from the atmosphere.

15.9.15. Based on the Proposed Scheme Design and using the criteria set out in the IEMA guidance (IEMA, 2022) and using professional judgement, the operational phase of the Proposed Scheme as detailed in **Table 15.11**, (and compared to the UK carbon budgets in **Table 15.13**) will result in a **significant beneficial** effect.

PROPOSED SCHEME LIFECYCLE IMPACTS

15.9.16. Using the assessment data, the lifecycle GHG emissions of the Proposed Scheme have been calculated. This is based on the construction and operational emissions over the 25-year design life of the Proposed Scheme to provide per annum emissions (tCO2e/yr). An emissions rate (gCO2e/kWh) is also provided for context with legislation, such as the Energy Act 2013 (HM Government, 2013).

Table 15.12 – Proposed Scheme total GHG Emissions

Data Type	Value*	Unit	Source
Construction Carbon (A1-A5) per annum	4,188	tCO_2e/yr	Calculation: Construction Carbon / years of operation.
CO_2 captured through the Carbon Capture Process (B1)	-9,206,989	tCO_2/yr	The Applicant estimates the Carbon Capture technology to capture approximately 95% of all CO2 from two biomass units.
Replacement and Refurbishment Emissions (B2-5)	0	tCO_2e/yr	Replacement and refurbishment would occur for minor components only. Data to quantitatively assess this is not available at the current design stage. Using professional judgement and taking into account the nature and scale of the Proposed Scheme, the GHG emissions from replacement and refurbishment activities are not expected to materially affect the lifecycle GHG emissions.
Operation energy use (B6)	0	tCO_2e/yr	Electricity generated from biomass boilers is used for the Carbon Capture process. Under IPCC guidelines (IPCC, 2019) GHG emissions from the combustion of biomass for energy generation are “zero” (i.e., the process is carbon neutral).

Data Type	Value*	Unit	Source
			Energy use from the national power grid (as noted in Section 15.5) is considered de minimis given that this is infrequent and used in emergency situations only.
Solvent Use (B8)	6,939	tCO_2e/yr	Calculation: annual quantity of KS-21 solvent * (NH_3 EF + Ethylene EF).
LULUCF during operation (B8) per annum	28	tC/yr	Habitat data and carbon storage / years of operation.
Biomass supply chain GHG emissions (D)	1,223,723	tCO_2e/yr	Calculation: (total proposed scheme electricity generated (net) * supply chain GHG emissions rate/10^6) * Boiler efficiency ratio (Drax, 2020) – see Appendix 15.2.
Total GHG emissions per year	**-7,972,111**	**tCO_2e/yr**	Calculation: Operational Carbon (B1-B8) + Biomass supply chain GHG emissions + construction carbon per annum.
GHG emissions Rate per kWh	- 978	gCO_2e/kWh	Calculation: Total GHG emissions per year *10^6) / total proposed scheme electricity generated.
*For a full breakdown of data provided, refer to **Appendix 15.2**.			

15.9.17. The lifecycle emissions for the Proposed Scheme are considered to have a **significant beneficial** effect as the sequestered emissions during operation occur over a longer timeframe and are greater than the construction phase adverse emissions, resulting in a net reduction in emissions in comparison to the baseline scenario.

GHG EMISSIONS CONTEXT

15.9.18. To aid in the determination of significance of the Proposed Scheme's whole lifecycle GHG emissions in line with the methods outlined in **Section 15.5,** the GHG emissions are presented in the context of the UK's carbon budgets in **Table 15.12**.

15.9.19. Utilising the construction programme (set out in **Chapter 2 (Site and Project Description)**, **paragraph 2.3.4**) the emissions with the UK carbon budget periods have been calculated. The emissions have been applied from the first full year of construction or operation activities.

a. Construction works would commence in early 2024, as such no emissions relevant to the Proposed Scheme occur in the third carbon budget which occurs from 2018 to 2022;

b. During the fourth carbon budget, construction emissions would occur. Minimal operational emissions would occur during the fourth carbon budget as one unit would only become operational until the end of 2027. For the purposes of comparison to the carbon budget, the emissions have been applied from the first full calendar year of operation;

c. In the fifth carbon budget, construction emissions would occur until 2029, Operational emissions for one unit have been assessed from 2028 (the first full calendar year of operational activities), with the second unit entering its first full year of operation from 2030; and

d. In the sixth carbon budget, both units are fully operational during the entire carbon budget period.

