Lighthouse Green Fuels Development Consent Order

Preliminary Environmental Information Report

Chapter 14: Greenhouse Gases

Planning Inspectorate Reference: EN0110025

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1. Introduction

1.1 Overview

1.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) provides the preliminary assessment of likely significant effects of greenhouse gases (GHG) from the construction, operation and decommissioning of the proposed 'Lighthouse Green Fuels' (LGF) Project (the Proposed Development, as detailed in Chapter 4: Proposed Development).

1.1.2 Within this chapter, topic-specific sections are included on:

- Legislation and planning policy context (Section 2);
- Assessment methodology and significance criteria (Section 3);
- Baseline conditions (Section 4);
- Development design and impact avoidance (Section 5);
- Likely impacts and effects of the Proposed Development (Section 6);
- Additional mitigation and enhancement measures (Section 7);
- Residual effects (Section 8);
- Next Steps (Section 9); and
- Summary of significant effects (Section 10).

1.1.3 This chapter should be read in conjunction with Chapter 4: Proposed Development (PEIR Volume 1).

1.1.4 This chapter is supported by Appendix 14A: GHG assessment - Data and assumptions (PEIR Volume 3).

2. Legislation and Planning Policy Context

2.1 Overview

2.1.1 Table 2-1 lists the legislation, policy and guidance relevant to GHG for the Proposed Development and specifies where in the PEIR information is provided in relation to these.

Table 2-1 Relevant legislation, case law, policy and guidance for GHG

Legislation, case law, policy or guidance description	Relevance to assessment	Where in the PEIR is information provided in address to this
Legislation and case law		
United Nations Framework Convention on Climate Change (Ref 1) 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.	The aviation sector is a significant contributor to global carbon emissions. SAF presents a viable solution to reduce these carbon emissions. The Proposed Development will help the UK meet its ambitions of 10% SAF uptake by 2030.	This requirement is addressed in Section 6.4.
The Climate Change Act (2008), as amended 2019 (Ref 2) 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 the UK Government updated this commitment to net zero Emissions by 2050. This target is supported by a system of legally binding five-year "Carbon Budgets" that restrict the amount of GHG emissions the UK can legally emit. Carbon Budgets four, five and six are currently in force as government policy. In February 2025, the Climate Change Committee (CCC)	With the national Net Zero targets, it is important for the whole life GHG emissions of the Proposed Development to align with a Net Zero trajectory. The assessment considers the likely significant effects of GHG emissions in terms of alignment to this trajectory. The Proposed Development construction phase would start from 2027, with the plant being operational from 2031, meaning effects on GHG would span across the fourth (2027 only), fifth (2028-2032), sixth (2033-2037) and seventh (2038-2042) Carbon Budgets. As part of the assessment, estimated GHG emissions for the Proposed Development are compared against relevant Carbon Budgets.	This requirement is addressed in Section 6.4.

Legislation, case law, policy or guidance description	Relevance to assessment	Where in the PEIR is information provided in address to this
published its advice on the seventh carbon budget (2038–2042), which outlines the recommended emissions limits for that period (Ref 3). However, this seventh budget has not yet been ratified by the UK government, meaning it is not yet legally binding. The CCC uses the Balanced Pathway as the core scenario when recommending the level of each carbon budget to the UK government. The Balanced Pathway is designed to align with the Net Zero target by 2050, as mandated by the 2019 amendment to the Climate Change Act. It provides a detailed emissions trajectory that meets the requirements of each carbon budget period, including the sixth and proposed seventh budgets.	The CCC's Balanced Pathway projections have been used to contextualise GHG emissions in the assessment alongside the Carbon Budgets. The CCC's Balanced Pathway projections for different transport modes (rail and bus) have also been incorporated into the calculations of transport emissions in the future.	
R (Finch on behalf of the Weald Action Group & Others) v. Surrey County Council (& Others) July 2024 (Ref 4) Supreme Court judgement relating to Scope 3 (downstream) emissions in Greenhouse Gas assessments in EIA. The Supreme Court's decision specifically concerned fossil fuel projects and confirmed that EIAs must assess indirect effects where a causal connection exists. The Court held that impacts which inevitably follow from a project are its effects, even if they occur off-site.	While specific to fossil fuels, this interpretation of the EIA Regulations — requiring assessment of direct and indirect significant effects — may influence other developments with foreseeable indirect emissions. In line with this principle, the GHG assessment for the Proposed Development has scoped in Scope 3 emissions from the use of SAF.	This requirement is addressed in Sections 5 and 6.
Policy		
Infrastructure Carbon Review, 2013 (Ref 5) In 2013, the UK government published the Infrastructure Carbon Review (HM Government, 2013), aiming to "release the value of lower carbon solutions and to	The assessment in this chapter evaluates the GHG emissions over the whole lifecycle of the Proposed Development. By considering the carbon emissions of a project in EIA, the emissions of the project are assessed early on.	This requirement is addressed in Sections 5 and 6.

Legislation, case law, policy or guidance description	Relevance to assessment	Where in the PEIR is information provided in address to this
make carbon reduction part of the DNA of infrastructure in the UK." Major infrastructure owners, operators and developers across the communication, energy, transport, waste and water sectors were invited to endorse it, become signatories and make commitments under the Review. The Review provided increased emphasis on 'capital carbon' (GHG Emissions associated with raw materials, activities and transport for construction, repairs, replacement, refurbishment and de-construction of infrastructure) while acknowledging that 'operational carbon' (associated with energy consumption for the operation, use and maintenance of infrastructure) will continue to dominate overall emission to 2050 and beyond. The Infrastructure Carbon Review highlighted the importance of assessing GHG Emissions early in the lifecycle of an infrastructure scheme when there is the greatest carbon reduction potential. The Infrastructure Carbon Review also led to the publication of a Publicly Available Specification on infrastructure carbon management; PAS2080:2016. An updated version of PAS2080 was released in 2023.	This ensures the greatest potential in carbon reductions can be achieved through relevant mitigation measures.	
The Overarching National Policy Statement for Energy (EN-1) (Ref 6) The Overarching National Policy Statement (NPS) for Energy (EN-1) establishes the need for nationally significant energy infrastructure and sets out requirements for assessing environmental impacts. Section 5.3 acknowledges that while energy infrastructure is vital for the UK's transition to net zero, it will inevitably produce GHG	EN-1 sets out the national policy framework for energy infrastructure and require an ES to assess GHG emissions in line with the UK's net zero objectives.	This requirement is addressed in Sections 5 and 6

Legislation, case law, policy or guidance description	Relevance to assessment	Where in the PEIR is information provided in address to this
emissions during construction, operation and decommissioning. A whole-life GHG assessment must be provided as part of an ES, outlining emissions at each stage, the measures taken to minimise them, and any offsetting proposals. Paragraph 5.3.12 on Secretary of State decision making: "Operational emissions will be addressed in a managed, economy-wide manner, to ensure consistency with carbon budgets, net zero and our international climate commitments. 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." NPS EN-1 explains, in paragraphs 3.3.13–3.3.16, 3.3.57, 3.3.82, 3.5.3 and 3.5.4, how the government's Net Zero Strategy (Ref 7) informs the delivery of nationally significant energy infrastructure projects (NSIPs). These sections address projected electricity demand, the mix of generation sources, affordability considerations, national and sectoral decarbonisation, and targets for carbon capture and storage.		
National Policy Statement for Renewable Energy Infrastructure (EN-3) (Ref 8) The National Policy Statement for Renewable Energy Infrastructure (EN-3), read alongside EN-1, applies to nationally significant renewable projects and stresses the urgent need for renewable generation to meet net zero and carbon budgets. It requires applicants to assess GHG impacts	EN-3 sets out the national policy framework for renewable energy infrastructure and requires an ES to assess GHG emissions in line with the UK's net zero objectives.	This requirement is addressed in Sections 5 and 6.

Legislation, case law, policy or guidance description	Relevance to assessment	Where in the PEIR is information provided in address to this
in the ES, considering the full lifecycle of the project.		
UK Marine Policy Statement (Ref 9) The Marine Policy Statement (MPS) provides the framework for marine planning and decision-making across UK waters. It requires that proposals consider the potential of a project to reduce GHG emissions and support the transition to a low-carbon economy.	The UK MPS sets out the national policy framework for marine planning and requires that proposals consider the potential of a project to reduce GHG emissions.	This requirement is addressed in Section 6.
The National Planning Policy Framework (NPPF) (Ref 10) Explains that achieving sustainable development requires the planning system to pursue three interdependent overarching objectives in mutually supportive ways, so that opportunities can be taken to secure net gains across all 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). Section 14, Paragraph 161 of the NPPF notes that "The planning system should support the transition to net zero by 2050" and "help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, … and support renewable and low-carbon energy and associated infrastructure." Paragraph 164 notes that "New development should be planned for in ways that: … b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design."	The Proposed Development will help the UK reduce the carbon emissions of the aviation sector by contributing to the production of SAF. With the national Net Zero targets, it is important for the whole life GHG emissions of the Proposed Development to align with a Net Zero trajectory. The assessment considers the likely significant effects of GHG emissions in terms of alignment to this trajectory.	These requirements are addressed in Sections 5 and 6.
Industrial Decarbonisation Strategy, 2021 (Ref 11)	The Proposed Development will use sustainably sourced biomass (which	No requirements

