Statutory Consultation 2022

Preliminary Environmental Information Report

Volume 2: Main Report

Chapter 12: Greenhouse Gases

Contents

Tables

Insets

12 GREENHOUSE GASES

12.1 Introduction

12.1.1 This chapter presents the preliminary assessment of likely significant effects of Greenhouse Gas (GHG) emissions arising from the Proposed Development during construction and operation. As assessment of Climate Change Resilience (i.e. the impact of the future climate changes on the Proposed Development) is presented in **Chapter 9**.

12.1.2 GHG emissions are used as a measure and indicator of the Proposed Development's impact on climate. The increase in concentration of GHG emissions in the global atmosphere is causing a change in climatic conditions creating climate change impacts. Any GHG emissions arising as a result of the Proposed Development will therefore have an impact on climate change.

12.1.3 The Environmental Impact Assessment (EIA) Scoping Report available in **Appendix 1.1** in Volume 3 of this PEIR sets out the proposed scope for the assessment of Greenhouse Gases. In summary, the following have been assessed in this assessment as part of the Preliminary Environmental Information Report (PEIR):

a. GHG impact assessment: the effects on the climate of GHG emissions arising from the Proposed Development, including how the Proposed Development would affect the ability of the UK government to meet its carbon reduction targets and budgets. The assessment considers emissions from:

   i. construction activities;
   ii. airport operations;
   iii. surface access journeys; and
   iv. air traffic movements (including landing take-off (LTO) up to 3000ft and climb, cruise, descent (CCD) emissions above 3000ft for departing flights).

   Table 12.6 provides further details of the full range of activities and operations taken into account under each of these categories.

b. Decommissioning of the airport was scoped out of the assessment due to the length of the expected lifetime of the Proposed Development, as agreed in the EIA Scoping Opinion. The airport is anticipated to last beyond its design life and by the time it is decommissioned, the UK will be net zero. This leads to a high level of uncertainty, as it is not possible to say with any certainty how the airport would be decommissioned.

12.1.4 The remainder of this chapter consists of:

a. **Section 12.2** Legislation, policy and guidance relevant to the scope and methodology of the Greenhouse Gases preliminary assessment;

c. **Section 12.3** Scope of the assessment;

d. **Section 12.4** Stakeholder engagement undertaken to inform the preliminary assessment;

e. **Section 12.5** Methodology applied to the preliminary assessment;
f. **Section 12.6** Assumptions and limitations at this stage of work;
g. **Section 12.7** Baseline conditions;
h. **Section 12.8** Embedded and good practice mitigation;
i. **Section 12.9** Preliminary assessment;
j. **Section 12.10** Additional mitigation;
k. **Section 12.11** Residual effects;
l. **Section 12.12** Offsetting**;**
m. **Section 12.13** In-combination climate change;
n. **Section 12.14** Monitoring;
o. **Section 12.15** Assessment summary; and
p. **Section 12.16** Completing the assessment - remaining work to complete the EIA for the Environmental Statement (ES) to be submitted with the application for development consent.

12.2 Legislation, policy and guidance

12.2.1 This section identifies the key legislation, policy and guidance relevant to the scope and methodology for the GHG assessment which may influence the type of mitigation measures that could be incorporated into the Proposed Development during construction and/or operation.

12.2.2 **Table 12.1** to **Table 12.4** provide descriptions of the relevant legislation, policy and guidance, and identify how and where each of these have been addressed in the PEIR.

Legislation

Table 12.1: Greenhouse Gases legislation

Legislation	How and where addressed in PEIR
The Paris Agreement (Ref. 12.1) is a legally binding international treaty within the United Nations Framework Convention on Climate Change (UNFCCC) dealing with GHG emissions mitigation, adaptation and finance starting in the year 2020. It requires all signatories to declare their Nationally Determined Contributions (NDC) towards balancing anthropogenic sources and sinks of GHGs in the second half of this century with the objective of keeping global warming to well below 2°C and to pursue efforts to limit global warming to 1.5°C.	Since its withdrawal from the EU, the UK Government declares its own NDC setting out its climate change obligations under the Paris Agreement and the climate change target and budgets set under the Climate Change Act 2008. **Section 12.9** presents an assessment to identify the impact of the Proposed Development on the UK meeting its climate change target and five-yearly carbon budgets. In support of this the embedded and additional mitigation measures of the Proposed Development are set out in the **Section 12.8** and **Section 12.10.**
The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Ref. 12.2) requires a description of the factors "*likely to be significantly affected by the development*" including climate (for example greenhouse gas emissions and impacts relevant to adaptation) (Schedule 4 (Paragraph 4)) and 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" (Schedule 4 (paragraph 5(f)).	This PEIR follows the process for assessment within the regulations. Likely significant effects of climate change with the embedded and good practice mitigation measures are presented in the **Section 12.9.**
The Climate Change Act 2008 and Climate Change Act 2008 (2050 Target Amendment) Order 2019 (Ref. 12.3)	Embedded and good practice mitigation measures have been identified in **Section 12.8.**

Legislation	How and where addressed in PEIR
The Climate Change Act 2008 (hereafter referred to as the 'Act') originally set a legally binding target for the UK to reduce its GHG emissions from 1990 levels by at least 80% 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. An independent body, the Climate Change Committee (CCC), was established to monitor progress. The Act was amended in June 2019 to revise the 80% reduction target to 100% by 2050, compared to 1990 levels (through the Climate Change Act 2008 (2050 Target Amendment) Order 2019). Section 30 of the Act addresses emissions from international aviation and international shipping.	An assessment of the impact of the Proposed Development against the Government's carbon target and budgets is set out in **Section 12.9.** Following the tables set out here in **Section 12.2**, a summary description is provided for how the Proposed Development GHG assessment is presented within the national context and the Climate Change Act and the Secretary of State's legal obligations defined by it (**Section 12.2.6**).
The Carbon Budget Order 2021 (Ref. 12.4) In June 2021, the UK Government passed into law the sixth carbon budget, in line with the recommendation of the CCC. The budget for the years 2033-37 is 965 Mt CO_2e[1]. For the first time the sixth carbon budgets includes international aviation and shipping emissions. Prior to this UK carbon budgets included only domestic aviation emissions and left 'headroom' within the budget to account for international aviation (and shipping) emissions. The Sixth Carbon Budget does not provide a separate allowance for aviation. The CCC's Sixth Carbon Budget Report did set out a range of different scenarios for the growth on aviation to meet the 'net zero' target (Ref. 12.5), but these scenarios have not been adopted as Government policy. Outturn emissions from aviation in 2050 vary widely across these scenarios[2].	An assessment of the impact of the Proposed Development against the Government's carbon budgets is set out in the **Section 12.9.**
The Air Navigation (Carbon Offsetting and Reduction Scheme for International	Aircraft operators are responsible for carbon emissions associated with flights

[1] A megatonne (Mt) is equivalent to 1,000,000 metric tonnes

[2] The Jet Zero consultation also includes a range of potential emissions scenarios for aviation which represent additional modelling from UK Government, and which include potential trajectories reflecting technology improvements and SAF uptake.

Legislation	How and where addressed in PEIR
Aviation) Order 2021 (Ref. 12.6) came into force on 26 May 2021 and it implements the International Civil Aviation Organisation (ICAO) Carbon Offsetting Reduction Scheme for International Aviation (CORSIA) (Ref. 12.7) in the UK and contains duties for aeroplane operators, verification bodies and Regulators in the UK. CORSIA is a global market-based measure whereby offsetting is used to reduce sectoral emissions to agreed levels. Offsetting of CO_2 emissions will be achieved through the acquisition and cancelation of emissions units from the global carbon market by aeroplane operators. CORSIA imposes on aeroplane operators' requirements to: 1) monitor, report and verify CO_2 emissions - operators with annual emissions over 10,000 tonnes of CO_2 are required to annually report their emissions for international flights only. 2) offset CO_2 emissions - from 2021, at the end of each 3-year compliance period, operators must demonstrate that they have met their offsetting requirements by cancelling the appropriate number of emissions units. On 18 January 2021, the Department for Transport (DfT) launched a consultation on Implementing the CORSIA in the UK which closed on 28 February 2021. The Government plan to consult again on detailed proposals for implementing CORSIA offsetting in the UK.	(presented in **Section 12.9)**, therefore, it is not the direct responsibility of individual airport owners (including the Applicant) to meet requirements of CORSIA. CORSIA will apply to both the baseline and Do Something scenarios. The UK policy and legislation regimes are under development to manage and control aviation emissions at a national and global level, within UK climate obligations and carbon budgets. Therefore, CORSIA has not been addressed in this PEIR.
The Greenhouse Gas Emissions Trading Scheme Order 2020 (Ref. 12.8) provides the legislation which implements the UK Emission Trading Scheme (UK ETS), as a replacement to the UK's participation in the EU ETS. The UK ETS is a cap-and-trade mechanism which includes aviation emissions. The aviation routes covered by the UK ETS include UK domestic flights, flights between the UK and Gibraltar, and flights departing the UK to the European	Carbon emissions from aviation are capped at a national level by the UK ETS, CORSIA and, in future, such other mechanisms are UK Government may introduce. Aircraft operators (i.e. airlines) have to operate within this legislative framework . Emissions calculations within this PEIR have been quantified in line with the Airports National Policy Statement (ANPS) and are presented in the **Section 12.9** as domestic or international, and

Legislation	How and where addressed in PEIR
Economic Area conducted by all included aircraft operators, regardless of nationality. Aircraft operators covered by the UK ETS need to surrender a greenhouse gas emission permit for each tonne of CO_2 emitted in a year and have obligations to comply with the conditions in their Environmental Management Plan and monitor their aviation emissions each year. In 2021, the UK Government has consulted on how the UK ETS will integrate with wider industry initiatives to reduce GHG emissions, including a proposed approach to implementing CORSIA in the UK and it covered the detail of the CORSIA MRV provisions (Ref. 12.9).	categorised as traded vs. non-traded carbon emissions under UK ETS.
UK Nationally Determined Contribution (Ref. 12.10). In 2020, the UK communicated its new Nationally Determined Contribution to the UNFCCC pursuant to the Paris Agreement. Within its latest NDC, the UK has committed to reducing GHG emissions by at least 68% by 2030 compared to 1990 levels.	Embedded measures to mitigate the impacts of climate change from the Proposed Development are set out in the **Section 12.8.** An assessment of the impact of the Proposed Development against the Government's carbon target and budgets is set out in the **Section 12.9**.

Policy

Table 12.2: Greenhouse Gases policy

Policy	How and where addressed in PEIR
The National Planning Policy Framework (2021) (Ref. 12.11) (NPPF) sets out the Government's planning policies for England. Policies of relevance to climate change and sustainability assessment include those relating to achieving sustainable development and meeting the challenge of climate change. Paragraph 152 of the NPPF states 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*	The GHG emissions methodology and assessment described in **Section 12.5** and **Section 12.9** respectively have been developed in line with the NPPF guidance. Mitigation measures have been incorporated into the Proposed Development design, construction and operation to minimise and mitigate the impacts of GHG emissions on climate change from the Proposed Development. These are set out in the **Section 12.8** and **Section 12.10**.

Policy	How and where addressed in PEIR
improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure." *Paragraph 154 states 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."* *Paragraph 155 states that:* *"To help increase the use and supply of renewable and low carbon energy and heat, plans should:* *a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);* *b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and* *53 In line with the objectives and provisions of the Climate Change Act 2008. 46* *c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for colocating potential heat customers and suppliers."* Paragraph 157 states that: *"in determining planning applications, local planning authorities should expect new development to: a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable…".*	
The Airports National Policy Statement (ANPS) (Ref. 12.12) sets out the Government's policy on the need for new airport capacity in the South East of England.	Relevant sections of the ANPS are discussed in more detail in **Table 12.3**.