Table 15.13 – GHG Emissions Context

Time Period	Carbon Budget $ktCO_2$	Proposed Scheme GHG Emissions $ktCO_2$	Proportion of Carbon Budget %
Third: 2018-2022	2,544,000	0	0
Fourth: 2023-2027	1,950,000	70	0.004
Fifth: 2028-2032	1,725,000	-31,867	-1.847
Sixth: 2033-2037	965,000	-39,878	-4.132

15.9.20. **Table 15.13** shows that the Proposed Scheme would generate GHG emissions during the construction phase. During operation however the Proposed Scheme would result in a reduction in emissions from the fifth carbon budget (2028-2032) in comparison to the baseline scenario, due to the sequestration of operational emissions.

15.9.21. An annual average of the total operational GHG emissions arising from the Proposed Scheme are also presented in comparison with the total CO_2e emissions for Selby in 2019, shown in **Table 15.14**.

Table 15.14 – Proposed Scheme Operational Impact Compared to Selby and North Yorkshire GHG Emissions for 2019

Proposed Scheme average annual operational phase GHG emissions ($ktCO_2e$)	2019 Selby emissions ($ktCO_2$)	2019 North Yorkshire emissions ($ktCO_2$)
-7,972	783.5	4,263.8

15.9.22. When considering the Proposed Scheme net emissions in the context of energy sector policy (as outlined in **Section 15.2**), the Proposed Scheme supports a move towards carbon capture and storage as part of the transition to a net zero economy low carbon.

15.9.23. The UK's net zero strategy supports the use of carbon capture and storage from biomass. The Proposed Scheme would contribute towards the UK Net Zero strategy ambition to deploy "*at least 5 $MtCO^2$/year of engineered [GHG] removals by 2030".*

15.10. DESIGN, MITIGATION AND ENHANCEMENT MEASURES

15.10.1. This Section sets out the design, mitigation and enhancement measures which are likely to be required to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment.

DESIGN

15.10.1. Measures to minimise GHG emissions through design are outlined below and should be reflected in the detailed design of the Proposed Scheme. These design measures are reflected in the **Register of Environmental Actions and Commitments** (REAC) produced for the Proposed Scheme (document reference 6.5).

a. Detailed design optimisation to reflect the carbon reduction hierarchy outlined in PAS 2080 (BSI, 2016). This would include potential for re-using or refurbishing existing assets; and use of low carbon solutions (technologies, materials and products) to minimise resource consumption.

MITIGATION

15.10.2. The **REAC** outlines how the actions and commitments set out within it (and described in this section) are secured and includes within it a requirement for a Construction Environmental Management (CEMP) to be produced for the Proposed Scheme. Measures to reduce GHG emissions during the construction of the Proposed Scheme would be set out in the CEMP. The CEMP would provide a review, monitoring and audit mechanism to determine the effectiveness of and compliance with environmental control measures, which include the consideration of manufacture, transport and supply of materials. Measures that would be incorporated into the CEMP comprise:

a. Use of efficient construction processes, such as design for manufacture and assembly aligning with the carbon hierarchy outlined in PAS 2080 (BSI, 2016). This would include potential for re-using site arisings; using low carbon solutions (technologies, materials and products) to minimise resource consumption; and using construction techniques that reduce resource consumption; and

b. Implementation of a Site Waste Management Plan (SWMP) and Materials Management Plan (MMP), by the Principal Contractor; and re-use of material resources and site arisings where practicable (further details are noted in **Chapter 13 (Materials and Waste)** of this ES.

15.10.3. The draft overarching National Policy Statement for Energy (EN1) notes under paragraph 15.3.10 that steps taken to minimise and offset emissions should be set out in a GHG Reduction Strategy. Given the net reduction in GHG emissions of the Proposed Scheme, it is considered that a GHG Reduction Strategy is not required. Furthermore, as noted in **Section 15.5**, it is anticipated that decarbonisation of the supply chain will occur over time.