Legislation, case law, policy or guidance description	Relevance to assessment	Where in the PEIR is information provided in address to this
This is the first strategy published by a major economy, which sets out how industry can decarbonised in line with net zero, while remaining competitive and without pushing emissions abroad. It builds on the Ten Point Plan and sets out the Government's vision for a prosperous, low-carbon UK industrial sector by 2050, and aims to provide industry with the long-term certainty it needs to invest in decarbonisation. Chapter 4 'Adopting low-regret technologies and building infrastructure' states: "To be on track to deliver net zero, we expect that the minimum, in all future scenarios, is 20 TWh per year of fossil fuel use replaced with low-carbon alternatives in 2030". It goes onto state that "Current evidence strongly suggests that, given limited sustainable biomass supply, we may need to prioritise the use of biomass where it can be combined with carbon capture and storage (BECCS), resulting in negative emissions".	may include agricultural residues) to produce SAF. In the future, the carbon from the production process of the SAF may be captured in permanent carbon storage.	
Jet Zero Strategy, 2022 (Ref 12) The Strategy sets out the Government's vision for decarbonising aviation, focusing on the development of technologies in a way that maintains the benefits of air travel, especially post COVID 19, whilst maximising the opportunities that decarbonisation can bring for the UK. It includes a 5-year delivery plan, setting out how the Government will achieve net zero aviation by 2050.	SAF presents a viable solution to decarbonise the aviation sector. The Proposed Development supports the Jet Zero Strategy (DfT, 2022) by producing SAF to decarbonise aviation. The Proposed Development will help the UK meet its ambitions of 10% SAF uptake by 2030 and beyond.	No requirements
Sustainable Aviation Fuel (SAF) Mandate (Ref 13) The SAF Mandate is a UK Government policy initiative aimed at decarbonising the aviation sector by requiring a minimum	The Proposed Development is expected to be the UK's first commercial scale, 2nd generation low-carbon SAF production facility. The plant would be one of the largest of its kind in Europe,	This requirement is addressed in Section 6.

Legislation, case law, policy or guidance description	Relevance to assessment	Where in the PEIR is information provided in address to this
proportion of jet fuel supplied in the UK to be derived from sustainable sources. The mandate came into force in 2025, with a target of 10% SAF by 2030 and 22% by 2040. It sets strict sustainability and lifecycle greenhouse gas emissions criteria for eligible fuels, promoting the use of waste-derived and advanced biofuels. The SAF Mandate is a key mechanism for delivering the UK's Jet Zero Strategy and supports investment in domestic SAF production infrastructure, such as the Proposed Development	converting over 1 million tonnes of biomass feedstock into approximately 180 million litres of low-carbon SAF and approximately 30 million litres of renewable naphtha per annum. The Proposed Development contributes directly to the UK's SAF Mandate targets, supporting domestic SAF production. The SAF Mandate aligns with RED II (Ref 14) and RTFO methodologies (Ref 15 and Ref 16), which treat emissions from fuel in use (combustion) as zero for biofuels. This principle is based on the fact that CO_2 released during combustion is offset by CO_2 absorbed during biomass growth. Therefore, lifecycle reporting excludes in use (combustion) emissions for SAF, reflecting its biogenic nature and alignment with these frameworks.	
Stockton-on-Tees Borough Council Local Plan 2019 (Ref 17) Policy SD 5 states: "2 (h), Supporting proposals for renewable and low-carbon energy schemes including the generation and supply of decentralised energy."	The Proposed Development will use sustainably sourced biomass (which may include agricultural residues) to produce SAF.	No requirements
Redcar and Cleveland Borough Council Local Plan 2018 (Ref 18) Policy SD 4 - General Development Principle states: "All development must be designed to a high standard. Development proposals will be expected to: be sustainable in design and construction, incorporating best practice in resource management, energy efficiency and climate change adaptation."	The assessment considers the likely significant effects of the GHG emissions of the Proposed Development based on the embedded design mitigation.	These requirements are addressed in Section 5.
Net Zero Strategy for Tees Valley (Ref 19) Five local authorities (Darlington, Hartlepool, Middlesbrough,	With the net zero targets, it is important for the whole life GHG emissions of the Proposed Development to align with a net zero	This requirement is addressed in Section 6.

Legislation, case law, policy or guidance description	Relevance to assessment	Where in the PEIR is information provided in address to this
Stockton-on-Tees and Redcar & Cleveland) forms the regional Tees Valley Combined Authority. The Local Industrial Strategy sets an overarching ambition - "Tees Valley will be a global leader in clean energy, low-carbon and hydrogen. The area will achieve a Net Zero carbon industrial cluster by 2040, providing good jobs with long-term prospects that local people can access."	by 2040 trajectory. The assessment considers the likely significant effects of GHG emissions in terms of alignment to this trajectory.	
Guidance		
Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (Ref 20) EIA Guidance published by IEMA in 2022 will be followed. This provides a framework for the consideration of GHG emissions in the EIA process, in line with the 2014 amendment to the EIA Directive (2014/52/EU) (Ref 21). The guidance sets out how to: • Identify the GHG emissions baseline in terms of GHG current and future emissions; • Identify key contributing GHG sources and establish the scope and methodology of the assessment; • Assess the impact of potential GHG emissions and evaluate their significance; and • Consider mitigation in accordance with the hierarchy for managing project related GHG emissions (avoid, reduce, substitute, and compensate).	The IEMA guidance provides the overarching framework for integrating GHG assessment into EIA, focusing on the principles of significance and mitigation. The 2022 update (Version 2) builds on the 2017 guidance by introducing a more nuanced approach to determining significance. It does not prescribe a specific calculation method but directs practitioners to established technical standards such as the GHG Protocol (Ref 22), PAS 2080 (Ref 23) and RICS Professional Statement on Whole Life Carbon Assessments (Ref 24) for detailed quantification and lifecycle accounting.	This guidance has informed the assessment methodology outlined in Section 3. The requirements of this guidance are addressed in Sections 6.2, 6.3 and 6.4.
The GHG Protocol (Ref 22) The GHG Protocol provides overarching guidance on developing GHG inventories and reporting standards.	The GHG Protocol provides internationally recognised principles for GHG accounting and reporting. It underpins the quantification of emissions by defining how activity data and emission factors should be	This guidance has informed the assessment methodology outlined in Section 3.

Legislation, case law, policy or guidance description	Relevance to assessment	Where in the PEIR is information provided in address to this
	applied to produce robust inventories. The IEMA guidance references the GHG Protocol as a key technical standard for ensuring consistency with global best practice in GHG accounting.	
PAS2080: 2023 (Ref 23) PAS2080 is a specification for carbon management in buildings and infrastructure. It provides a framework for organisations to manage and reduce whole-life carbon emissions across the lifecycle of their projects. The main areas identified in PAS2080 are: • Whole-life carbon management emphasizes managing carbon emissions throughout the entire lifecycle of infrastructure, from planning to end-of-life; • Supply chain collaboration: encourages collaboration across the value chain involving all stakeholders in carbon reduction efforts; • Integrated decision-making: promotes integrated carbon management into decision-making processes to support sustainability goals; and Decarbonisation principles: includes principles for setting targets, monitoring, and reporting on carbon emissions.	PAS 2080 sets out a framework for managing and reducing whole-life GHG emissions in infrastructure projects. It provides detailed requirements for data quality, carbon mitigation, and engagement across the value chain, including with designers and the supply chain. In the GHG assessment, PAS 2080 informs the approach to GHG mitigation application, and proportionality in assessment, ensuring that emissions are managed throughout design.	This guidance has informed the assessment methodology outlined in Section 3. The requirements of this guidance are addressed in Sections 5 and 6.
RICS Professional Standard – Whole Life Carbon Assessment (Ref 24) The RICS Whole Life Carbon Assessment (WLCA) framework sets out a detailed standard for evaluating carbon emissions throughout the full lifecycle of built assets. Its goal is to establish a uniform and reliable method for carbon accounting, supporting progress toward net-zero goals and reducing the effects of climate	The RICS Whole Life Carbon Assessment standard provides a structured methodology for evaluating carbon emissions across all lifecycle stages of built assets. The GHG assessment conducted in this chapter follows the modular, lifecycle approach outlined in RICS. In cases where project-specific data is unavailable, the standard supplies default scenarios and assumptions for various life cycle stages, including the transportation of	This guidance has informed the assessment methodology outlined in Section 3, and the results of the GHG assessment in Section 6.

Legislation, case law, policy or guidance description	Relevance to assessment	Where in the PEIR is information provided in address to this
change. The framework applies to all types of buildings and infrastructure, assessing emissions from early design and construction through to end-of-life stages, including demolition and disposal.	construction materials, maintenance activities, and demolition processes.	
EN 17472:2022 Sustainability of construction works (Ref 25) EN 17472 provides a standardized framework for assessing the sustainability of infrastructure and civil engineering works across their lifecycle. It supports consistent evaluation of environmental impacts, as well as those economic and social.	EN 17472 establishes a standardised framework for assessing the sustainability of infrastructure works, including lifecycle GHG emissions. While not referenced in the IEMA guidance (Ref 20), it complements the RICS standard (Ref 24) by supporting modular lifecycle assessment and consistent boundary definition. In the GHG assessment, EN 17472 helps ensure alignment with European standards and allows for comparability across different projects.	This guidance has informed the assessment methodology outlined in Section 3.