Policy	How and where addressed in PEIR
A Green Future: Our 25 Year Plan to Improve the Environment, 2018, updated 2019 (Ref. 12.13). The 25 Year Plan sets out government action to help the natural world regain and retain good health. It sets out commitment to *'take all possible action to mitigate climate change, while adopting to reduce its impact."*	Measures to minimise and mitigate the impacts of climate change from the Proposed Development are set out in the **Section 12.8** and **Section 12.10.**
The UK Aviation Policy Framework (Ref. 12.14) outlines the Government's policy for the UK aviation sector. With respect to climate change, paragraph 2.4 states that the UK Government's objective is to: *"ensure that the aviation sector makes a significant and cost-effective contribution towards reducing global emissions"*.	Measures to minimise and mitigate the impacts of climate change from the Proposed Development are set out in the **Section 12.8** and **Section 12.10.**
Beyond the horizon: The future of UK aviation. Making best use of existing runways (Ref. 12.15) Published by the Department of Transport (DfT), it represents current UK Government policy on aviation and climate change. It sets out the Government's support for airports (other than Heathrow) making best use of their existing runways subject to related economic and environmental considerations being considered.	This policy states that climate change issues are embedded in, and controlled by, decision-making undertaken at a national level. Aviation emissions are to be appropriately addressed at a national level. The inclusion of international aviation within the Sixth Carbon Budget removes the need for a 'planning assumption' from 2033-37, but does not change the pathway to carbon net zero. This PEIR calculates gross emissions in line with methodology set out in the EIA scoping opinion and the guidance in the ANPS as reported in **Section 12.5** and assessed in **Section 12.9** to determine whether these prejudice the UK's ability to meet the Government's carbon budgets.
Aviation 2050: the future of UK aviation (Ref. 12.16) The Aviation 2050 strategy reviews the climate change policies detailed in the Aviation Policy Framework. Published as a green paper for the consultation which concluded in June 2019, as such, it does not represent currently adopted policy.	This strategy does not represent currently adopted policy therefore has not been addressed in the PEIR.
The Transport Decarbonisation Plan, Decarbonising Transport: a better, greener Britain (Ref. 12.17)	Government commitments that are expected to influence GHG emissions from the airport activities have been accounted for when modelling the Do-

Policy	How and where addressed in PEIR
The plan sets out the government's commitments and actions to further decarbonise the full transport system in the UK before 2050. The strategic priorities included are modal shift and active transport; decarbonisation of road transport; decarbonising the freight system; green transport technology and innovation; place-based solutions; and reducing carbon in the global economy. Relevant commitments to the Proposed Development are as follows: a. To deliver a net zero railway network by 2050, with sustained carbon reductions in rail along the way, including removal of all diesel-only trains (passenger and freight) from the network by 2040. b. To improve rail journey connectivity with walking, cycling and other modes of transport. c. To deliver 4,000 new zero emission buses and the infrastructure needed to support them. d. To invest £2 billion over five years with the aim that half of all journeys in towns and cities will be cycled or walked by 2030.	Minimum (DM) and Do-Something embedded (DS DCO-embedded) study. Those allowed for in the assessment are: a. Uptake of electric vehicles, reduction in diesel and petrol cars. b. New diesel and petrol cars and vans would no longer be sold from 2030, and all new cars and vans must be fully zero emission at the tailpipe from 2035. c. Removal of all diesel-only trains (passenger and freight) from the network by 2040. The strategy has been also considered in mitigation measures described in **Section 12.8** and **Section 12.10** and Draft GHG Management Plan **Appendix 12.1**.
Jet Zero consultation: our strategy for net zero aviation (Ref. 12.18). The Jet Zero Consultation was published alongside the Transport Decarbonisation Plan to seek consultation responses on the Government's proposed approach and principles to reach net zero aviation by 2050. The consultation concluded in September 2021, and responses are currently under review. It is understood that the DfT will publish a summary of responses, including the next steps, around the end of 2021. This will be considered as necessary within the ES accompanying the application. The aim of the Jet Zero Consultation is stated in the Decarbonising Transport strategy (page 10) being for *"aviation to*	Many of the mitigation measures described in the Jet Zero consultation are beyond the power of airport owners to control, such as the introduction of SAFs, the development of more efficient aircraft, or the use of carbon pricing to manage overall passenger demand and encourage low carbon sector innovation; although airports may be able to influence some of these things. Other measures in the Jet Zero consultation, including the implementation of single engine taxiing, and the use of electric motors or tugs for taxiing, have been considered in **Section 12.8** and **Section 12.10.**

Policy	How and where addressed in PEIR
decarbonise in a way that preserves the benefits of air travel and delivers clean growth of the UK sector by maximising the opportunities that decarbonisation can bring". The consultation includes the potential adoption of a net zero target for UK domestic aviation by 2040 in line with recommendations from the Climate Change Committee (CCC). The consultation also proposes to set a CO_2 emissions reduction trajectory for aviation from 2025 to 2050 against which progress can be monitored. It also identifies the role of the UK Government and aviation sector in delivering international leadership in achieving long term goals for GHG emissions. The consultation proposes a suite of policies to support industry across five different measures: a. improving the efficiency of UK's aviation system; b. accelerating the deployment of Sustainable Aviation Fuels (SAF); c. supporting the development of zero emission aircraft; d. using markets to drive down emissions in the most cost-effective way; and e. working to influence the behaviour of consumers. The consultation also includes four illustrative scenarios to reach UK net zero by aviation by 2050 through different technological pathways. The consultation document also specifically addresses non-CO_2 impacts such as contrails and NOx emissions, acknowledging that the scale of the effect from these has a large degree of scientific uncertainty. The consultation notes that many measures to improve efficiencies will help to reduce non-CO_2 emissions, and commits to ensuring that the latest scientific knowledge is used to inform aviation policy.	

Policy	How and where addressed in PEIR
The National Policy Statement for National Networks (Ref. 12.19) sets out the need for development of road, rail and strategic rail freight interchange projects on the national networks and the policy against which decisions on major road and rail projects will be made. Paragraph 5.16 states that: *"Carbon budgets and plans will include policies to reduce transport emissions, taking into account the impact of the Government's overall programme of new infrastructure as part of that."* Paragraph 5.17 explains that any carbon impacts should be included at the option appraisal stage and as part of the EIA for the DCO application, and that applicants should provide evidence of the carbon impacts and assess them against the carbon budgets. Paragraph 5.18 explains how carbon increases from road development are included in the UK carbon budget and state the following: *"any increase in carbon emissions is not a reason to refuse development consent, unless the increase in carbon emissions resulting from the proposed scheme are so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets."* *Paragraph 5.19 states:* *"Evidence of appropriate mitigation measures (incorporating engineering plans on configuration and layout, and use of materials) in both design and construction should be presented. The Secretary of State will consider the effectiveness of such mitigation measures in order to ensure that, in relation to design and construction, the carbon footprint is not unnecessarily high. The Secretary of State's view of the adequacy of the mitigation measures relating to design and construction will be a material factor in the decision-making process."*	The policy has been taken into account in relation to the highway improvements proposed as part of the Proposed Development. The assessment of GHG emissions provides preliminary evidence of the carbon impact against the Government's carbon obligations and quantifies the GHG effects of the Proposed Development, presented in **Section 12.9.** Mitigation measures have been incorporated into the Proposed Development design, construction and operation to minimise and mitigate the impacts of GHG emissions on climate change from the Proposed Development, these are set out in the **Section 12.8** and **Section 12.10.**

Policy	How and where addressed in PEIR
The Luton Local Plan 2011-2031 (Ref. 12.20) The Local Plan discusses challenges faced within transport and climate change. It sets out policies to support delivery of strategic objectives leading to reduction of carbon through waste management, increase energy and water efficiency, and promotion of renewable energy. Strategic Objective 11 aims to increase energy and water efficiency and encourage and promote the use of renewable energy sources and ensure effective waste management. Policy LLP25 - High Quality Design states: *"Proposals will need to demonstrate adherence to the best practice principles of urban design to help create quality places in the Borough. In particular, where the following design criteria are material to an application site, its context and development proposals, provision should be made to: (…) reduce carbon emissions, risk of flooding, and increase energy and water efficiency and quality."* Policy LLP31 - Sustainable Transport Strategy states: *"Support for the continued economic success of London Luton Airport as a transport hub (policy LLP6) will be delivered through: a. measures to ensure there is capacity at strategically important junctions; and continued enhancement of sustainable modes of transport via the Airport Surface Access Strategy."*	Measures to mitigate the impacts of climate change from the Proposed Development are set out in the **Section 12.8** and **Section 12.10.**
Luton Borough Council (LBC) Climate Change Action Plan 'My climate action plan. Becoming a carbon neutral borough by 2040' (Ref. 12.21) The Action Plan sets out actions to reduce carbon emissions and increase carbon sequestration arising from the council's operations, measures include encouraging and supporting public and active transport, prioritising active travel when improving local highways, provision of Electric Vehicles (EVs) chargers.	LBC's commitments set out in the Plan have been considered for mitigation measures in the **Section 12.8.**

Policy	How and where addressed in PEIR
The Plan also states that LBC are in the process of reviewing Local Transport Plan and coming review of the Local Plan, which will address sustainable transport and environmental standards for new developments.	
Central Bedfordshire Council (CBC) Local Plan 2015 - 2035 (Ref. 12.22) The Local Plan aims to reduce the impact of the proposed developments by at least 10%. It includes the Policy CC1: Climate Change and Sustainability to ensure that new developments contribute to the mitigation of climate change and minimise the lifetime carbon emissions resulting from the development with aim to reduce the impact of the proposed developments by at least 10%.	Embedded measures to minimise and mitigate the impacts of climate change from the Proposed Development are set out in the **Section 12.8.** Additional mitigation measures are presented in and **Section 12.10** together with emissions reduction in Scope and 2 from these additional measures**.**
North Hertfordshire District Council (NHDC) Proposed Submission Draft Local Plan for 2011-2031(Ref. 12.23). The submission draft Plan addresses the climate change by setting out policies to mitigate effects of climate change through efficient use of natural sources, use of sustainable construction techniques, use of renewable energy technologies.	Measures to mitigate the impacts of climate change from the Proposed Development are set out in the **Section 12.8** and **Section 12.10.**

12.2.3 The Airports National Policy Statement (ANPS) (Ref. 12.24) does not have effect in relation to an application for development consent for an airport development not comprised of an application relating to the Heathrow Northwest Runway. Nevertheless, as set out within paragraph 1.41 of the ANPS, the Secretary of State considers that the contents of the ANPS will be both important and relevant considerations in the determination of such an application, particularly where it relates to London or the south east of England.

12.2.4 Accordingly, whilst the ANPS does not have effect in relation to the Proposed Development, it will be an important and relevant consideration in the determination of the application for development consent. A summary of the relevant provisions for the GHG assessment and how and where these have been addressed in this PEIR is provided within **Table 12.3**.