Opportunities for Environmental Enhancement

15.10.4. Operational enhancement measures to maximise the overall net benefit of the Proposed Scheme relate to the supply chain. Measures to enhance this comprise;

a. Continuing to pro-actively monitor and identify ways to reduce GHG emissions associated with the supply chain for biomass, as is currently undertaken by the Applicant in respect of the existing biomass generation operations at the Power Station and will likely continue to be required as part of any business model and subsidy support relating to the Proposed Scheme.

15.11. ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

15.11.1. This section details the assessment of significant effects taking account of the secondary mitigation detailed in **Section 15.10** above.

CONSTRUCTION PHASE

15.11.2. The mitigation measures noted above would likely reduce the adverse effect during the construction phase of the Proposed Scheme. However, the impact of the mitigation measures are not quantifiable at this stage and as such, the residual effects of the Proposed Scheme remain unchanged from those presented in **Section 15.9** (**moderate, significant adverse** GHG emissions).

OPERATIONAL PHASE

15.11.3. The operation of the Proposed Scheme is assessed to have a **significant beneficial** effect. The operational enhancement measure noted above (**paragraph 15.10.4**) would seek to ensure the continuation of beneficial impacts of the Proposed Scheme. However, the impact of the enhancement measures are not quantifiable at this stage and as such, the residual impacts of the Proposed Scheme remain unchanged from those presented in **Section 15.9**.

ASSESSMENT AGAINST FUTURE BASELINE

15.11.4. In the future baseline for construction GHG emissions were assessed to be zero as no construction would take place. With the Proposed Scheme the total estimated construction emissions of the Proposed Scheme are 104,700 tCO_2e.

15.11.5. In the future baseline, operational emissions would include emissions from the biomass fuels for electricity generation, as well as their supply chain for two operational units which totals 558,778 tCO_2e. With the Proposed Scheme, operational emissions are anticipated to total -7,975,620 tCO_2e / year of. However, certain assessed GHG emissions, such as supply chain emissions, are likely to reduce over time (such as transport as presented in **Plate 15.1)** therefore increasing the carbon savings achieved by the Proposed Scheme.

15.11.6. Taking into account the lifecycle impacts (construction and operation), the Proposed Scheme scenario is considered to be significantly more beneficial than the future baseline due to the operational sequestration of carbon.

15.12. CUMULATIVE EFFECTS

15.12.1. Consideration of cumulative GHG emissions is inherent in the assessment as GHG emissions of the Proposed Scheme are assessed against various contextual scales, such as sector and local authority policies and UK carbon budgets. This includes comparing the Proposed Scheme GHG emissions against the annual emissions of Selby and North Yorkshire (**Table 15.14)** and the UK carbon budgets **(Table 15.13).**

15.12.2. A detailed assessment of intra-project combined effects and inter-project cumulative effects for the Proposed Scheme has been carried out and is presented in **Chapter 18 (Cumulative Effects)** (document reference 6.1.18) of this ES.

15.13. IN-COMBINATION CLIMATE CHANGE IMPACTS

15.13.1. The in-combination climate change impact assessment considers the extent to which climate change may alter the effects which have already been identified within this chapter.

15.13.2. The impacts of GHG emissions relate to their contribution to global warming and climate change. As such, in-combination climate change impacts are not assessed for GHG emissions.

15.13.3. The assessment of the impacts of climate change is reported in **Chapter 14 (Climate Change Resilience)** (document reference 6.1.14) of this ES.

15.14. MONITORING

15.14.1. Monitoring of operational GHG emissions from Drax Power Station (including the Proposed Scheme emissions), would be incorporated into the Emissions Trading Scheme requirements and existing non-financial data reporting. Furthermore, it is anticipated that any supporting subsidy regime for the Proposed Scheme will contain detailed fuel measurement and sampling requirements and obligations to monitor

and comply with supply chain emission requirements associated with the Proposed Scheme (as is currently the case for the investment contract subsidy that is currently in place with respect to Unit 1). Accordingly, no additional monitoring would be required.

15.15. RESIDUAL EFFECTS

15.15.1. **Table 15.14** below summarises the residual environmental effects associated with the Proposed Scheme.