2.2 Consultation, engagement and scoping

Scoping opinion

2.2.1 The EIA Scoping Report (Appendix 1A PEIR Volume 3) was issued to the Planning Inspectorate (PINS) on 1st of October 2025. PINS provided its EIA Scoping Opinion (EN0110025) on 11th of November 2025 (Appendix 1B PEIR Volume 3), which included feedback from consultation bodies that it formally consulted.

2.2.2 Table 2-2Key scoping feedback for GHG captures the key Scoping Opinion comments received from PINS relevant to the GHG assessment, along with the Applicant's response to these at this stage of the assessment. The full consultee comments on the EIA Scoping Report and responses to these are provided in Appendix 1B (PEIR Volume 3).

Table 2-2 Key scoping feedback for GHG

Stakeholder	Scoping comment	Applicant response
PINS	[Replacement and refurbishment] is proposed to be scoped out on the basis that significant replacement or refurbishment is not expected within the 30-year design life. The inspectorate is content to scope this matter out on this basis.	No response required.
PINS	[Emission sources] will include negative emissions from the use of SAF displacing hydrocarbons in the aviation fuel sector. The context of the aviation fuel sector should be clearly established, and any argument that the production of SAF would be displacing hydrocarbon-based fuel (as opposed to enabling a growth in the aviation sector) should be evidenced.	The PEIR assumes that SAF produced by the Proposed Development displaces conventional Jet A-1 fuel, and the magnitude of impact of this displacement is discussed in Section 6.4. This assumption reflects the UK Government's policy framework for aviation decarbonisation. The Jet Zero Strategy (Ref 12) sets out a pathway to achieve net zero in the aviation sector by 2050, identifying SAF as a critical lever. While Jet Zero anticipates continued growth in the aviation sector, it requires that this growth occurs along a decarbonising trajectory, supported by measures such as SAF uptake, efficiency improvements, and emerging technologies. The UK SAF Mandate (Ref 13), which came into force in January 2025, requires jet fuel suppliers to blend an increasing proportion of SAF into the UK aviation fuel mix—2% in 2025, 10% by 2030, and 22% by 2040. The mandate is designed to ensure SAF progressively replaces fossil-derived Jet A-1 fuel, even as overall demand for air travel is projected to increase.
PINS	Potential emissions sources include emissions associated with the transportation of the captured CO_2 off-site to its end use (storage). CO_2 collection, compression and export does not form part of the application. This discrepancy should be clarified.	The capture and storage of CO_2 from the Biomass CHP plant and thermal pretreatment does not form part of this application and is not covered by the GHG assessment. The possible future application of this technology is discussed in Section 9 Next Steps.
PINS	Emissions from the end use (combustion) of SAF biofuels are considered zero because the CO_2 released during combustion is offset by the CO_2 absorbed during the growth of the sustainably sourced	In Section 3.4, paragraphs 3.4.21-3.4.22 explain how emissions from the end-use (combustion) of SAF biofuel can be assumed to be zero. The sustainability of the feedstock will be secured through compliance with

Stakeholder	Scoping comment	Applicant response
	biomass feedstock, quoting Renewable Transport Fuel Obligations, Renewable Energy Directive (RED II), and SAF Mandate methodologies. The ES should explain the mechanisms which underpin this assumption and how the sustainability of the biofuel feedstock is secured.	the strict sustainability requirements set out in the SAF Mandate (Ref 13) and RTFO (Ref 15 and Ref 16). Compliance will be demonstrated through independent certification by recognised schemes such as Sustainable Biomass Program (SBP), Programme for the Endorsement of Forest Certification (PEFC), Forest Stewardship Council (FSC), and International Sustainability and Carbon Certification (ISCC), which verify that feedstock sourcing meets criteria for GHG savings, traceability, and responsible land management. These certifications provide assurance that the SAF produced by the Proposed Development aligns with UK and EU sustainability standards.

Statutory public consultation

2.2.3 This PEIR forms part of the statutory consultation process for the DCO application. Following publication of the PEIR, statutory public consultation on the emerging proposals for the Project will be undertaken with stakeholders and local communities. Any feedback relevant to the GHG assessment will be taken into account in the greenhouse gas assessment to be included within the ES to be submitted as part of the DCO application in early Q3 2026.

Ongoing engagement

2.2.4 To date, engagement with stakeholders on GHG emissions has focused on the methodology that was set out in the Scoping Report. As outlined in Section 9 Next steps, we will seek to consult with all relevant local authorities and parties on the GHG emissions assessment and proposed mitigation measures.

3. Assessment Methodology and Significance Criteria

3.1 Overview

3.1.1 This section outlines the methodology followed to assess the likely significant effects of the Proposed Development in relation to GHG including:

- Effects scoped into the assessment;
- Study area;
- Criteria for determining likely significant effects; and
- Assessment of cumulative effects.

3.1.2 The project-wide approach to the assessment methodology is set out in Chapter 2: Assessment Methodology (PEIR Volume 1).

3.1.3 The assessment methodology for the GHG Emissions assessment follows the IEMA guidance (Ref 20)), which states that GHG quantification within an EIA should follow the principles outlined in key documents such as the GHG Protocol (Ref 22) and PAS 2080 (Ref 23), and in doing so, enable the assessment to align with the principles of relevance, completeness, consistency, transparency and accuracy.

3.2 Effects scoped into the assessment

3.2.1 RICS Professional Standard (Ref 24) and BS EN 17472 (Ref 25) outline a modular, lifecycle approach for GHG emissions assessments, providing a framework to consider effects throughout a project's lifecycle. This approach has informed the scope of this assessment. The assessment includes both direct and indirect GHG emissions from the Proposed Development and includes benefits and loads beyond the system boundary.

3.2.2 Effects that are scoped in for the GHG Emissions assessment relevant to the construction stage (Modules A1-A5) are:

- Extraction, transportation and manufacturing of construction materials and products (A1-A3);
- Transport of construction materials and products to site (A4);
- Construction and installation activities (A5); and
- Construction waste and waste management (A5).

3.2.3 Effects that are scoped in for the GHG Emissions assessment relevant to the operation stage (Modules B2-B3 and B6-B8) are:

- Maintenance and repair (B2-B3);
- Operational energy use (B6);
- Operational water use (B7);
- Biomass cultivation, collection and transport to pellet production plant (B8);
- Pellet production and waste biomass transport to LGF plant (B8);
- Materials, gases and chemicals utilised during LGF plant operation (B8);
- Transport, processing and disposal of operational waste from LGF plant (B8);
- Carbon dioxide released from chemical processes during LGF plant operation (B8); and
- Transport and distribution of low-carbon SAF produced at the LGF plant (B8).

3.2.4 Effects that are scoped in for the GHG Emissions assessment relevant to the end-of-life stage (Module C1-C4) are:

- Deconstruction and demolition (C1); and
- Transport, waste processing and disposal of construction materials and products (C2-C4).

3.2.5 The beyond-system-boundary benefit in the magnitude of GHG emissions associated with the end-use of low-carbon SAF (D1) is also quantified in the assessment.

3.2.6 While the SAF lifecycle does result in GHG emissions, its overall lifecycle emissions are significantly lower than those of conventional jet fuel, making it a more environmentally sustainable option. The use of SAF therefore contributes to decarbonising the aviation sector and supports the UK's progress toward its net zero target. To illustrate this, the use (i.e., combustion) of the amount of low-carbon SAF produced by the Proposed Development will be compared with the use of an equivalent amount of traditional jet fuel (Jet A-1 Kerosene). Although this comparison falls outside the defined lifecycle scope of the GHG assessment (as set out in paragraphs 3.2.2 to 3.2.4), it provides important additional context on the climate benefits of SAF compared to traditional jet fuel.

3.2.7 The following GHG Emissions Effects that relate to land use change have been scoped out due to the minimal existing vegetation within the study area:

- Construction waste from land-use change (A5); and
- Land use and forestry-based carbon removals (B1).

3.3 Study area

3.3.1 The study area for the GHG assessment defines the physical location of emission sources associated with the Proposed Development, some of which are or will be within the Draft Order Limits (for PEIR) (e.g. fuel use associated with construction plant equipment) and some of which are outside of the Draft Order Limits (e.g. extraction, manufacturing and production of construction materials). For the assessment of GHG emissions, the receptor is the global atmosphere as all emissions, regardless of where they occur, contribute to the concentration of GHGs in the atmosphere and associated global warming. Therefore, there is no defined physical study area with regard to the identification and assessment of impacts to the receptor.

3.4 Methodology

3.4.1 The GHG assessment methodology seeks to quantify the whole-life GHG emissions associated with the Proposed Development (absolute Proposed Development emissions) and the difference in emissions between the Proposed Development and baseline scenario (net Proposed Development emissions). The assessment has been based on a reasonable worst-case scenario. Significance has been determined based on IEMA guidance (Ref 20) and professional judgement, balancing both quantitative and qualitative assessments of the whole-life GHG impact (construction, operation and decommissioning) of the Proposed Development. Significance is ultimately determined based on the Proposed Development's alignment with the UK's trajectory to net-zero by 2050.

Baseline

3.4.2 The assessment considers the likely evolution of the baseline without the implementation of the Proposed Development. This is termed the future baseline, and for the GHG assessment, is defined by the GHG emissions arising from the study area in the absence of the Proposed Development.