Table 12.3: How relevant Greenhouse Gases requirements of ANPS are addressed in the PEIR

ANPS Section	How and where addressed in PEIR
Paragraph 5.74 recognises that the carbon impact of airport development falls into four areas namely: *"air transport movements (both international and domestic) as a result of increased demand, emissions from airport buildings and ground operations, emissions from surface transport accessing the expanded airport; and emissions caused by construction."*	The GHG assessment considers the four areas of carbon impact named in the ANPS. This is covered in **Section 12.5**.
Paragraph 5.76 sets out the considerations that will need to be taken into account for an assessment of GHG emissions, including the quantification of impacts. 5.76 requires the applicant to: a. *"Provide evidence of the carbon impact of the project (including embodied carbon), both from construction and operations such that it can be assessed against the Government's carbon obligations, including but not limited to carbon budgets.* b. *Quantify GHG impacts before and after mitigation to show the impacts of the proposed mitigation.* c. *Split emissions into traded and nontraded sector."*	The construction and operational GHG impact of the Proposed Development is set out in **Table 12.31 and Section 12.9** which includes GHG emissions for Do-Minimum (i.e. the Proposed Development is not consented) and Do- Something with embedded mitigation scenarios, as well as emissions split into traded and non-traded sectors for aviation. An assessment of the impact of the Proposed Development against the Government's carbon obligations including the carbon budgets is set out in **Section 12.9.**
Paragraph 5.77 states that the applicant's assessment should seek to quantify impacts including: a. *"Emissions from surface access due to airport and construction staff;* b. *Emissions from surface access due to freight and retail operations and construction site traffic;* c. *Emissions from surface access due to airport passengers/visitors; and* d. *Emissions from airport operations including energy and fuel use.* *This should be undertaken in both a 'Do-Minimum' and 'Do-Something' scenario for*	GHG emissions impacts for each of the required emissions sources are presented in **Table 12.20** to **Table 12.23**. These tables present Do-Minimum and Do-something with embedded mitigation scenarios for the year of opening, year of peak operation and the worst-case scenario.

ANPS Section	How and where addressed in PEIR
the opening, peak operation and worst-case scenarios."	
Paragraph 5.78 states that the Secretary of State needs to be satisfied that mitigation measures are acceptable and provides a list of suggested measures for inclusion. 5.78 suggests *"a management /project plan may help clarify and secure mitigation at this stage".*	Mitigation measures suggested in the policy have been considered in the embedded and additional measures to mitigate GHG emissions from the construction and operation of the Proposed Development which are presented in **Section 12.8** and **Section 12.10.** These measures have been collated into the Draft GHG Management Plan available in **Appendix 12.1** in Volume 3 of this PEIR. Next steps will see close working with the Project design teams to confirm any further mitigation measures which will be presented in the final ES.
Paragraph 5.82 specifies that: *"Any increase in carbon emissions alone is not a reason to refuse development consent, unless the increase in carbon emissions resulting from the project is so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets, including carbon budgets."* Paragraph- 5.83 set outstates that: *"The Secretary of State's view of the adequacy of the mitigation measures relating to design, construction and operational phases will be a material factor in the decision-making process.*	Following the tables set out here in **Section 12.2**, a summary description is provided (from **Section 12.2.5**) for how the Proposed Development GHG assessment is being carried out including the assessment of significance and for the materiality of its emissions with respect to the Government's ability to meet its carbon reduction targets and budgets as referenced in paragraph 5.82 of the ANPS. Further description to this is also given from **Section 12.9.22**.

Guidance

Table 12.4: Greenhouse Gases guidance

Guidance	How and where addressed in PEIR
National Planning Practice Guidance on Climate Change (Ref. 12.25) This guidance sets out how to identify suitable mitigation and climate adaptation measures to incorporate into the planning process. Paragraph 001 states "*effective spatial planning is an important part of a*	The assessment of significance of effects is outlined in Section 12.5 and has followed the approach in line with the Appraisal of Sustainability (AoS) for the ANPS. Measures to minimise and mitigate the impacts of climate change from the

Guidance	How and where addressed in PEIR
successful response to climate change as it can influence the emission of greenhouse gases." *Paragraph 004 states "Sustainability appraisal can be used to help shape appropriate strategies in line with the statutory duty on climate change and ambition in the Climate Change Act 2008."*	Proposed Development are set out in **Section 12.8** and **Section 12.10.**
Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (Ref. 12.26). This provides guidance on the identification, assessment and subsequent mitigation of life cycle impacts of GHG emissions throughout the Environmental Impact Assessment (EIA) process.	The approach to assessing GHG emissions from construction and operation of the Proposed Development outlined in the **Section 12.5** has been undertaken in accordance with this guidance.
Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Ref. 12.27). Provides a guide for companies to use in quantifying their GHG emissions and defines three 'scopes' of emissions that are used for corporate reporting. It categorises emissions by the scope (scope 1, scope 2 and scope 3) based on whether emission sources are in controlled or not by the reporting company. Broadly these scopes can be summarised as follows: a. Scope 1: direct emissions of GHGs from plant, equipment, vehicles owned by the reporting corporate entity (e.g. combustion of natural gas, vehicle fuels, and emissions of refrigerants). b. Scope 2: indirect emissions of GHGs associated with purchased electricity, steam, heating and cooling (purchased by the reporting corporate entity). c. Scope 3: other GHG emissions arising from the activities of the organisation including those associated with construction, transportation and distribution,	This PEIR reports GHG emissions by Scope from the perspective of the Applicant, in line with the scope breakdown in the 2019 baseline report. The scopes are presented in **Table 12.7** and emissions are reported in **Section 12.9**.

Guidance	How and where addressed in PEIR
waste, water, business travel, employee commuting, and energy use by tenants and 3rd party organisations.	
PAS 2080 Carbon Management in Infrastructure (Ref. 12.28). Provides guidance on how to incorporate effective carbon management in infrastructure.	The approach to assessing GHG emissions from construction and operation of the Proposed Development outlined in the **Section 12.5** has been undertaken in line with this guidance.
BS EN 15978 Sustainability of construction works – assessment of environmental performance of buildings – calculation method (Ref. 12.29).	Focusses on the calculation method to assess the environmental performance of a building based on life cycle assessment for both new and existing buildings and has been used to define the assessment methodology outlined in **Section 12.5**
European Monitoring and Evaluation Programme (EMEP)/ European Environment Agency (EEA) air pollutant emission inventory guidebook:2019 (Ref. 12.30) (formerly known as 'Corinair'). Provides guidance on calculating GHG emissions from aircraft and has been used to calculate emissions over the climb, cruise, descent (CCD) and (landing/ take-off (LTO) phases.	It has been used to inform the assessment methodology for calculating aircraft emissions outlined in **Section 12.5.**

GHG assessment of the Proposed Development and the national context

12.2.5 It is important to set out clearly the context within which the assessment of the Proposed Development's GHG impacts and their significance is to be undertaken.

12.2.6 The key policy in respect of GHG assessment for airport projects is the ANPS (Ref. 12.31), which makes clear in paragraph 5.82 that:

> *"Any increase in carbon emissions alone is not a reason to refuse development consent, unless the increase in carbon emissions resulting from the project is so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets, including carbon budgets."*

12.2.7 To assess the impacts of the project it is therefore critical to understand both the scale of any increase in GHG emissions and the materiality of their impact on the government's ability to meet its obligations.

12.2.8 In setting out the scale of any increase associated with the Proposed Development, as with any similar assessment, the GHG assessment has been developed on the basis of known plans and robustly foreseeable trends across the scopes of assessment as described in **Section 12.3**. A description of these can be found in **Section 12.8** on Embedded and Good Practice Mitigation Measures, including both the level of aviation demand and the carbon intensity of flights; further detail is provided in **Section 2.3.6** of **Appendix 12.2** in Volume 3 of this PEIR.

12.2.9 The adoption of these assumptions means that the assessment does not take account of the substantial improvements in aviation carbon intensity through technology improvement that are envisaged over the next ~30 years and as set out in the recently published Jet Zero consultation document (Ref. 12.32). The reason for this is that the specific blend of changes, their timing, and the pace at which they scale is difficult to be specific on. In a similar way, the assessment does not take account of the improvements to the carbon efficiency of surface transport which are anticipated in the DfT's Transport Decarbonisation Plan (Ref. 12.33).

12.2.10 Since in both cases some level of improvement in carbon efficiency over and above what can be confidently predicted is highly likely, this means that the assessment is necessarily conservative, making it an appropriate representation of a reasonable worst case.

12.2.11 In relation to the materiality of the impact of the project and its influence on the government's ability to meet its carbon reduction targets and comply with the UK's national carbon budgets, it must first be noted that the government's targets and budgets are expressed at a national level. This is therefore the scale at which the assessment of materiality must be considered.

12.2.12 It is also important to note the variety of mechanisms available to the government to control carbon emissions, since this bears on the ability of the government to meet its obligations. Among these, the UK ETS (Ref. 12.34), in which airlines operating in the UK are legally required to participate, is a powerful policy lever.

12.2.13 The UK ETS sets an overall cap on the amount of carbon which may be emitted by scheme participants. Participants receive free carbon emissions allowances and/or buy emission allowances (at auction or on the secondary market) which they can trade with other participants as needed to cover the carbon emissions associated with operating their business, or to derive a commercial benefit from their own lower carbon emissions.

12.2.14 The cost to airline operators of purchasing carbon allowances operations will of course ultimately flow through to the cost of airline ticket prices to passengers. This has been factored into the aviation demand forecasts underlying the project.

12.2.15 The cap on the total amount of GHG emissions that can be emitted by sectors covered by the UK ETS will be reduced over time, in line with the government's national carbon reduction obligations, stimulating innovation by participants to

increase the carbon efficiency of their operation, or indeed to take steps which would reduce the overall scale of their operations.

12.2.16 The Government's control of aviation's GHG emissions, and the assessment against the policy text in para 5.82 of the ANPS, must also be seen within the context of the Secretary of State's legal duty under section 1 of the Climate Change Act 2008, to achieve a UK net carbon account at least 100% below 1990 levels (i.e. net zero GHG emissions) by 2050 and its legal duty under section 4 to meet the five-yearly carbon budgets (including the Sixth Carbon Budget). The UK ETS and such other mechanisms as the Government may adopt, mean that the Secretary of State will have both the controls and the legal obligation to ensure that the 2050 'net zero' target and future carbon budgets are met.

12.2.17 It is notable that the use of the UK ETS in this way would be effective regardless of the total airport *capacity* in the UK, or indeed the capacity of the country's individual airports, since it would bear directly on the operators of aircraft from wherever they flew in the UK. Like the UK's carbon targets themselves, the UK ETS operates at the national level – by targeting the activity emitting GHGs rather than the infrastructure which they rely on, this also avoids the risk of simply moving the source of carbon emissions (within the total ETS cap) from one airport to another – the likely outcome if emissions were targeted on an airport-by-airport basis either through capacity constraint or direct emissions controls.

12.3 Scope of the assessment

12.3.1 This section describes the scope of the GHG assessment, including how the assessment has responded to the Scoping Opinion. The temporal and spatial scope, the relevant receptors, and matters scoped in and out are identified. A description of engagement undertaken with relevant technical stakeholders to develop and agree this scope is provided in **Section 12.4**.

Scoping Opinion

12.3.2 The EIA Scoping Report, which was submitted to the Planning Inspectorate on 29 March 2019 set out the proposed scope and assessment methodologies to be employed in the EIA and is provided in **Appendix 1.1** of Volume 3 to this PEIR.

12.3.3 In response to that Scoping Report, a Scoping Opinion was received from the Planning Inspectorate on 9 May 2019 and is provided in **Appendix 1.3** in Volume 3 of this PEIR.

12.3.4 **Table 12.5** describes the main matters highlighted by the Planning Inspectorate in the Scoping Opinion and how these have been addressed in this PEIR. Final responses to all comments received during Scoping will be provided in an appropriate format in the ES.