Table 15.15 - Summary of GHG Effects

Receptor	Potential Effects	Additional Mitigation	Residual Effects
Contribution to global warming and climate change impacting on natural and human systems	GHG emissions generated through the construction phase of the Proposed Scheme (104,700 tCO_2e)	Design and construction mitigation measures incorporating the carbon reduction hierarchy.	**Moderate Adverse (significant)** P / D / LT
Contribution to global warming and climate change impacting on natural and human systems	GHG emission sequestration from the operational Carbon Capture process of the Proposed Scheme (-7,975,620 tCO_2e)	No additional mitigation required. Enhancement measure to pro-actively monitor and identify ways to reduce GHG emissions associated with the supply chain for biomass.	**Beneficial (significant)** P / D/ LT

Key to table:

P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term, N/A = Not Applicable

REFERENCES

BEIS. (2021). *Biomass Policy Statement.* Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1031057/biomass-policy-statement.pdf

BEIS. (2021). *Draft National Policy Statement for Renewable Energy Infrastructure (EN-3).* Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015236/en-3-draft-for-consultation.pdf

BEIS. (2021). *Greenhouse gas reporting: conversion factors 2021*. Retrieved from UK Government Publications.

BEIS. (2021). *UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2019*.

BSI. (2011). *BS EN 15978:2011 Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method*.

BSI. (2016). *PAS 2080: Carbon Management in Infrastructure.* BSI.

DECC. (2011). *National Policy Statement for Renewable Energy Infrastructure (EN-3).* Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en3.pdf

Department for Business, Energy & Industrial Strategy. (2021). *Draft Overarching National Policy Statement for Energy (EN-1)*.

Department of Energy and Climate Change. (2011). *Overarching National Policy Statement for Energy (EN-1)*.

Drax. (2020). *Sourcing Sustainable Biomass*. Retrieved from www.drax.com.

GHG Protocol. (n.d.). *Calculating CO2 Emissions from Ammonia Production (Version 2.0)*.

GHG Protocol Initative Team. (2015). *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard*.

HM Government. (2009). *The Carbon Budgets Order 2009.* HM Government.

HM Government. (2011). *The Carbon Budgets Order 2011.* HM Government.

HM Government. (2013). *Energy Act 2013.* Retrieved from https://www.legislation.gov.uk/ukpga/2013/32/enacted

HM Government. (2016). *The Carbon Budgets Order 2016 .* HM Government.

HM Government. (2021). *Carbon Budget Order 2021.* HM Government.

HM Government. (2021). *Net Zero Strategy Build Back Greener*.

HM Treasury. (2013). *Infrastructure Carbon Review*.

IEMA. (2017). *Assessing Greenhouse Gas Emissions and Evaluating their Significance.*

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

Institution of Civil Engineers. (2012). *CESMM4: Civil Engineering Standard Method of Measurement.*

IPCC. (2006). *2006 IPCC Guidelines for National Greenhouse Gas Inventories. Chapter 3: Chemical Industry Emissions.* IPCC.

IPCC. (2019). *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 2, Energy*.

IPPC. (2006). *EFDB Emissions Factor Database*.

ISO. (2018). *ISO 14064-1:2018 Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*.

Luis, P. (2016). *Use of monoethanolamine (MEA) for CO2 capture in a global scenario: Consequences and alternatives.* Retrieved from ScienceDIrect.

Ministry of Housing, Communities & Local Govenment. (2021). *National Planning Policy Framework*.

Natural England. (2021). *Carbon Storage and Sequestration by Habitat*.

North Yorkshire County Council. (n.d.). *Local plan - district and borough councils*.

Quantis, G. P. (2019). *GHG Protocol Scope 3 Evaluator tool*. Retrieved from Greenhouse Gas Protocol.

RICS. (2017). *Whole life carbon assessment for the built environment, 1st edition*.

Selby District Council. (2013). *Selby District Core Strategy Local Plan*.

UK Government. (2020). *United Kingdom of Great Britain and Northern Ireland's Nationally Determined Contribution.*

University of Bath. (2019). *Bath Inventory of Carbon and Energy (ICE) V3*.

Woodland Carbon Code. (2021). *Woodland Carbon Code Calculator*.