3.4.3 The future baseline for the GHG emissions assessment assumes that the study area would continue to operate in its existing configuration for the duration of the study period (i.e. construction, operation and decommissioning).

Criteria for the assessment of significance

3.4.4 The methodology for assessing effects is based on the principle that the environmental effects of the Proposed Development, in relation to a

receptor, should be determined by identifying the receptor's sensitivity, assessing the magnitude of impact the Proposed Development would have on the receptor's sensitivity and then combining these two elements to identify the significance of effect.

Assessment of sensitivity

3.4.5 For the GHG assessment, emissions are not geographically limited and have a global effect rather than directly affecting local receptors. As per the IEMA (Ref 20) guidance, the receptor 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.

Magnitude of impact

3.4.6 The approach used to assess the magnitude of impact on the global climate considers the nature and magnitude of impact in GHG emissions as a result of the Proposed Development. In line with applicable guidelines from the GHG Protocol (Ref 22), GHG emissions are reported as tonnes of carbon dioxide equivalent (tCO_2e) and consider the seven Kyoto Protocol gases:

- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous oxide (N_2O);
- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs);
- Sulphur hexafluoride (SF_6); and
- Nitrogen trifluoride (NF_3).

3.4.7 These GHGs are broadly referred to in this chapter under an encompassing definition of 'GHG emissions'. GHG emissions have been assessed using a calculation-based methodology as per the below equation:

Activity data × GHG factor = GHG emissions or removals.

Where:

***Activity data** – a measure of the quantity of an activity; and*

***GHG factor** – a measure of the GHG emissions per unit of activity*

3.4.8 The activity data used to inform this assessment has been provided by the Applicant. Where data was unavailable from the Applicant, appropriate industry-recognised assumptions and benchmarks have been used.

3.4.9 Appendix 14A (PEIR Volume 3) contains a detailed account of the data sources, limitations and assumptions of the GHG assessment.

3.4.10 For the reporting of GHG emissions in this assessment, a 30-year

operational study period is considered (2031-2060). The 30-year operational study period, in this case, is considered to reflect the minimum design life of the Proposed Development. Construction of the Proposed Development is assumed to take place over 4 years between 2027 and 2030. End-of-life activities are assumed to take place in the final year of the design life of the Proposed Development (post 2060).

3.4.11 A 30-year operational study period has been adopted as a reasonable worst-case scenario. This approach helps ensure that the estimated avoided emissions resulting from the displacement of fossil fuel-based jet fuel with the low-carbon SAF produced by the Proposed Development are not overstated. For a detailed analysis of these avoided emissions, refer to Section 6.4, beginning at paragraph 6.4.9.

Significance of effect

3.4.12 The IEMA guidance (Ref 20) defines the overall approach to assessing the impacts and significance of effects of GHG emissions from projects. There is no quantifiable threshold above or below which the significance of GHG emissions can be based on. The guidance directs that emissions must be contextualised as part of the assessment process, including, but not exclusively, against national Carbon Budgets.

3.4.13 The guidance restates the principles that:

- GHG emissions from all projects will contribute to climate change, the largest interrelated cumulative environmental effect; and
- That the consequences of a changing climate have the potential to lead to significant environmental effects on all topics in the EIA Directive (e.g. human health, biodiversity, water, land use, air quality).

3.4.14 The current IEMA guidance (Ref 20) provides a more nuanced approach to the appraisal of significance of changes in GHG emissions arising from a project than was set out in the previous iteration of the IEMA guidance. The previous iteration of the IEMA guidance concluded that all GHG emissions, regardless of scale or extent of mitigation, were significant. The updated IEMA guidance notes that some projects will lead to increases in emissions but that this alone does not represent a significant effect. Instead, it is the role of the competent professional carrying out the assessment to consider the scale of changes in emissions; the context within which these are expected to occur; the mitigation undertaken to minimise negative impacts; and the overall alignment of the Proposed Development with the UK's carbon targets.

3.4.15 In determining significance, the indirect impacts of the Proposed Development will be considered where appropriate. For example, the

relative GHG benefit of the end-use of SAF compared to conventional jet fuel.

3.4.16 The GHG emissions of the Proposed Development have been contextualised against the following Carbon Budgets and UK emission trajectory:

- The Climate Change Committee's (CCC) UK Carbon Budgets; and
- Balanced Pathway (Ref 3) (see Table 6-2).

3.4.17 It should be noted that the CCC Carbon Budgets are legislated and provide a national scale context for GHG emissions. Although the CCC's Balanced Pathway is non-statutory, it does provide an indicative pathway to net zero by 2050 at a national level and at industry level. The approach to the assessment of significance draws on guidance set out in the IEMA guidance and is summarised in Table 3-1.

Table 3-1 Significance categories

Significance category	Significance	Descriptor
Major adverse	Significant	The GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy and does not make a meaningful contribution to the UK's trajectory towards net zero.
Moderate adverse	Significant	The GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals, falling short of fully contributing to the UK's trajectory towards net zero.
Minor adverse	Not significant	The GHG impacts are fully consistent with applicable existing and emerging policy requirements and good practice design standards, fully in line with measures necessary to achieve the UK's trajectory towards net zero.
Negligible	Not significant	The GHG impacts are reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050.
Beneficial	Significant	The net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared

Significance category	Significance	Descriptor
		to the without-project baseline, substantially exceeding net zero requirements with a positive climate impact.

3.4.18 Significance has been determined based on IEMA guidance and professional judgement, balancing both quantitative and qualitative assessments of the whole-life GHG impact (construction, operation and end-of-life) of the Proposed Development. The determination of significance has considered whether the Proposed Development is in line with existing and emerging best practice and policy requirements for GHG emissions reduction (see Table 2-1). In applying this approach, regard has been given to the purpose of the infrastructure—namely, the production of SAF to displace conventional fossil-derived jet fuel — given its role in enabling decarbonisation of the aviation sector (see Section 6.4).

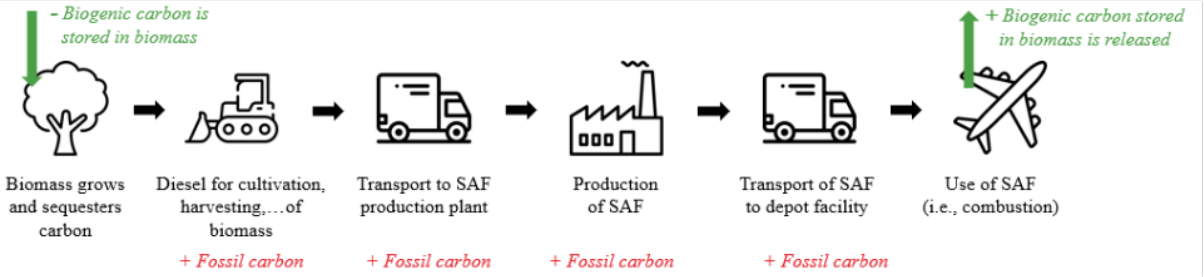
3.4.19 Therefore, an assessment has been made, based on professional judgement, as to whether GHG emissions from the Proposed Development will have a material impact on the ability of the UK Government to meet its GHG emissions reduction targets (and would, therefore, potentially be significant).

3.4.20 For the initial assessment of significance within this preliminary assessment, the assessment of effects has assumed that 'embedded design mitigation' and 'standard good practice mitigation' relevant to the GHG assessment are in place (these measures are presented in Section 5).

Biogenic carbon neutrality

3.4.21 The treatment of emissions from the use (or “combustion”) of SAF follows established government-approved methodologies for biofuels (Ref 13, Ref 14, Ref 15 and Ref 16). These methodologies are based on the principle of biogenic carbon neutrality, which is explained below.

3.4.22 Biomass used to produce SAF absorbs carbon dioxide during growth, a process referred to as biogenic carbon uptake. When SAF is combusted, this biogenic carbon is released back into the atmosphere. These removals and emissions are considered to balance each other out, meaning combustion emissions are treated as ‘neutral’ or zero. This principle is illustrated in Inset 3-1. It is important to note that carbon neutrality applies only to biogenic carbon; GHG emissions from processes such as harvesting, transport, and SAF production are still accounted for in the lifecycle assessment (refer to Inset 3-1).



Inset 3-1 Biogenic and fossil carbon emissions occurring over the lifecycle of biomass-based SAF.

3.5 Assessment of cumulative effects

3.5.1 All global GHG sources are relevant to the effect on climate change, therefore effects of GHG emissions from other developments should not be individually assessed, as there is no basis for selecting any particular cumulative projects that emit GHG for assessment over any other. This is in line with IEMA guidance (Ref 20). Instead, it is necessary for EIA to consider GHG emissions in the context of the UK's net-zero trajectory, using benchmarks such as the UK Carbon Budgets. These benchmarks are inherently cumulative as they consider emissions from all sources across the economy including future emissions from new developments. The contextualisation of the GHG emissions against Carbon Budgets, and the significance criteria adopted for the assessment (see Section 6.4) account for the alignment of the Proposed Development with a net-zero trajectory, and therefore, considers the potential cumulative effect of GHG emissions on the atmospheric concentration of GHG emissions. Therefore, no separate cumulative GHG assessment with other developments is required.