Table 12.5: GHG Scoping Opinion comments

Scoping Opinion ID	PINS Scoping Opinion comment	How is this addressed
3.2.14	The Scoping Report proposes that decommissioning impacts are to be scoped out of the ES for two specific aspect chapters: Chapter 8 Climate Change and Chapter 9 Greenhouse Gas. Paragraph 5.2.5 also states that the assessment of potentially significant effects arising from the decommissioning of the Proposed Development is proposed to be scoped out of the ES. The Inspectorate therefore infers that the Applicant intends to scope out decommissioning impacts from the ES entirely. Having regard to the nature and characteristics of the Proposed Development the Inspectorate agrees that decommissioning can be scoped out of the ES. The Inspectorate does however, advise that the ES	Decommissioning of the Proposed Development was scoped out of the assessment.

Scoping Opinion ID	PINS Scoping Opinion comment	How is this addressed
	includes details of any infrastructure elements predicted to be decommissioned over a shorter time period and give consideration to the potential for likely significant effects to arise in relation to these elements.	
3.2.17	Include a description and assessment (where relevant) of the likely significant effects the Proposed development has on climate (for example having regard to the nature and magnitude of greenhouse gas emissions).	An assessment of the likely significant effects the Proposed Development has on climate is included at **Section 12.9** and in **Table 12.31**.
3.2.19	Detail and justify the conclusion that the Proposed Development is not likely to have significant effects on another European Economic Area (EEA) State and that transboundary effects do not need to be considered within the ES.	The Inspectorate has undertaken, and published, a transboundary screening exercise stating that "Under Regulation 32 of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 2017 EIA Regulations) and on the basis of the current information available from the Applicant, the Inspectorate is of the view that the Proposed Development is not likely to have a significant effect on the environment in another EEA State." (Ref. 12.35)
4.4.1	The Inspectorate agrees that decommissioning can be scoped out of the impact assessment (see also comments at Paragraph 3.2.14 of this opinion).	Decommissioning of the Proposed Development was scoped out of the assessment.
4.4.2	Identify and consider cumulative effects of the Proposed Development and other relevant projects or plans.	GHG emissions and their assessment are inherently cumulative for the following reasons: a. the environmental impact arising from GHGs is the aggregation and increased concentration of GHGs within the atmosphere; b. the location of the emissions source is not relevant to the impact arising from it; any development leading to GHG

Scoping Opinion ID	PINS Scoping Opinion comment	How is this addressed
		emissions has the same impact whether it is located near to the Proposed Development or in another region/country; and c. impacts on a given location arise from the aggregated GHG levels in the atmosphere, not from the magnitude of GHG emissions in the local area. Any attempt to compile a cumulative assessment of GHG emissions would have to include all development projects in the UK (as the impact of GHG is not related to their emission location) and for this reason the approach for managing the cumulative GHG emissions across the UK is through the adoption of national carbon budgets. This GHG assessment has considered whether the carbon emissions from the Proposed Development will have a material impact on the UK's ability to meet its carbon reduction target, including its carbon budgets, and this is presented in the **Table 12.32**.
4.4.3	Assess the impact on arriving flights to the extent that the airspace change process affects the arriving traffic consistent with the CAP1616a requirements.	CAP1616 relates to airspace redesign. The application for development consent does not specifically concern airspace redesign however there is broad compatibility between the EIA and CAP1616 methods of assessment.
4.4.4 and 4.4.5	Include an assessment of the increased emissions from additional GHG emissions from construction staff and increased passengers to and from the airport.	Modelling of GHG emissions presented in this PEIR includes emissions from construction staff travelling to/from the site and emissions from surface access journeys made by passengers to/from the airport. See **Table 12.24** for construction emissions and **Table 12.25** for surface access journeys during operation.
4.4.6	Provide justification for the choice of peak construction and operation years selected for the	A justification for the choice of peak construction and operation years has been presented in this PEIR

Scoping Opinion ID	PINS Scoping Opinion comment	How is this addressed
	assessment.	assessment. The output of the GHG modelling has been used to identify the years with highest GHG emissions from construction and the year with the highest overall GHG impact, as shown in **Inset 12.2**.
4.4.7	The future baseline will account for decarbonisation of the national grid and other technological improvements such as lower emission vehicles. The assumptions and uncertainties regarding future improvements scenarios, including any sensitivity analysis, should be clearly set out in the ES, in order to understand the reliance placed on such measures in assessing likely significant effects.	The assumptions and uncertainties regarding future improvements and the reliance placed on these measures when calculating the future scenarios are set on in **Table 12.9** and **Section 12.7**.

Study area

12.3.5 The study area for the GHG emissions assessment considers all GHG emissions arising over the lifecycle of the Proposed Development during construction and operation including direct emissions arising from activities within the Proposed Development boundary (as shown in **Figure 2.1** in Volume 4 of this PEIR) and indirect emissions from activities outside the Proposed Development boundary (e.g. transport of materials to site, embedded carbon in construction materials, treatment and disposal of waste and surface access journey's from passengers, employees and freight).

Zone of influence

12.3.6 A Zone of Influence is not identified for the GHG emissions assessment as gases are not geographically bound, but rather globally distributed.

Temporal Scope

12.3.7 The Proposed Development is assessed over three assessment Phases, during which construction and operation may take place simultaneously. Assessment years for each phase are described in **Chapter 5** Approach to the Assessment.

12.3.8 The temporal scope for the GHG assessment covers the periods of construction, operation and maintenance of the Proposed Development from 2025 to 2050 inclusive.

12.3.9 GHG emissions are reported for Do-Minimum (DM) and (Do-Something embedded (DS DCO-embedded) scenarios, for the following years:

a. the current consented capacity (18 million passengers per annum (mppa)) (2019);
b. the year the forecast throughout of the existing terminal for (i.e. opening year) Phase 1 is first reached (21.5 mppa) (2027);
c. the year the forecast throughout of the existing terminal for Phase 2a is first reached (27 mmpa) (2039);
d. year of maximum forecast passenger throughout (i.e. peak operation) is first reached (32 mppa) (2043);
e. worst case scenario – Year of predicted maximum environmental impact (i.e. the year with the highest estimated GHG emissions, including as appropriate a combination of construction, operational, surface access and Air Traffic Movement (ATM) activities); and
f. the target year for the UK Government's carbon reduction target (to reduce emissions to net zero) (2050).

12.3.10 The annual GHG emissions were estimated for every year between 2025 and 2043 in order to determine the year of predicted maximum environmental impact for the worst-case scenario in accordance with the ANPS.

Receptors

12.3.11 The global atmosphere is the receptor for the effects on the climate of GHG emissions arising from the Proposed Development.

Matters scoped in

12.3.12 In line with requirements from the ANPS (Ref. 12.36), the GHG emissions assessment considers emissions from four key activities:

a. construction activities;
b. airport operations (including emissions from airport buildings, assets and infrastructure and airside/landside vehicles);
c. surface access journeys; and
d. air traffic movements (including landing take-off (LTO) and climb, cruise, descent (CCD) emissions).

12.3.13 The GHG emissions sources within each activity are outlined within **Table 12.6** along with the source of data used for the assessment.

Table 12.6: GHG emissions sources arising from the Proposed Development

Activity	GHG emission sources	Data source
Construction activities	a. emissions from fuel/electricity used by vehicles, plant, facilities and equipment during construction works;	Applicant data

Activity	GHG emission sources	Data source
	b. embedded carbon in materials used for the construction of the Proposed Development; c. emissions from fuel used for the transportation of materials and construction workers; d. emissions from fuel used for the transportation and treatment of construction related waste (including demolition, excavation and land clearance); e. emissions from the provision of water and treatment of wastewater; and f. emissions associated with land use change e.g. removal of carbon stock within soil and vegetation for the Proposed Development or addition of greenspace transformation from greenfield site to development.	
Airport operations	a. emissions from fuel/electricity use for buildings, assets and other infrastructure; b. emissions from fuel/electricity use for landside and airside owned and third-party vehicles and equipment; c. emissions from the transportation and disposal/treatment of operational waste; and d. emissions from the provision of water and treatment of wastewater.	Applicant data Baseline extrapolation from London Luton Airport Operations Limited (LLAOL) 2019 (Ref. 12.37)
Surface access journeys	a. emissions from fuel/electricity use for the transportation of passengers to/from the airport; b. emissions from fuel/electricity use for the transportation of staff to/from the airport.	Traffic data from surface access modelling team.
Air traffic movements (ATMs)	a. emissions from aircraft fuel consumption during the landing take-off cycle (including descent/ascent up to 3000ft); and b. emissions from aircraft fuel consumption during the climb, cruise, descent phase of flight (i.e. above 3000ft, includes aircraft departing from the airport only to	ATM data (fleet mix and world region split) provided by the Applicant's aviation planning team.

Activity	GHG emission sources	Data source
	avoid double counting of emissions with other airports).	

12.3.14 The concept of "scopes" is used in the corporate reporting of GHG emissions. It categorises emissions by the scope (scope 1, scope 2 and scope 3) based on whether emission sources are in controlled or not by the reporting company (Ref. 12.38). **Table 12.7** presents breakdown of emissions sources in line with scopes of emissions used for corporate reporting (Ref. 12.39).

12.3.15 Scope 1 includes GHG emissions from sources that are owned or controlled by the airport operator, therefore referred to as direct. Scope 2 accounts for GHG emissions from the generation of purchased electricity consumed by the airport operator (electricity indirect GHG emissions). Scope 3 emissions include indirect emissions which are a consequence of the activities of the airport operator, but occur from sources not owned or controlled by the operator, who has therefore influence but not control over these emissions.

12.3.16 These scopes are used in the preliminary assessment in **Section 12.9** to demonstrate direct and indirect GHG emissions from the Proposed Development.

Table 12.7: Breakdown of emissions sources by scope

Scope	Category
1	Natural gas consumption
1	Airport operational vehicles
1	Other fuels (heating and power)
1	Refrigerants
1	Fire training
2	Airport electricity consumption
3	Aircraft movements (LTO and CCD)
3	Surface access (passengers and staff)
3	Tenant electricity consumption
3	Electricity transmission and distribution losses
3	3rd party vehicles
3	Aircraft engine tests
3	Water
3	Waste
3	Staff business travel
3	Construction materials and activities

Matters scoped out

12.3.17 Due to the length of the lifetime of the Proposed Development decommissioning of the airport was scoped out of the assessment, as agreed with PINS in the

EIA Scoping Opinion, and therefore is not considered further in this assessment.

12.4 Stakeholder engagement and consultation

12.4.1 Engagement in relation to GHG emissions has been undertaken with a number of prescribed and non-prescribed stakeholders. Consultation on the climate change assessment has been completed through the following:

a. the EIA Scoping process (**Appendices 1.1 to 1.4** of Volume 3 of this PEIR);

b. non-statutory and statutory consultation, where comments relevant to the GHG assessment were received as part of the joint response issued by WSP on behalf of Luton Borough Council (LBC), Central Bedfordshire Council (CBC), North Hertfordshire District Council (NHDC) and Hertfordshire County Council (HCC); and

c. meetings with the Climate Change and Greenhouse Gases stakeholder working group comprising representatives from:

i. Buckinghamshire Council;
ii. CBC;
iii. Dacorum Borough Council;
iv. East Herts and Stevenage Council;
v. LBC.;
vi. Milton Keynes Council; and
vii. NHDC.

12.4.2 A programme of statutory consultation was undertaken between 16 October 2019 and 16 December 2019. This consultation included 35 public exhibition. The 2019 PEIR was published as part of this statutory consultation, in accordance with Section 42 of the Act. Responses were received from local authorities, organisations and public representatives. The **2019 Statutory Consultation Feedback Report** contains a full account of the previous statutory consultation process and issues raised in feedback. Matters raised regarding the scope, method, mitigation or compensation being considered as part of the GHG assessment were then subject to further discussions directly with stakeholders during working group meetings. The main matters/themes raised during consultation considered relevant to the GHG assessment were:

a. additional policies within the Host Authorities local plans and any other strategic documents related to climate change should be referenced in the ES;

b. additional methodological transparency should be provided in the ES;

c. identification of additional and more ambitious mitigation measures during construction and operation;

d. concerns about efficiency of the proposed mitigation measures to minimise increase in GHG emissions;

e. consideration of the investing and utilising in green energy and new technologies by the Applicant to diverse the local economy;

f. mitigation measures considered for the Proposed Development to be implemented for the airport regardless of the Proposed Development;

g. compatibility of the emissions arising from the Proposed Development with the government climate targets and national carbon budgets; and

h. the impact of radiative forcing and flight arrivals, not only departures as presented in the 2019 PEIR, should be considered in the assessment of significant effects.

12.4.3 **Table 12.8** provides a summary of engagement with relevant stakeholders, undertaken to inform this PEIR and EIA to date, including the date and time of meetings and a summary of discussions to resolve matters raised.

Table 12.8: Stakeholder engagement relating to GHG

Meeting name and date	Attendees (organisation)	Summary of discussion
Greenhouse Gas and Climate change working group – meeting no 1. (18th March 2021)	Buckinghamshire Council CBC Dacorum Borough Council East Herts and Stevenage Council LBC NHDC	Main focus of the discussion was on the GHG assessment on topics of the methodology, assessing the significance of the effects and potential mitigation. Net Zero Strategy and Green Controlled Growth were also discussed. No matters raised regarding the GHG assessment to be addressed.
Climate change and greenhouse gas working group – meeting no 2. (4th November 2021)	LBC NHDC Milton Keynes Council CBC East Herts District Council Buckinghamshire Council	Preliminary findings of 2022 PEIR presented and update on Green Controlled Growth was provided and discussed. No matters raised regarding the GHG assessment to be addressed.

12.4.4 Stakeholder engagement will continue as the Proposed Development progresses during the run up to application submission and will include further meetings with the Climate Change and Greenhouse Gas working group to discuss results of the PEIR and next steps for the ES.

12.5 Methodology

Overview

12.5.1 This section outlines the methodology employed for assessing the GHG emissions likely to result from the construction and operation of the Proposed Development. The approach outlined below for GHG assessment is in line with the ANPS. Full details of the methodology, including relevant assumptions and limitations, can be found in **Appendix 12.2** in Volume 3 to this PEIR.

12.5.2 To meet the requirements of the ANPS, and in line with the EIA Regulations, three assessment scenarios are assessed and reported:

a. Baseline/Future baseline: the Do-Minimum (DM) scenario i.e. the Proposed Development is not built, and the airport continues to operate within its current consented 18 mppa capacity. Expected impacts based on current policy on decarbonisation and climate change (for example the phasing out of vehicles with internal combustion engines and the decarbonisation of the national electricity grid) are included in this future baseline.

b. A Do-Something DCO scenario with embedded mitigation (DS DCO-embedded): the Proposed Development with embedded mitigation such as increased low carbon on-site energy generation. The expected impacts of current policy considered in the future baseline will also underpin this scenario.

c. A Do-Something DCO scenario with additional mitigation (DS DCO-additional): the Proposed Development with embedded and additional mitigations agreed and committed to as part of the EIA and planning process. The expected impacts of current policy on the future baseline will also underpin this scenario.

12.5.3 Only the DM and DS DCO-embedded scenarios are presented in **Section 12.7** and **Section 12.9** of this PEIR respectively. Additional mitigation measures to be implemented by the Applicant are identified in **Section 12.10**. Other additional measures are committed to, but are not included in the data presented due to lack of data granularity or detail required to carry out a quantitative analysis.

12.5.4 The airport operational emissions presented for the DS DCO-embedded scenario, therefore, are greater than actual anticipated emissions, but it is not possible to quantify their emissions reduction impact.

Quantifying GHG emissions

12.5.5 The approach to assessing GHG emissions from construction and operation of the Proposed Development has been undertaken in line with available GHG guidance listed in **Table 12.4.**

12.5.6 Generally, all estimated GHG emissions have been calculated as per the equation below:

Activity data x GHG emissions factor = GHG emissions value

12.5.7 All emissions are reported as tCO_2e (tonnes of carbon dioxide equivalent[3]) accounting for the seven GHG included in the UNFCCC/Kyoto Protocol namely carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3)).

12.5.8 When calculating GHG emissions from the Proposed Development the influence of Policy and Guidance on reducing future GHG emissions has been considered. Further detail on the various policies and guidance are provided in **Table 12.2** and **Table 12.4**.

Baseline methodology

Airport operations

12.5.9 Baseline GHG emissions for the operation of airport buildings and infrastructure, as well as airside and landside vehicles and equipment have been calculated based on an extrapolation of 2019 through to 2043 data. Activity data has been assumed to be proportional to passenger numbers, with the exception of fire training and aircraft engine testing which are assumed to be proportionate to ATM numbers, and business travel which is assumed to be proportionate to staff numbers. Emissions factors are assumed to remain constant at 2021 levels with the exception of grid electricity. Future grid carbon intensity values are taken from projections published by the UK Government (Ref. 12.40) and can be found in **Appendix 12.2** in Volume 3 of this PEIR.

Surface access journeys

12.5.10 Baseline GHG emissions for surface access journeys have been calculated from 2019 through to 2043 based on surface access journey data for passengers and staff provided by Transport Planners; qualified and experienced in providing specialist advice on planning, designing and managing transportation systems.

12.5.11 Passenger surface access journey data provided by the Transport Planners was derived from demand forecasts. These considered the 2016 Luton Airport Passenger Survey conducted by the Civil Aviation Authority (CAA) and provided information on the origin and destination of passengers within the United Kingdom and their mode of travel.

12.5.12 Airport staff surface access journey data provided by the Transport Planners was derived from demand forecasts based on data from the Applicant's 2016 and 2017 Annual Monitoring Reports (AMRs) updated for 2019 data and taking account of the change in mode share as reported in Luton London Airport's Annual Monitoring Report (Ref. 12.41) .

12.5.13 For passenger and staff travel by car, the split between petrol, diesel and electric cars has been taken from the DfT's TAG Databook (Ref. 12.42).

[3] Carbon dioxide equivalent (CO_2e) is a metric measure used to compare the emissions from various greenhouse gases on the basis of their global-warming potential (GWP). CO_2e is calculated by converting amounts of other gases to the equivalent amount of carbon dioxide with the same GWP. GWP is the relative potency on a molecule for molecule basis, of a greenhouse gas, taking account of how long it remains active in the atmosphere.

Emissions factors per km for petrol and diesel cars, and for taxis, buses and rail travel, are assumed to remain constant at 2021 levels; this is a conservative, worst-case assumption. Emissions factors for electric vehicles are assumed to fall in line with the projected decarbonisation of the grid.

Air traffic movements

12.5.14 Baseline GHG emissions for air traffic movements are based on data provided which detail ATMs by destination, distance travelled and aircraft type for forecast air traffic movements from 2019 through to 2043 assuming airport capacity remains at 18 mppa. Baseline emissions were further modelled through to 2050 assuming passenger numbers remain constant 18 mppa and the fleet mix remains the same as projected for 2043. GHG emissions from ATMs are calculated separately for the LTO and cruise phases of flight.

12.5.15 LTO is defined as aircraft movements below an altitude of 3000 feet i.e. during the approach, taxiing, take-off and climb. The EMEP/EEA Aviation Emissions Calculator (Ref. 12.43) was used to estimate the fuel consumption and carbon dioxide ($CO_{2)}$ emissions for each model of aircraft and world region distance during the landing take-off cycle. Emissions were then converted to CO_2e using the appropriate ratio for aviation fuel taken from the Department for Business, Energy and Industrial Strategy (BEIS) conversion factors (Ref. 12.44).

12.5.16 CCD emissions are defined as all activities that take place at altitudes above 3000 feet. CCD includes climb to cruise altitude, cruise, and descent from cruise altitudes to 3000ft at the destination. CCD emissions are only calculated for flights departing from the airport to avoid double counting with other airport inventories. This is in line with approach defined in the UNFCCC. GHG emissions from the CCD phase have been calculated using the EMEP/EEA Air Pollutant Emissions Inventory guidebook aviation calculator (Ref. 12.45) based on aircraft type and distance travelled (in nautical miles) for aircraft departures from the airport.

12.5.17 ATM forecasts are limited to a breakdown of ATMs at a regional basis, namely Central and Eastern Europe, Domestic (UK), Middle East, North America, Turkey, Near East and North Africa, and Western Europe. Given the uncertainty around forecasting future ATMs the forecast data provides an average distance travelled per journey to each region, rather than distances to specific destination airports.

12.5.18 The fleet mix used for the ATM data is based primarily on types of aircraft that exist now or will do so in the near future. The fleet mix modelled reflects a shift from current older aircraft models to newer aircraft such as the Airbus A320 and A321neo (new engine option) models. Where Airbus neo aircraft models in the fleet mix are not included in the EMEP/EEA model database, a representative fuel efficiency improvement of 15% has been assumed over the standard current engine option equivalents (Ref. 12.53).

12.5.19 The approach to defining future baseline is described in **Section 5.4** of **Chapter 5** of this PEIR**.** The future baseline considered for GHG assessment is described in **Section 12.7** of this chapter.

Accounting for GHG policy

12.5.20 Government policy and strategy is expected to influence GHG emissions from airport activities and has been accounted for when modelling the DM scenario. Those allowed for in the study are presented in **Table 12.9**.

Table 12.9: Policy and strategy influencing future GHG emissions

Policy/Strategy	Potential impact on emissions
Department for Business, Energy and Industrial Strategy (BEIS)	Decarbonisation of electricity generation (grid) will influence future emissions from the airport operations. The source of information used for this is the UK Government Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions (Ref. 46) for appraisal which provides forecasts for the carbon intensity of grid electricity in the future. Projected grid carbon intensities are presented in **Appendix 12.2** in Volume 3 of this PEIR.
Transport Decarbonisation Plan (TDP) (Ref. 12.47)	Uptake of electric vehicles, reduction in diesel and petrol cars. New diesel and petrol cars and vans would no longer be sold from 2030, and all new cars and vans must be fully zero emission at the tailpipe from 2035. Removal of all diesel-only trains (passenger and freight) from the network by 2040.
UK Emission Trading Scheme (UK ETS) (Ref. 12.48)	Emissions trading schemes work on the 'cap and trade' principle, where a cap is set on the total amount of certain greenhouse gases that can be emitted by sectors covered by the scheme. The aviation routes covered by the UK ETS will include UK domestic flights, flights between the UK and Gibraltar, and flights departing the UK to European Economic Area states conducted by all included aircraft operators, regardless of nationality. In 2021, the UK Government has consulted on how the UK ETS will integrate with wider industry initiatives to reduce GHG emissions.
Decarbonisation Road Map, Sustainable Aviation (Ref. 12.49)	Improvements in air traffic management and operational practices are likely to improve the carbon intensity of UK aviation by around 8.7% by 2050 relative to 2010.
European Environmental Aviation Environmental Report 2019 (Ref. 12.50)	Introduction of new aircraft and more efficient engine technology expected. The European Aviation Environmental Report (2019) considers a continued technology improvement of 1.16% per year until 2035.

12.5.21 The policies and strategies identified, if implemented as expected, will impact future carbon emissions from energy used in airport operations, surface access journeys and aviation. As far as reliable data permits, these policies and strategies are accounted for in this PEIR.