4. Baseline Conditions

4.1 Overview

4.1.1 To provide an assessment of the likely effect of the Proposed Development, it is necessary to identify and understand the baseline conditions in the study area. This provides a reference point against which potential changes in GHG emissions can be assessed.

4.2 Current baseline

4.2.1 The current baseline represents the environmental conditions at the time of the assessment (2025) for the PEIR. The existing baseline is not relevant to the assessment of GHG emissions across the lifecycle of the Proposed Development. Instead, the future baseline is the reference point against which the GHG impact of the Proposed Development can be compared and assessed (see Section 4.3).

4.3 Future baseline

4.3.1 The assessment has considered the likely evolution of the baseline without the implementation of the Proposed Development. This is termed the future baseline, and for the GHG assessment, is defined by the predicted GHG emissions arising from the study area in the absence of the Proposed Development.

4.3.2 The Draft Order Limits are located in an industrial area including brownfield and greenfield land as well as existing development and utilities. The Main Site predominantly comprises concrete hardstanding with limited areas of vegetation, much of which is sparse and low in ecological value. The western portion of the Main Site includes a closed and restored inert landfill which accepted industrial and commercial waste between 1973 and approximately 1985; this area is now vegetated.

4.3.3 The future baseline for the GHG emissions assessment assumes that the study area would continue to operate in its existing configuration for the duration of the study period (i.e. construction, operation and decommissioning), where:

- existing site land uses remain the same; and
- no construction of any new assets is assumed.

4.3.4 Therefore, for the purposes of the GHG assessment, the future baseline is assumed to be zero. Assuming the future baseline is zero allows the

assessment to reflect a reasonable worst case net change in GHG emissions between the future baseline and the Proposed Development.

5. Development Design and Impact Avoidance

5.1 Overview

5.1.1 Embedded design mitigation and standard good practice measures are included throughout the lifecycle phases of the Proposed Development to reduce the potential for environmental effects. An overview of these measures is provided in this section.

5.2 Construction

5.2.1 At this stage in the Proposed Development, detailed construction design and logistics are still under development and therefore cannot be fully reflected in the GHG assessment. However, a range of construction and procurement strategies are actively being explored to reduce GHG emissions across the full construction lifecycle of the Proposed Development. A comprehensive list of mitigation opportunities will be reviewed with design teams and will inform the GHG assessment undertaken as part of the ES.

5.2.2 Key embedded mitigation measures included in the PEIR assessment include:

- Use of a brownfield site, reducing the need for extensive demolition and associated emissions; and
- Use of modular and prefabricated construction approaches to reduce on-site energy use and waste generation.

5.2.3 These embedded measures reflect the principles of the PAS 2080 carbon reduction hierarchy (specifically “Avoid” and “Switch”) (Ref 23). They are intended to ensure that construction emissions are minimised as far as practicable, supporting the Proposed Development’s alignment with the UK’s Net Zero trajectory.

Construction Environmental Management Plan (CEMP)

5.2.4 The development and implementation of a Construction Environmental Management Plan (CEMP) is a key measure proposed by the Applicant to assist in reducing GHG emissions during the construction phase. The CEMP will set out how construction activities will be controlled through relevant regulations, industry good practice, and specific mitigation measures.

5.2.5 While the CEMP will be secured within the DCO, it is not available at the

PEIR stage. An outline CEMP (oCEMP) will be prepared and submitted with the DCO application. The appointed contractor(s) will be required to implement the final CEMP during construction.

5.2.6 The oCEMP is expected to include measures such as:

- Monitoring and reporting of energy consumption and GHG emissions during construction;
- Encouraging the use of construction materials with lower embodied carbon (e.g. higher recycled content); and
- Implementation of a Construction Workers Travel Plan (CWTP) to promote sustainable transport options, including public transport, cycling and car sharing. An outline CWTP (oCWTP) is included with the PEIR application.

5.2.7 It should be noted that the scope and content of the CEMP are subject to change and refinement during the ES stage, as the design of the Proposed Development and associated mitigation measures evolve.

5.3 Operation

5.3.1 The Proposed Development is inherently designed to reduce lifecycle greenhouse gas emissions in the aviation sector. As the UK's first commercial-scale, second-generation low-carbon SAF production facility, it will convert over 1 million tonnes of sustainably sourced biomass into approximately 180 million litres of advanced SAF and 30 million litres of renewable naphtha per annum. This represents a significant embedded (albeit indirect) mitigation measure, as the use of low-carbon SAF results in substantially lower lifecycle emissions compared to conventional jet fuel, while renewable naphtha can displace fossil-derived feedstocks in the chemicals sector.

5.3.2 In addition to the decarbonisation benefits of the products themselves, the Proposed Development incorporates embedded design features to minimise operational emissions. These include:

- On-site generation of low-carbon electricity and steam via a biomass-fired Combined Heat and Power (CHP) plant;
- Use of sustainably sourced feedstocks in line with SAF Mandate criteria; and
- Efficient logistics and transport strategies to reduce emissions from feedstock and product movement.

5.3.3 These embedded measures align with the PAS 2080 (Ref 23) carbon reduction hierarchy (specifically "Switch" and "Improve"), supporting the UK's Net Zero Strategy and Jet Zero ambitions.

5.4 Decommissioning

5.4.1 To ensure alignment with national climate targets, a Decommissioning Environmental Management Plan (DEMP) will be prepared at the time of decommissioning. The DEMP will set out best practice measures to minimise GHG emissions, including:

- Reuse and recycling of plant, equipment and materials;
- Sustainable waste management practices; and
- Low-emission demolition and transport methods.

5.4.2 The scope and content of the DEMP will be informed by additional survey and assessment work undertaken as part of the Environmental Impact Assessment Report (EIAR) and will reflect best practice guidance available at the time. As such, the embedded mitigation measures described here are indicative and subject to refinement in the ES.

6. Likely Impacts and Effects of the Proposed Development

6.1 Overview

6.1.1 This chapter assesses the GHG emissions arising from the Proposed Development. The first section of the chapter explains the important parameters, assumptions and limitations for the GHG assessment, while a second section discusses the emissions for the different lifecycle phases of the Proposed Development.

6.2 Project parameters, assumptions and limitations

6.2.1 This section identifies the assumptions and limitations made for the preliminary GHG assessment, including those related to the availability of data to inform the assessment and assumptions used in the methodology. All assessed effects in this chapter are preliminary and will be revisited in the ES depending on the availability of data at that stage. Assumptions and limitations identified in relation to the preliminary GHG assessment are as follows:

Construction

- Construction material quantities, such as volumes of concrete and steel, are based on an early design stage bill of quantities provided by the Applicant. This bill of quantities is assumed to cover all assets built within the Draft Order Limits but will be further refined in the ES.
- Distances for transporting the construction materials to the site (Module A4) were not available at the time of this assessment. Therefore, the default transport scenarios defined by the RICS Professional Standard (Ref 24) are used.
- Pre-construction demolition activities (Module A5) include the demolition of two jetties along the frontage with the River Tees. Due to data limitations, pre-construction demolition activities have been modelled following the general assumptions outlined in the RICS Professional Standard (Ref 24). The assumptions consider a fixed impact per m^2 GIA of the Proposed Development. In the ES project-specific data will be considered.
- Due to data limitations, construction activities (Module A5) have been modelled following the general assumptions outlined in the RICS Professional Standard (Ref 24). The assumptions consider a fixed impact per m^2 GIA of the Proposed Development. In the ES project-specific data will be considered.

- Construction waste materials and quantities (Module A5) are based on an early design stage bill of quantities provided by the Applicant. This bill of quantities will be further refined in the ES.

Operation

- To assess the GHG emissions related to maintenance (Module B2) and repair (Module B3), the assumptions outlined in the RICS Professional Standard (Ref 24) are followed. These assumptions consider a fixed impact per m^2 GIA of the Proposed Development.
- Data for the operational energy use (Module B6), operational water use (Module B7) and activities related to the production and distribution of low-carbon SAF (Module B8) are based on indicative figures provided by the Applicant. The SAF produced by the Proposed Development will in any event need to comply with the requirements of the Renewable Transport Fuel Obligations Order (RTFO) guidance (Ref 15 and Ref 16).
- All electricity used by the LGF plant (Module B6) (e.g., lighting, kitchens, electrical equipment/machinery, etc) is assumed be supplied by the biomass CHP plant. Therefore, GHG emissions associated with Module B6 are upstream emissions related to the harvesting, processing and transport of the required biomass.

Decommissioning

- GHG emissions for the deconstruction and demolition (Module C1) of the Proposed Development are based on the general scenario defined by the RICS Professional Standard (Ref 24). These assumptions consider a fixed impact per m^2 GIA of the Proposed Development.
- Demolition waste materials and quantities (Module C2-4) are based on an early design stage bill of quantities provided by the Applicant. This bill of quantities will be further refined in the ES.

6.2.2 For a more complete list of data assumptions and limitations related to the GHG assessment see Appendix 14A: Data and assumptions (PEIR Volume 3).

6.3 Preliminary assessment of likely significant effects

6.3.1 This section reports the preliminary assessment of effects on the global climate as a result of the estimated GHG emissions associated with the Proposed Development prior to the application of additional mitigation measures. As noted, assessments reported within this PEIR chapter are considered a reasonable 'worst case' as a precautionary approach has been taken. Where provisional likely significant effects are identified at this stage, these may ultimately be determined as not significant in the ES once data gaps are addressed, and the design and mitigation are further developed.