Construction assessment methodology

12.5.22 Construction GHG emissions calculated for the DS DCO-embedded scenario presented in the PEIR are based on data for estimated energy use, types and quantities of construction materials, waste generated during construction, water use and land use change leading to a loss of carbon stock. Data sources are listed in **Table 12.6,** data used included:

a. construction materials and their transportation to site;
b. construction plant/equipment use estimates;
c. estimated energy demand for equipment and facilities used during the construction;
d. waste disposal and transportation estimates;
e. land use change data;
f. estimated water consumption; and
g. estimated worker transport data.

12.5.23 GHG emissions from construction have been calculated by applying GHG emissions conversion factors for 2021 published by BEIS (Ref. 12.51) to the estimated quantities of energy, water used, and waste generated during construction provided by the Design Team. Embodied carbon in construction materials has been calculated by applying embodied carbon conversion factors from the Inventory of Carbon and Energy (Ref. 12.52) to quantities of key materials provided by the Design Team. Full details of the methodology, including relevant assumptions and limitations, can be found in **Appendix 12.2** in Volume 3 to this PEIR.

Operational assessment methodology

Aviation

12.5.24 Estimates for future GHG emissions from air traffic movements are based on air traffic forecast data provided by the Applicant's aviation planners. They are specialist air transport consultants providing advice for the airports business, including aviation policy advice, economic impact assessment, air traffic forecasting, and specialist advice on airport capacity assessment and planning. Passenger forecast modelling compares the drivers of passenger demand for the airport compared to other airports. It is an allocation model which assumes passengers will be attracted based on time/frequency/cost. The model covers the whole of the UK and will allow passengers to be attracted from across all districts, therefore there will be full national coverage. These passenger forecasts are converted to ATM forecasts.

12.5.25 Granularity of ATM forecasts for current and forecast journeys is limited to the data being available by region. CO_2e emissions are calculated as an average distance travelled per journey for each region, on the basis of the existing nature of the route network from the airport. This approach is adopted as it is not possible to forecast exact destinations with certainty.

12.5.26 ATM forecasts assume an aircraft fleet mix based on aircraft types that exist now or that are understood to be coming into service. The fleet mix modelled reflects a shift from current older aircraft models to newer aircraft such as the 737 Max and A320 Neo.

12.5.27 Further information on the demand forecasts can be found in the **Draft Need Case** published as part of statutory consultation.

Surface access journeys

12.5.28 Estimates for future GHG emissions from passenger surface access journeys, journeys to and from the airport by public and private transport, are based on data provided by the transport planners. Demand forecast data provided by the aviation planners were input into the strategic traffic model to provide traffic data. Predictions of the distribution of future year trips on the transport networks are provided by an updated version of the Central Bedfordshire and Luton Traffic Model (CBLTM) which has been amended to provide more detail on the networks around the airport and to extend the area over which the performance of the highway network can be assessed. The modified version of that model is referred to as the CBLTM-LTN.

12.5.29 Further information on surface access can be found in the **Getting to and from the airport – our emerging transport strategy** published as part of statutory consultation.

Airport operations

12.5.30 Estimated emissions from ground operations for the DS DCO-embedded scenario are derived from the 2019 carbon footprint with energy demand and other activity data assumed to be proportionate to passenger numbers. Emissions factors for natural gas and other fuels are assumed to remain constant at 2021 levels, while the carbon intensity of grid electricity is assumed to fall as projected by the UK Government.

12.5.31 Emissions for the DS DCO-embedded scenario are extrapolated from the London Luton Airport Footprint 2019 (Ref.. 12.53) (aircraft engine tests, fire training, refrigerants, tenant electricity consumption, 3rd party vehicle use, water, waste and business travel). Where the 2019 baseline data has been used, energy inputs have been assumed to be proportionate to passenger numbers, ATM numbers or staff numbers as relevant, and appropriate emissions factors have been applied.

12.5.32 Full details of the methodology, including relevant assumptions and limitations, can be found in **Appendix 12.2** in Volume 3 of this PEIR.

Assessing the Significance of Effects

12.5.33 In this PEIR the significance of effect has been determined based on the variation of GHG emissions between the DM and DS DCO-embedded mitigation. The difference between the DM and DS DCO-embedded scenarios are considered additional emissions arising as a result of the Proposed Development and therefore equate to the GHG impact.

12.5.34 There is currently no defined quantitative threshold for determining if GHG emissions are significant. IEMA (Ref.. 12.54) has identified that:

"GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit, as such any GHG emissions or reduction from a project might be considered significant." IEMA further states that: "*Under the principle that all GHG emissions might be considered significant, and the ongoing research of how to actually measure significance, it is down to the practitioner's professional judgement on how best to contextualise a project's GHG impact. Generating a project's carbon contribution, will enable the impact of your project, to be contextualised against sectoral, local or national carbon budgets. This will provide the practitioner and the LPA with a sense of scale."*

12.5.35 Paragraph 5.82 in ANPS states that:

"Any increase in carbon emissions alone is not a reason to refuse development consent, unless the increase in carbon emissions resulting from the project is so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets, including carbon budgets."

12.5.36 There is no agreed approach to determining the overall significance of GHG emissions, so for the purposes of this assessment we have undertaken two tests. The first is the assessment of significance of effect based on a qualitative approach in line with the Appraisal of Sustainability (AoS) (Ref.. 12.55) developed alongside the ANPS.

12.5.37 The second approach is a quantitative assessment of future emissions relative to appropriate carbon budgets. International aviation has only been included in the UK's national carbon budgets from the 6th carbon budget period onwards, so for the 4th (2023-27) and 5th (2028-32) periods, the so-called planning assumption for aviation of 37.5 $MtCO_2e$ per year set by the Committee on Climate has been used as the comparator, while for the 6th period (2033-37) the UK's national carbon budget itself has been used.

12.5.38 The significance as determined by these approaches has then been applied in the context of paragraph 5.82 of the ANPS to assess if it is "*so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets, including carbon budgets*."

12.5.39 Definitions from the AoS used to assess the significance of the effects are presented in **Table 12.10**.

Table 12.10: Criteria for assessing significance of effect

Description of the effect	Definition used for the AoS assessment
Direct / indirect	Direct or secondary effect on the receptor
Cumulative effect	Cumulative impact with other development = very high, high, medium, low

Description of the effect	Definition used for the AoS assessment
Risk	Threat of harm to the receptor = low, medium, high
Duration (short/medium/long term)	Short = 0-5 years Medium = 6-10 years Long = 10 years plus
Frequency	Continual / intermittent determined by number of occurrence/s per annum
Probability	Very low = <20% (unlikely that a receptor will be affected) Low = 20-40% Medium 40-80% High = 80% (highly likely a receptor will be affected)
Permanent / temporary	E.g. continual impact during construction, operation or temporary impact during construction
Reversible / irreversible	The receptor can return to baseline condition without significant intervention, or the receptor would require significant intervention to return to baseline condition.
Spatial extend transboundary Magnitude	International / Transboundary – effects beyond the UK National - effects within the UK but beyond region Regional - effects within South East England but beyond local Local – effects within a Unitary Authority or confined to the local area Magnitude defined by professional judgement as high, medium, low, very low.

12.6 Assumptions and limitations

12.6.1 This section provides a description of the assumptions and limitations to the GHG assessment.

12.6.2 The assessment undertaken for the PEIR has been based on the collation and appraisal of available construction and current and future operational data provided by LLAOL, and the Applicants advisors on construction, aviation and surface access, with data from environmental specialists undertaking assessment of the Proposed Development.

12.6.3 The findings of the preliminary assessment may be subject to change as the design of the Proposed Development is developed and refined through the EIA process and consultation.

12.6.4 The temporal scope of this assessment extends to 2043, and this means that assumptions have been made for activities occurring over the period from baseline (2019) to 2043. These assumptions include emissions factors for the range of GHG emitting activities.

12.6.5 Most future emission factors will be dependent on factors outside of the Applicant's control, for example those affected through UK Government policy and legislation (as set out in **Section 12.2**). This means that there are inherent uncertainties in the quantification of future GHG emissions.

12.6.6 **Table 12.11** sets out the main assumptions that have informed the development of the future scenario GHG estimates. Additional details on assumptions within the modelling process are set out in **Appendix 12.2** in Volume 3 of this PEIR.

Table 12.11: Assumptions within the GHG Assessment

Assessment Issue	Assumptions
Construction activities	GHG emissions from construction activities are based on estimated activities provided by the construction advisors. Embodied carbon in construction materials is based on initial material quantity estimates provided by the design teams. The assessment of construction activities and embodied carbon emissions in materials may be revised for the ES as the design for the Proposed Development and construction programme for the Proposed Development further evolves.
Future decarbonisation of the UK national grid	The grid is forecast to reduce in carbon intensity over the period of the Proposed Development, meaning that the GHG emissions from electricity use will reduce per kilowatt hour (kWh). The extent and rate at which this will happen is unclear. The assessment has used UK Government forecasts for grid decarbonisation set out in the Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal (Ref.. 12.56). This decarbonisation trajectory is set out in **Appendix 12.2** in Volume 3 of this PEIR.
Changes to the road vehicle fleet	The road vehicle fleet in the UK is projected to change in terms of the efficiency of vehicles, and the shift from use of petrol/diesel vehicles to increasing numbers of electric vehicles. The assumed changes in vehicle fleet make-up are presented in **Appendix 12.2** in Volume 3 of this PEIR.
Sustainable Aviation Fuels (SAF)	The use of SAFs has not been included in the DM Baseline or the DS DCO–embedded scenarios. Projected penetration of SAFs are included in various scenarios published in the Jet Zero consultation (Ref.. 12.57) and the Aviation Sector Summary of the 6th Carbon Budget report (Ref.. 12.58)
Zero emissions flight technology	Zero emissions flight includes the use of hydrogen-electric and battery electric technologies, and these have been demonstrated in small aircraft in the UK but have yet to be scaled up to commercial passenger usage. The dataset accompanying the Jet Zero consultation paper includes indicative emissions reductions figures from the use of zero emissions aircraft, but there remains considerable uncertainty around the timescale or magnitude of what may be achieved. For this reason, the use of

Assessment Issue	Assumptions
	zero emissions aircraft has not been included in either of the scenarios addressed in this PEIR.
Surface access for passengers	The 2019 data is used for baseline, with data for later milestone years reflecting a modal shift away from car travel towards bus and particularly rail travel. The assessment takes account of a shift from petrol and diesel powered cars to EVs, based on projections included in the most recent iteration of the DfT's TAG Databook (Ref. 12.59); it also takes account of the projected reduction of the carbon intensity of electricity for EV charging.
Surface access for airport staff/workers	The 2019 data is used for baseline, with data for later milestone years reflecting a modal shift away from car travel towards bus and particularly rail travel. The assessment takes account of a shift from petrol and diesel powered cars to EVs, based on projections included in the most recent iteration of the DfT's TAG Databook (Ref. 12.60).
Air traffic movement	Air traffic movement forecasts assume an aircraft fleet mix based on aircraft types that exist now or that are understood to coming into service. The fleet mix modelled reflects a shift from current older aircraft models to newer aircraft such as 737 Max and A320 Neo. Where future aircraft models (specifically Airbus 320/321neo) do not appear in the database of the EMEP model used to estimate fuel burn and emissions, a representative fuel efficiency improvement of 15% is applied relative to current engine option variants. (Ref. 12.61)
Emissions for the period 2044-2050	ATM data are provided for the period to 2043. Beyond this date, it is assumed that the projected fleet mix and world region split for 2043 remain constant to 2050; this is a conservative assumption as it is very likely that further improvements to aircraft engine efficiency will be achieved during this period. Surface access data provided by transport planners are also provided to 2043; beyond this date it is assumed that the modal split for 2043 remains constant, which is also a conservative assumption. The surface access assessment beyond 2043 does take account of a shift from petrol and diesel engine cars to EVs, and of the ongoing decarbonisation of the UK electricity grid.
Traded and non-traded emissions	Traded sector emissions are those which fall under the UK ETS and include domestic and non-domestic intra-EEA aviation emissions. ATM forecasts are limited to a breakdown of ATMs at a regional basis namely Central and Eastern Europe, Domestic (UK), Middle East, North America, Turkey, Near East and North Africa, and Western Europe. Therefore, for the purpose of this assessment traded emissions include emissions arising from domestic, Western Europe and Central and Eastern Europe flight destinations; while non-traded includes Middle East, North America, Turkey, Near East and North Africa flight destinations.

Assessment Issue	Assumptions
	EEA countries comprise EU member states plus Iceland, Liechtenstein and Norway. There are some countries in Central and Eastern Europe (such as Albania and parts of the former Yugoslavia) that are not in the EEA, therefore emissions from flights to these destinations do not fall under the UK ETS but will be included in the traded sector emissions for the purposes of this PEIR. This discrepancy is not considered to be material to the overall assessment.
Non-CO_2 emissions	Emissions from aviation have both direct (CO_2, CH_4 and N_2O) and indirect (non-CO_2 emissions e.g. water vapour, contrails and NOx) climate change effects. The UK Government publishes two sets of emissions factors for aviation (Ref. 12.62); one that that includes the indirect effects of non-CO_2 emissions and one that represents direct effects only. Currently, the factor that includes indirect effects is 89% higher than the factor for direct effects only, although the government acknowledges that there remains significant uncertainty around the magnitude of these indirect effects (Ref. 12.63). This PEIR discusses non-CO_2 emissions in Section 12.9 but reports these separately from the Proposed Development's total emissions which will be used to test the scheme against the national carbon budgets.

Reasonable Worst Case

12.6.7 **Chapter 5** of this PEIR describes the general approach adopted to ensure that a reasonable worst case is assumed in this assessment including the use of parameters, accounting for uncertainty, and incorporating flexibility in design and demand forecasts.

12.6.8 The GHG assessment for each of the scenarios under consideration relies on applying appropriate emissions factors to activity data in order to quantify emissions. These emissions factors are subject to change over time, and where authoritative projections of future emissions factors are available, these have been used to quantify future emissions. An example of this is in relation to the future carbon intensity of grid electricity: the UK Government publishes projections of how the grid may decarbonise in future years.

12.6.9 Other emissions factors are also likely to fall in the future, but it is not currently possible to quantify with any certainty the magnitude and rate of these reductions. Examples of these relate to certain modes of travel and transport. It is very likely that emissions per km for HGV transport will fall over the construction period for the Proposed Development. But the HGV emissions factor for 2021 has been applied for every year of the construction phases, so the calculated emissions from HGV transport are likely to represent a worst case scenario.

12.6.10 This also applies to surface access travel by taxi, bus and rail: factors for 2021 have been applied to all future travel by these modes. The carbon intensity of gas supplied by the gas grid may also reduce in the future as biogas and hydrogen are added to the fuel mix, but as there is considerable uncertainty around the scale of this reduction the 2021 emissions factors for natural gas have been applied to all future gas consumption.

12.6.11 In relation to ATMs, the GHG assessment takes account of improved fuel efficiency in existing aircraft within the projected fleet mix. But additional emissions reductions from further improvements to engine technology, from the use of sustainable aviation fuels, and from zero emissions technology such as electric or hydrogen-fuelled aircraft have not been included in the current assessment due to lack of certainty around the future reduction pathways associated with these measures. For this reason, the emissions from ATMs also represents a worst case scenario, with very significant potential additional reductions likely to be achieved.

12.6.12 Further relevant assumptions on worst case specific to this assessment include:

a. The annual GHG emissions were estimated for every year between 2025 and 2043 in order to determine the year of predicted maximum environmental impact for the worst-case scenario as required in the ANPS.

b. Worst case has been interpreted as both the year of highest aggregated emissions, or the year in which emissions differ to the greatest extent from the baseline.

12.7 Baseline conditions

12.7.1 This section provides a description of the existing GHG emissions from the airport operating at the currently consented limit of 18 mppa. The DM scenario provides a future baseline with airport capacity maintained at 18 mppa against which the GHG emissions of the Proposed Development will be assessed.

Existing conditions

12.7.2 The DM scenario provides a future baseline against which the GHG emissions impact of the Proposed Development will be assessed. The DM scenario runs from the first year of construction (2025) through to the year of the UK's legally binding net zero emissions reduction target (2050). The ANPS requires the impact of the Proposed Development to be assessed through to 2050.

12.7.3 The DM scenario assumes that there will be no construction activity.

12.7.4 The baseline refers to the airport's GHG emissions in the calendar year 2019. It draws together information from a range of documents, analyses and sources. A full breakdown of emissions is included in **Appendix 12.2** to provide estimates of GHG emissions, these are summarised in **Table 12.12 to Table 12.14**.

Table 12.12: 2019 GHG emissions from the airport (by emissions source)

Emissions source	Emissions (tCO_2e)	Data source
Construction	Baseline construction emissions for 2019 are zero for the purposes of the assessment.	None required
Airport Operations	17,163	Baseline extrapolation from LLAOL 2019 operational data. Design engineers.
Surface access journeys	176,694	Transport planners
Air traffic movements (LTO cycle)	153,293	Aviation planners
Air traffic movements (CCD)	993,114	Aviation planners

Table 12.13: 2019 GHG emissions from the airport (by scope)

Scope	GHG Emissions (tCO_2e)
Scope 1	2,965
Scope 2	4,981
Scope 3	1,332,318

Table 12.14: 2019 Baseline GHG emissions summary

Emissions Totals	GHG Emissions (tCO_2e)
Total excluding international air transport	240,374
Total including international air transport	1,340,264

12.7.5 **Table 12.15** provides a breakdown of CO_2 emissions split between traded and non-traded aviation emissions for year 2019. Traded sector emissions for 2019 were those which fell under the EU ETS. It is important to note that aviation emissions regulated under the EU ETS and the UK ETS consider only CO_2 and not the wider CO_2-equivalent. For the purpose of this assessment traded emissions includes emissions arising from domestic, Western Europe and Central and Eastern Europe; while non-traded as includes Middle East, North America, Turkey, Near East and North Africa.

Table 12.15: 2019 Baseline: Traded and Non-traded Sector Emissions (tCO_2)

Emissions Totals	GHG Emissions (tCO_2)
Total traded sector emissions	950,106
Total non-traded sector emissions	173,527

Future baseline

12.7.6 In the absence of the Proposed Development, there is likely to be a change to the future baseline conditions as a result of other factors and developments in proximity to the airport. These are the conditions that will prevail 'Without Development' in place. The 'Without Development' scenario is used, where appropriate, as a comparator for the assessed case, to show the effect of the Proposed Development against an appropriate reference point. The approach to defining future baseline and the developments identified for consideration are described in **Section 5.4** of **Chapter 5** of this PEIR.

Future baseline (DM) Emissions

12.7.7 Future baseline emissions from aviation are based on:

a. recorded flights in 2019; and

b. forecast flight details (based on passenger and ATM forecasts) for 2027, 2043; further details of the methodology and assumptions are set out in **Appendix 12.2** in Volume 3 of this PEIR.

12.7.8 GHG emissions for the future baseline (DM scenario) have been presented in **Table 12.16** to **Table 12.19** for a worst-case scenario for the future baseline (2025) and for years: 2027, 2039, 2043 and 2050 which are in line with reporting years for DS DCO-embedded scenario.

Table 12.16: Future Baseline: GHG emissions from the airport (by source of emissions) (tCO_2e)

Reporting Category	2025 (Worst case scenario)	2027	2039	2043	2050
Airport operations	11,823	11,658	7,889	7,727	7,534
Surface access journeys	170,113	166,866	143,375	136,874	129,742
Air traffic movements (LTO)	149,266	145,517	138,216	138,210	138,210
Air traffic movements (CCD)	940,807	905,093	853,131	853,090	853,090
TOTAL	1,272,008	1,228,774	1,142,612	1,135,901	1,128, 575

Table 12.17: Future Baseline: Luton Airport GHG emissions (by scope) (tCO_2e)

Scope	2025 (Worst case scenario)	2027	2039	2043	2050
Scope 1	2,965	3,215	3,215	3,215	3,215
Scope 2	2,362	2,158	302	236	135
Scope 3	1,266,6828	1,223,401	1,139,095	1,132,450	1,125,225

Table 12.18: Future Baseline: Summary of GHG Emissions

Reporting Category	2025 (Worst case scenario)	2027	2039	2043	2050
Total excluding international air Transport	222,901	213,370	183,705	177,258	169,715
Total including international air transport	1,272,008	1,228,774	1,142,612	1,136,118	1,128,575

Table 12.19: Future Baseline: Traded and Non-Traded Sector Aviation Emissions (tCO_2)

Reporting Category	2025 (Worst case scenario)	2027	2039	2043	2050
Total traded sector emissions	898,085	858,977	811,314	811,267	811,267
Total non-traded sector emissions	172,332	170,408	160,340	160,340	160,340

12.7.9 Note that the traded sector aviation emissions shown in **Table 12.19** are based on ATM forecast data provided by the Applicant, and will be subject to the effects of the UK ETS, a market-based mechanism for which we can anticipate there will be a steady reduction in the total number of allowances available to emitters reporting under the scheme. The impact of this will be to increase the price of emissions, thereby accelerating innovation and low carbon aviation technology deployment and/or reducing the demand for aviation. In both outcomes emissions reduction across the entire sector can be anticipated.

12.7.10 The data shown here do not take account of the future impact of the UK ETS on aviation emissions, but the traded sector aviation emissions will be significantly lower than presented here.

12.8 Embedded and good practice mitigation measures

12.8.1 This section describes the embedded mitigation for GHG that has been incorporated into the Proposed Development design or assumed to be in place before undertaking the assessment. A definition of these classifications of mitigation and how they are considered in the EIA is provided in **Chapter 5** of this PEIR.

Embedded Mitigation

12.8.2 A summary of measures that have been incorporated into the design of the Proposed Development and that have been accounted for in the DS DCO-embedded scenario presented in this PEIR are presented in **Table 12.20** to **Table 12.23** by each of the four emissions source areas.

12.8.3 A full assessment and quantification of these individual measures in terms of GHG emission reduction, has not been carried out for this PEIR. Mitigation will be quantified within the ES and will comprise mitigation measures as indicated in **Table 12.20** to **Table 12.23**.

12.8.4 Draft GHG Management Plan, available as **Appendix 12.1** in Volume 3 of this PEIR, supports the delivery of the commitments and mitigation in the DCO.