6.3.2 As reported in Section 4, the GHG emissions in the future baseline scenario are assumed to be zero. Because the future baseline assumes zero emissions, all GHGs produced by the Proposed Development are considered additional. This means that the net change in GHG emissions from the future baseline to the Proposed Development is equivalent to the total lifecycle emissions estimated for the Proposed Development.

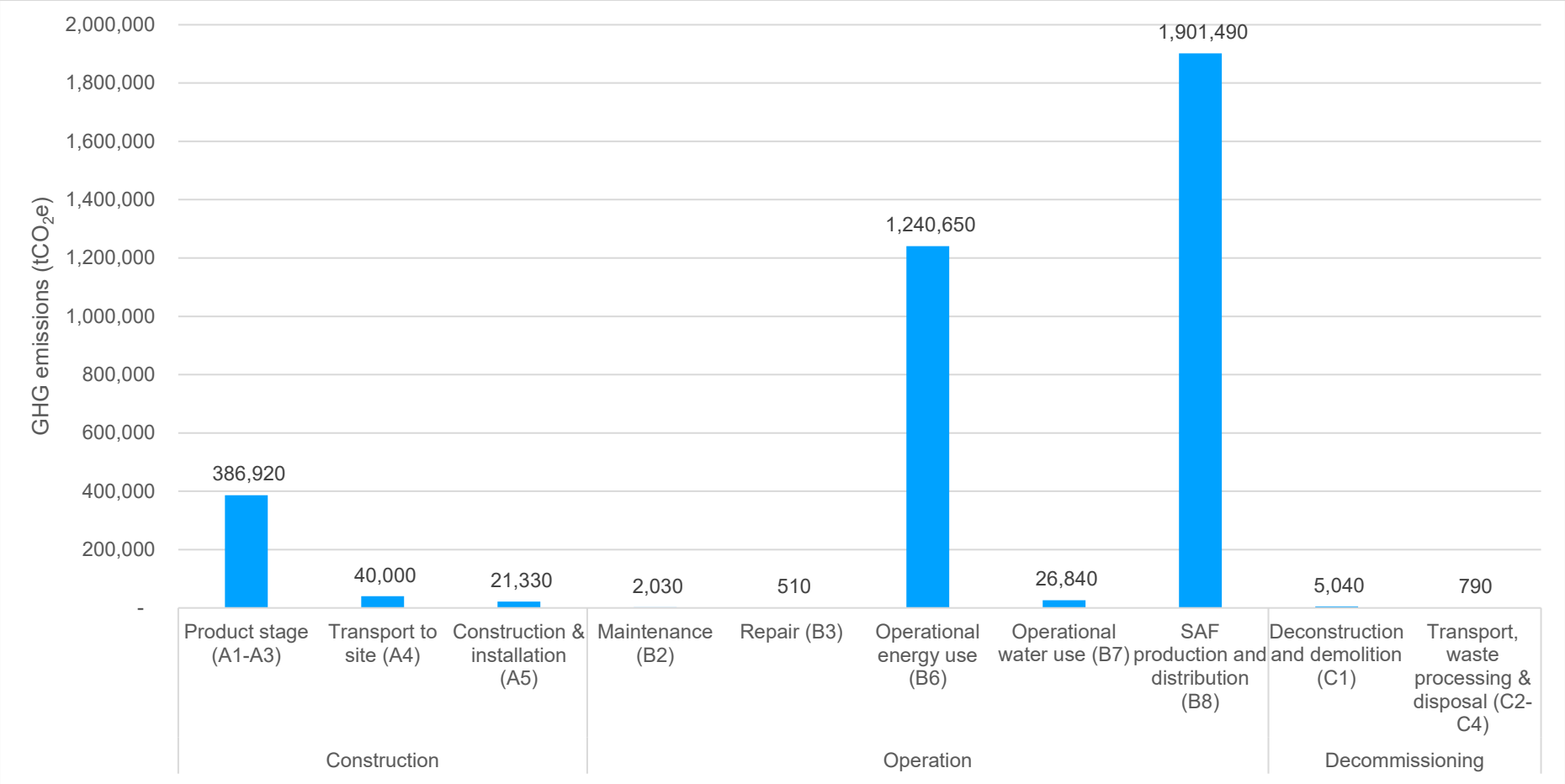
6.3.3 A breakdown of the GHG emissions according to the different life cycle phases of the Proposed Development is provided in Table 6-1 and Inset 6-1.

Table 6-1 Preliminary GHG emissions per lifecycle phase of the Proposed Development

Lifecycle module	Source of emissions	GHG emissions (tCO_2e)[i]
A1-A3 Product stage	Extraction, transportation and manufacture of construction materials	386,920
A4 Transport to site	Transport of construction materials to site	40,000
A5 Construction and installation	Pre-construction demolition	40
	Construction activities	20,140
	Transport and disposal of construction waste	1,150
B2 Maintenance	Maintenance activities	2,030
B3 Repair	Repair activities	510
B6 Operational energy use	Energy use associated with the operation of the Proposed Development	1,240,650
B7 Operational water use	Potable water	26,840
B8 Other activities associated with low-carbon SAF production and distribution	Biomass cultivation, collection and transport to pellet production plant	825,090
	Pellet production and pellet and waste biomass transport to LGF plant	859,630
	Materials, gases and chemicals utilised during LGF plant operation	74,320
	Transport, processing and disposal of operational waste from LGF plant	24,770

[i] Figures are rounded to the nearest 10. As a result, totals may not precisely match the sum of individual lifecycle modules.

Lifecycle module	Source of emissions	GHG emissions (tCO_2e)[i]
	Carbon dioxide released from chemical processes during LGF plant operation	57,810
	Transport and distribution of low-carbon SAF produced at the LGF plant	59,870
C1 Deconstruction/demolition	Deconstruction and demolition activities	5,040
C2 Transport	Transport, processing and disposal of demolition waste	790
C3 Waste processing for reuse, recycling or recovery		
C4 Disposal		
Total Construction (Module A)		**448,250**
Total Operation (Module B)		**3,171,510**
Total Decommissioning (Module C)		**5,830**
Total Lifecycle (Modules A-C)		**3,625,590**



Inset 6-1 Preliminary GHG emissions for the lifecycle phases of the Proposed Development

6.3.4 The breakdown of the GHG emissions of the Proposed Development shows that the vast majority is related to its operational phase, accounting for roughly 88% of the total footprint. This is followed by its construction phase, which accounts for 12%, and finally its decommissioning phase, which contributes less than 1% of total emissions.

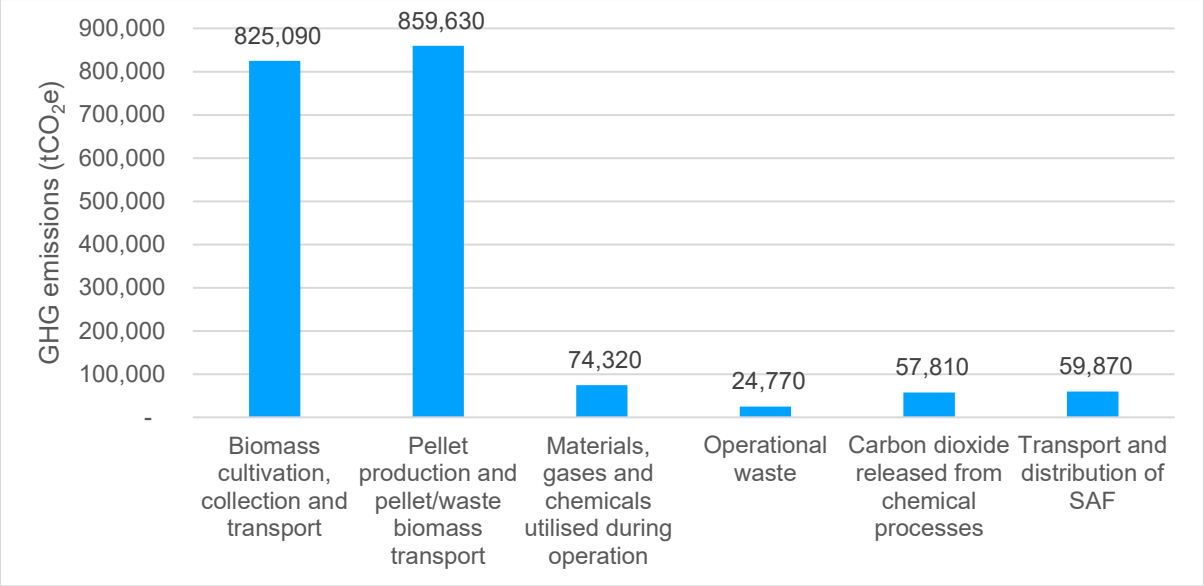
Construction

6.3.5 The construction phase of the Proposed Development is estimated to result in 0.45 $MtCO_2e$, equivalent to roughly 12% of the total lifecycle emissions. Within the construction phase, the production of the construction materials (module A1-A3) is estimated to have the highest contribution (86%).

Operation

6.3.6 The operational phase of the Proposed Development is estimated to result in 3.17 $MtCO_2e$. This is equivalent to approximately 88% of the total lifecycle emissions associated with the Proposed Development. Within this phase, activities associated with low-carbon SAF production and distribution (Module B8) represent the largest contribution, accounting for approximately 60% of total emissions, followed by operational energy use (Module B6) at 39%.

6.3.7 As shown in Table 6-1, the Module B8 activities can be further subdivided into submodules representing the various steps of low-carbon SAF production and distribution. Inset 6-2 shows the GHG emissions associated with each of these submodules.



Inset 6-2 GHG emissions associated with each of submodules of Module B8 user activities related to low-carbon SAF production.

Decommissioning

6.3.8 The decommissioning of the Proposed Development is estimated to result in 5,830 tCO_2e, corresponding to less than 1% of the lifecycle emissions associated with the Proposed Development. It is anticipated that emissions from the decommissioning phase will in reality be less than estimated at the time of this assessment due to future decarbonisation of surface transport, for example.

6.4 Significance of effects

Contextualisation of GHG Emissions

6.4.1 Table 6-2 presents the estimated absolute GHG emissions from the Proposed Development, grouped according to the five-year UK Carbon Budget periods (Ref 3) during which they are expected to occur. This includes the 7th Carbon Budget period, which has not yet been formally adopted by the UK Government. Since the Proposed Development will be operational beyond 2042, the last year of the 7th carbon budget, indicative 8th and 9th carbon budgets based on the CCC's Balanced Net Zero Pathway have been included. The table also illustrates the relative contribution of the Proposed Development's estimated GHG emissions to each relevant Carbon Budget.

Table 6-2 Proposed Development's GHG emissions contextualized against the UK Carbon Budgets

Carbon budget period	Carbon Budget Limit (tCO_2e)	Indicative Carbon Budgets based on the CCC's Balanced Net Zero Pathway (tCO_2e)	Proposed Development emissions within budget period (tCO_2e)	Total as percentage of CCC carbon budget (%)
4th carbon budget (2023 to 2027)	1,950,000,000		112,060	0.01%
5th carbon budget (2028 to 2032)	1,725,000,000		547,620	0.03%
6th carbon budget (2033 to 2037)	965,000,000		528,590	0.05%
7th carbon budget (2038 to 2042)	535,000,000		528,590	0.1%
8th carbon budget (2043 to 2047)		219,000,000	528,590	0.2%
9th carbon budget (2048 to 2052)		24,000,000	528,590	2%

6.4.2 The relative contribution of the Proposed Development's emissions to the Carbon Budgets is small for all periods, with a maximum of 0.1% for the carbon budget periods (and a maximum of 2% for the indicative carbon budgets).

6.4.3 From 2050 on, the goal for the UK is to align with Net Zero GHG emissions, with any residual emissions balanced by removals. The Proposed Development is estimated to emit 851,560 tCO_2e from 2053 until its decommissioning in 2060.

6.4.4 The Carbon Budgets accommodate development and activity at a national scale, and are intended to inform national policy, development and action. As a result, almost all individual projects when compared to the budgets appear small and are only a fraction of the allocated budget. The IEMA guidance (Ref 20) also encourages a more sector-specific contextualisation. The Proposed Development's GHG emissions have also been contextualised against the CCC's Balanced Pathway trajectory for both the Aviation and Fuel Supply sectors. For both sectors, indicative "carbon budgets" following the same time horizons as the UK carbon budgets have been set out in Table 6-3 and Table 6-4. While the CCC's Balanced Pathway provides indicative emissions trajectories for sectors such as aviation and fuel supply, these are not formal carbon budgets and

are presented here for contextualisation purposed only.

6.4.5 Table 6-3 compares the GHG emissions of the Proposed Development with the indicative carbon budgets for the Aviation sector. The table shows that, as with the UK carbon budgets, the GHG emissions of the Proposed Development have a small relative contribution to the Aviation sector indicative carbon budgets, never exceeding 0.6%.

Table 6-3 Proposed Development's GHG emissions contextualized against the CCC Balanced Pathway for the Aviation sector

Indicative carbon budget period	Indicative Carbon Budgets Based Upon the CCC's Balanced Net Zero Pathway (tCO_2e)	Proposed Development emissions within budget period (tCO_2e)	Total as percentage of CCC carbon budget (%)
4th carbon budget (2025 to 2027)	107,558,538	112,060	0.1%
5th carbon budget (2028 to 2032)	165,667,342	547,620	0.3%
6th carbon budget (2033 to 2037)	152,836,134	528,590	0.3%
7th carbon budget (2038 to 2042)	145,648,851	528,590	0.4%
8th carbon budget (2043 to 2047)	130,490,806	528,590	0.4%
9th carbon budget (2048 to 2052)	95,118,683	528,590	0.6%

6.4.6 Table 6-4 compares the estimated GHG emissions of the Proposed Development with the indicative carbon budgets for the Fuel Supply sector. The Proposed Development's estimated emissions represent a relatively small proportion of the indicative budgets up to the 2040's. Beyond the 2040's, the Proposed Development is estimated to contribute a larger proportion of the indicative carbon budgets, including approximately 9% for the indicative 9th carbon budget.

6.4.7 It should be noted that these budgets are indicative only, and while the CCC's Balanced Pathway provides indicative emissions trajectories for sectors such as aviation and fuel supply, these are not formal carbon budgets and are presented here for contextual comparison only. Additionally, the emissions estimated for the Proposed Development reflect a precautionary worst-case scenario and do not account for future decarbonisation across the SAF production value chain — including upstream and downstream activities such as biomass cultivation, transport, and processing — which is expected to reduce the lifecycle emissions

associated with the low-carbon SAF plant over time.

6.4.8 It is also important to highlight that the emissions reported do not include the avoided emissions expected from the displacement of conventional jet engine fuel by the low-carbon SAF produced by the Proposed Development. These avoided emissions are anticipated to be significant (see following subsection in this chapter) and would materially reduce the net climate impact of the Proposed Development.

Table 6-4 Proposed Development's GHG emissions contextualised against the CCC Balanced Pathway for the Fuel Supply sector

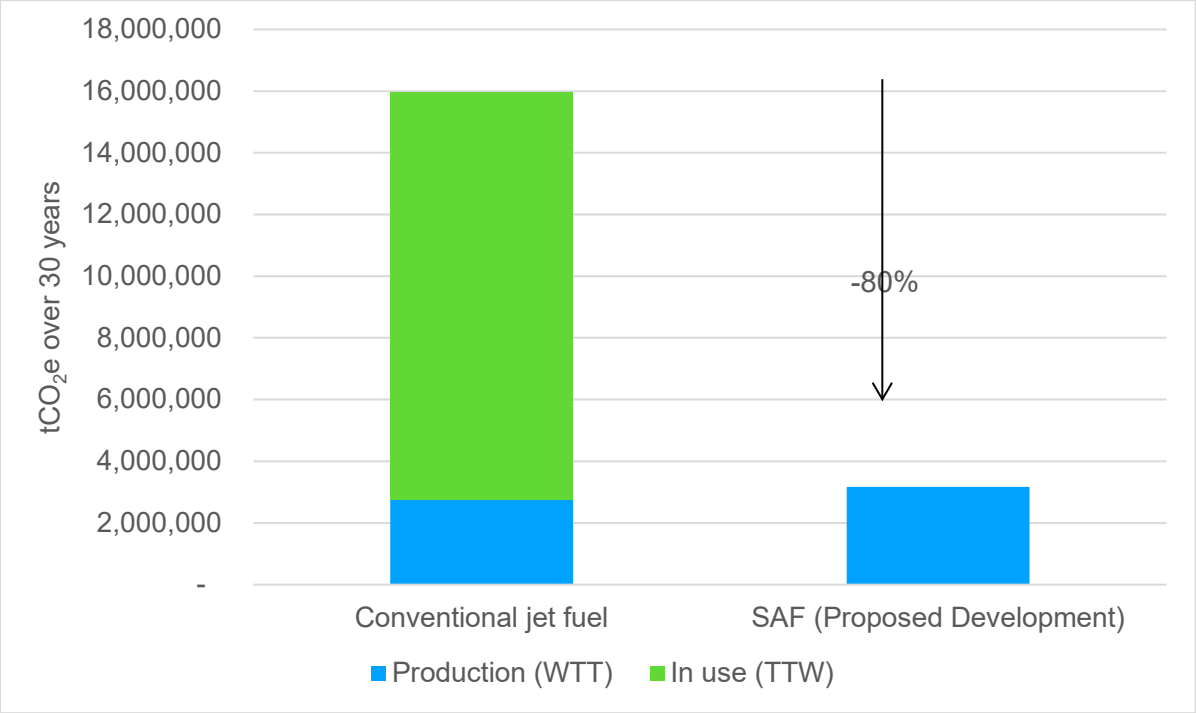
Indicative carbon budget period	Indicative Carbon Budgets Based Upon the CCC's Balanced Net Zero Pathway (tCO_2e)	Proposed Development emissions within budget period (tCO_2e)	Total as percentage of CCC carbon budget (%)
4th carbon budget (2025 to 2027)	75,571,595	112,060	0.2%
5th carbon budget (2028 to 2032)	81,485,054	547,620	0.8%
6th carbon budget (2033 to 2037)	42,982,001	528,590	1%
7th carbon budget (2038 to 2042)	25,684,407	528,590	3%
8th carbon budget (2043 to 2047)	12,400,087	528,590	4%
9th carbon budget (2048 to 2052)	5,245,253	528,590	9%

Comparison of low-carbon SAF versus traditional jet fuel

6.4.9 The primary purpose of the Proposed Development is to produce low-carbon SAF that displaces conventional Jet A-1 fuel, thereby contributing to the decarbonisation of the aviation sector and supporting the UK's SAF Mandate targets. Over its 30-year operational life, the Proposed Development is expected to produce approximately 180 million litres of low-carbon SAF annually, which equates to a significant reduction in lifecycle GHG emissions when compared to an equivalent volume of traditional jet fuel.

6.4.10 As illustrated in Inset 6-3, the lifecycle emissions of the Proposed Development's low-carbon SAF are approximately 80% lower than those of conventional jet (A1) fuel. This displacement results in avoided emissions that are directly attributable to the Proposed Development. Over the full operational period, the cumulative avoided emissions are estimated to be in the region of 12.8 $MtCO_2e$, based on the comparative lifecycle intensity

of low-carbon SAF produced by the Proposed Development and jet (A1) fuel.



Inset 6-3 Carbon impact of the low-carbon SAF produced by the Proposed Development over its 30-year operational period compared to an equivalent amount of traditional jet fuel[ii].

6.4.11 By comparison, the total lifecycle emissions associated with the Proposed Development—including construction, operation, and decommissioning—are approximately 3.6 $MtCO_2e$. This means the Proposed Development is expected to deliver a carbon payback ratio of approximately 3.5:1, whereby for every tonne of GHG emitted across its lifecycle, around three and a half tonnes are avoided through low-carbon SAF displacement of jet (A1) fuel. This represents a substantial net climate benefit.

6.4.12 This payback dynamic is particularly important when considering the construction phase emissions, which are often viewed as a carbon "investment." The construction emissions of approximately 448,250 tCO_2e are expected to be offset within just over one year of operation, based on annual avoided emissions from low-carbon SAF use. This relatively short payback period reinforces the strategic value of the Proposed Development in accelerating aviation sector decarbonisation.

[ii] Note: The comparison includes Well-to-Tank (WTT) and Tank-to-Wheel (TTW) emissions. In line with RTFO and SAF Mandate guidance, biogenic CO_2 emissions from biomass SAF combustion are treated as zero, with upstream carbon uptake assumed to offset downstream release. Non-CO_2 GHGs from combustion (e.g. CH_4, N_2O) are minor and excluded for consistency with indicative figures provided by the Applicant.

6.4.13 Therefore, while the Proposed Development does result in direct GHG emissions, its role in displacing conventional jet fuel leads to a net reduction in atmospheric GHG concentrations. The project not only aligns with the UK's Net Zero Strategy and Jet Zero ambitions but also delivers a strong return on its carbon investment, making it a key enabler of low-carbon aviation.

6.4.14 Furthermore, the UK Jet Zero Strategy sets out how the Government will achieve net zero aviation by 2050. They consider SAF a key lever to decarbonise the aviation sector. Table 6-5 compares the carbon impact of the low-carbon SAF produced by the Proposed Development against an equivalent amount of traditional jet fuel, contextualised within the UK's Jet Zero Strategy interim carbon targets for 2030, 2040, and 2050:

- In 2040, the low-carbon SAF produced by the Proposed Development would account for 0.4% of the Jet Zero interim carbon target, whereas the equivalent amount of traditional jet fuel would represent 2% of the same target; and
- By 2050, SAF contributes 0.4%, while traditional jet fuel would account for 3% of the carbon target.

Table 6-5 Comparison of yearly amount of low-carbon SAF produced by the Proposed Development against an equivalent amount of traditional jet fuel in the context of the interim carbon targets set out by the Jet Zero strategy

Year	Interim carbon target (tCO_2e)	Traditional jet fuel - Percentage of carbon target (%)	SAF - Percentage of carbon target (%)
2030	35,400,000	0%	0%
2040	28,400,000	2%	0.4%
2050	19,300,000	3%	0.5%

6.4.15 The SAF Mandate is the UK's key policy for decarbonising aviation fuel. It aims to stimulate the production and use of SAF by setting minimum percentages of SAF in the overall UK aviation fuel mix from 2025 to 2040. Table 6-6 quantifies how the Proposed Development contributes to the SAF blending targets UK's SAF Mandate:

- In 2030, the UK SAF Mandate requires 1.2 Mtpa of SAF (10% of total UK aviation fuel demand). The Proposed Development is not yet operational, so its contribution is 0%; and
- In 2040 and 2050, the mandate requires 2.6 Mtpa of SAF (22% of total aviation fuel). The Proposed Development is expected to produce 0.14 Mtpa, which equates to 5% of the mandated requirement.

6.4.16 This shows that the Proposed Development will be a significant contributor

to the SAF Mandate targets from 2040 onwards. While not sufficient on its own to meet the mandate, it represents a substantial share of the required SAF volume.

Table 6-6 UK SAF Mandate sets required percentages for the amount of SAF in the overall UK aviation fuel mix.

Year	Target (%)	Required SAF (Mtpa)	Produced SAF by Proposed Development (Mtpa)	% of required SAF produced by Proposed Development
2030	10%	1.2	0	0%
2040	22%	2.6	0.14	5%
2050	22%	2.6	0.14	5%

Significance conclusion

6.4.17 The key challenge to concluding whether a project's GHG emissions are significant or not is determining whether these support or undermine a UK trajectory to net zero i.e. does the project hinder the UK's ability to achieve its legally binding net zero target by 2050. It is, hence, the role of the competent professional carrying out the assessment to consider the scale of changes in emissions, the context within which these are expected to occur, the mitigation undertaken to minimise negative impacts and the overall alignment of the project with the UK's carbon targets.

6.4.18 The Proposed Development is expected to result in approximately 3.6 $MtCO_2e$ of lifecycle emissions. However, its primary purpose is to produce low-carbon SAF that displaces conventional Jet (A1) fuel, mitigating GHG emissions by delivering an estimated 12.8 $MtCO_2e$ of avoided emissions over its 30-year operational life. This equates to a carbon payback ratio of approximately 3.5:1, whereby for every tonne of GHG emitted across its lifecycle, around three and a half tonnes are avoided through SAF displacement of jet (A1) fuel. Further, it is estimated that construction emissions are offset by the avoided emissions within just over 1 year of operation.

6.4.19 When contextualised against the UK's Carbon Budgets and the CCC's Balanced Pathway, the Proposed Development's emissions remain below 2% of any five-year budget period. These emissions are therefore not considered material at a national scale.

6.4.20 Importantly, the Proposed Development supports the UK's Jet Zero Strategy and SAF Mandate. From 2040 onwards, it is expected to supply 5% of the UK's mandated SAF requirement, making it a significant enabler

of aviation decarbonisation.

6.4.21 In line with the IEMA guidance (Ref 20), the Proposed Development is considered, within this preliminary assessment, to have a **likely minor adverse not significant effect** on greenhouse gases. This is due to its role in displacing fossil-derived aviation fuel and supporting national decarbonisation targets. It is consistent with existing and emerging aviation policy requirements necessary to achieve the UK's trajectory towards net zero.

7. Additional Mitigation and Enhancement Measures

7.1.1 The Proposed Development is considered, within this preliminary assessment, to have a likely minor adverse not significant effect on greenhouse gases. Because the Proposed Scheme aligns and supports the aviation sector's drive towards net zero, no additional mitigation is proposed.

8. Residual Effects and Conclusions

8.1.1 No significant effects have been identified and as a result the assessment of residual effects remains the same as those reported in Section 6.4. The Proposed Development is considered to have a likely minor adverse not significant effect on GHGs.

9. Next steps

9.1.1 The next steps anticipated to be undertaken in relation to the GHG assessment prior to completion of the ES and submission of the DCO application are:

- At the PEIR stage, general assumptions were made for certain lifecycle phases of the Proposed Development. Further data collection will take place, and the ES will be based on project-specific data and assumptions as much as possible;
- Future carbon capture and storage (CCS) potential: Carbon dioxide from the Biomass CHP plant and thermal pretreatment could be captured, purified, compressed using a separately consented on-site carbon capture and compression plant and then transported for permanent storage via a possible potential future connection to the Northern Endurance Partnership's CO_2 Gathering Network pipeline which will run through and adjacent to the Main Site. This would enable the Proposed Development to further reduce direct GHG emissions produced on site. This is not part of the current consent but represents a credible future enhancement; and
- To date, engagement with stakeholders on GHG emissions has focused on the methodology that was set out in the Scoping Report. The Project team will next seek to consult with all relevant local authorities and parties on the GHG emissions assessment and proposed mitigation measures.

10. Summary of Significant Effects

10.1 Introduction

10.1.1 Summaries of the potential significant effects associated with the construction, operation and decommissioning of the Proposed Development are presented in Table 10-1.

Table 10-1 Summary of significance effects for construction, operation and decommissioning

Potential Impact	Receptor	Importance	Magnitude of Impacts	Likely Significant Effects	Proposed Mitigation	Residual Effects
GHG emissions	Global atmosphere	High	3.6 $MtCO_2e$ emitted, and 12.8 $MtCO_2e$ avoided	Likely minor adverse not significant effect	None	Likely minor adverse not significant effect

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