Table 12.20: Embedded mitigation: Construction

Embedded mitigation	Impact avoided	How secured
Measures to reduce waste generated and resource use during construction including: a) designing out waste workshops to identify opportunities to reduce waste and resources and to identify opportunities to achieve a cut/fill balance during construction; b) recycling of demolition waste on site; c) recycling and use on site of existing landfill material; d) balancing the cut (excavation) and fill (material placement) – Earthworks excluding landfill material; and e) setting waste targets in line with the ANPS.	Reduction in GHG emissions from waste sent to landfill and over use of resources. Reduction in GHG emissions from the delivery of materials and disposal of waste.	Site Waste Management Plan (Outline provided as **Appendix 19.1** in Volume 3 of this PEIR) Draft CoCP
The lead contractor will develop and implement a Carbon Efficiency Plan	Reduction in GHG emissions from construction activities.	Draft CoCP (provided as **Appendix 4.2** in

to manage carbon emissions and promote good practice including: a) monitoring of fuel use/compressed air leaks; b) driver/plant use training; c) avoidance of oversizing of generators for plant and temporary buildings; d) nominated individuals with responsibility for site energy management; e) use of renewable/ zero or low carbon fuels for construction vehicles, plant and machinery where reasonably practicable; f) early connection to grid electricity to reduce use of mobile diesel energy generation; and g) promotion of modes of sustainable transport in line with the Construction Workforce Travel Plan.		Volume 3 of this PEIR)
The contractor will set targets to minimise potable water use during construction.	Reduction in GHG from the provision of water and treatment of waste water	Draft CoCP

Table 12.21: Embedded mitigation: Airport operations

Embedded mitigation	Impact avoided	How secured
The new terminal building will utilise efficient building design: a) electric reverse heat pumps for heating and cooling supported with ground source heat pump technology; and b) storage of heat using water storage facilities.	Reduction in operational GHG emissions.	Contracts, Draft GHG Management Plan
Measures incorporated into the design to reduce waste include: a) design of adequate provision for internal and external waste storage; and b) setting of municipal waste recycling targets as per the ANPS and	Reduction in operational GHG emissions from waste.	Design Site Waste Management Plan

development of a waste and resources plan.		
The New Terminal 2 (T2) will: a) be designed with Passivhaus principles where practicable, to reduce the need for mechanical and electrical systems in new buildings; b) include equator-facing glazing to minimise heat gain; c) maximises daylighting; d) incorporate greywater recovery and re-use incorporated; e) increase airtightness and reduce thermal bridges.	Reduction in operational GHG emissions.	Design
The design has the flexibility to allow for battery storage for electricity to be accommodated in the future.	Reduction in operational GHG emissions.	Design
The design incorporates stormwater capture and treatment.	Reduction in operational GHG emissions from water.	Design
Options for low carbon renewable energy generation/or procurement, and options to incentivise the future uptake of low and zero carbon fuels for both vehicles using the airport and aircraft e.g. inclusion of EV charging points in carparks, inclusion of infrastructure for sustainable aviation fuels will be implemented where feasible.	Reduction in GHG emissions from the use of energy.	Design
Energy use will from local networks supplemented by solar photovoltaic cells built where practical over car parking and on roofs over the construction period to 2037; ground source heat pumps; and battery storage for back-up power rather than relying on diesel generators.	Reduction in GHG emissions from electricity use.	Contracts, Draft GHG Management Plan
Delivery of a landscaping strategy to offset any loss of vegetation in relation to the Proposed Development.	Reduction in loss of carbon sink.	Landscape and Biodiversity Management Plan

		(Outline provided as **Appendix 8.2** in Volume 3 of this PEIR)

Table 12.22: Embedded mitigation: Surface access journeys

Embedded mitigation	Impact avoided	How secured
a) The Applicant's Surface Access Strategy provides the medium to long term direction for a shift away from private car use to public transport. Where private cars are used it will incentivise low/zero carbon private transport options e.g. electric vehicles.	Reduction in GHG emissions from surface access journeys	Traffic Assessment and Travel Plan

Table 12.23: Embedded mitigation: Air traffic movements

Embedded mitigation	Impact avoided	How secured
Steps to reduce emissions from aircraft during the landing and take-off (LTO) cycle will be considered as part of the developing operational strategy. For example, single/reduced engine taxiing, electric towing, review/minimise use of auxiliary power units (APU), reduce emissions due to aircraft idling and hold.	Reduction in GHG emissions from aircraft during the landing take-off cycle.	Draft GHG Management Plan
LLAOL to encourage take up of sustainable aviation fuels/newer aircraft through operating policy/strategy.	Reduction in GHG emissions from aircraft during the landing take-off cycle and from cruise emissions.	Draft GHG Management Plan

Good Practice Mitigation

12.8.5 Contractors will adopt good practice in sustainable procurement and construction waste management to reduce the quantity of waste produced and increase the recycled content of materials. This will be secured through the Draft CoCP provided as **Appendix 4.2** in Volume 3 of this PEIR and will include:

a. agreements with material suppliers to reduce the amount of packaging or to participate in a packaging take-back scheme;

b. implementation of a 'just-in-time' material delivery system to avoid materials being stockpiled, which increases the risk of their damage and disposal as waste;

c. attention to material quantity requirements to avoid over-ordering and generation of waste materials;

d. reuse of materials onsite wherever feasible;
e. recycling of waste onsite wherever feasible, e.g. recycling of demolition material;
f. reuse and recycling of materials off-site where reuse on-site is not practical (e.g. through use of off-site waste management infrastructure and resale for direct reuse or reprocessing);
g. setting construction and demolition waste recovery targets in line with the ANPS;
h. establishment of a project specific recycled content target e.g. for aggregates;
i. contractual requirements for contractors to procure and use recycled and more sustainable materials; and
j. preparing a sustainable procurement plan to include sustainable sourcing of materials.

12.9 Preliminary assessment

12.9.1 This section presents the results of the preliminary assessment of likely significant effects taking into account the embedded and good practice mitigation measures, described in the previous section, in place.

12.9.2 A summary of the assessment of effects is provided on in **Table 12.35** in **Section 12.15**. Significant effects are discussed in further detail in this section.

Construction effects: DS DCO-embedded

12.9.3 The total GHG emissions for the construction of the DS DCO-embedded would be 1,082,369 tCO_2e and are presented by each category in **Table 12.24**. A full breakdown of emissions is presented in **Appendix 12.2** in Volume 3 of this PEIR.

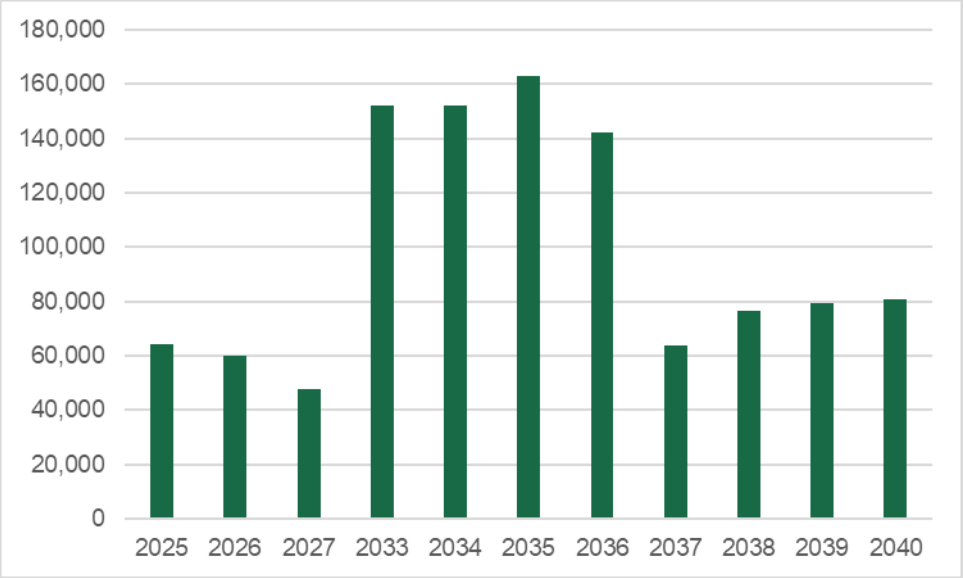
12.9.4 Phase 1 construction occurs between 2025 and 2027, Phase 2a between 2033 and 2036 and Phase 2b between 2037 and 2040.

Table 12.24: DS DCO-embedded: construction GHG emissions (tCO_2e)

Reporting category	Total emissions
Construction materials	213,946
Materials transport	59,547
Plant use	536,924
Energy use	1,071
Waste (including transport)	9,372
Land use change	243,559
Water and wastewater	75
Construction worker transport	17,875
TOTAL	**1,082,369**

12.9.5 **Inset 12.1** presents a breakdown of GHG emissions from construction during the construction period of the Proposed Development. There is no construction occurring in period 2028-2032, therefore these years have not been included.

Inset 12.1 Construction emissions: DS DCO-embedded



Operational effects: DS DCO-embedded

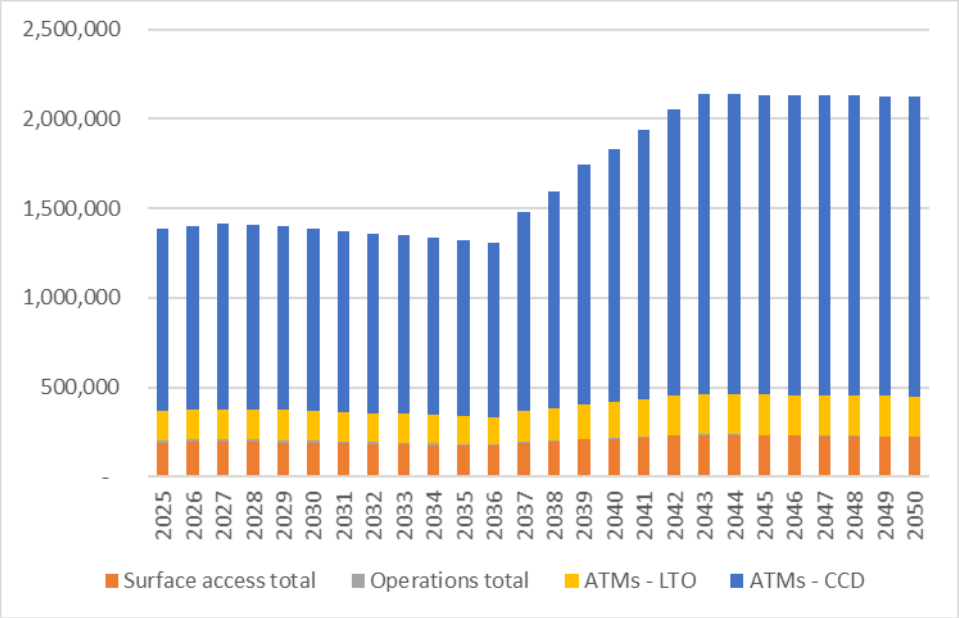
12.9.6 The total GHG emissions for the operation of the DS DCO-embedded would be 102,253,567 tCO_2e and are presented in **Table 12.25** for each of the reference years required by the ANPS. A full breakdown is provided in **Appendix 12.2** of Volume 3 of this PEIR.

Table 12.25: DS DCO-embedded: Operational emissions: (tCO_2e)

Reporting Category	2019 (Baseline)	2027 (Year of capacity for the Phase 1)	2039 (Year of capacity for the Phase 2a)	2043 (Peak operation)	Worst case scenario (2043)	2050
Airport operations	17,163	13,018	5,587	3,154	3,154	2,229
Surface access journeys	176,694	197,835	143,375	234,144	234,144	222,866
Air traffic movements (LTO)	153,293	167,493	138,216	224,584	224,584	224,584
Air traffic movements (CCD)	993,114	1,036,671	853,131	1,675,505	1,675,505	1,675,505
TOTAL	1,340,264	1,462,763	1,823,447	2,137,386	2,137,386	2,125,184

12.9.7 **Inset 12.2** presents the output of GHG emissions modelling for the DS DCO-embedded scenario. Emissions from air traffic movements peak in 2043 due to the airport reaching maximum capacity of 32 mppa.

Inset 12.2 Operation emissions: DS DCO-embedded (tCO_2e)



12.9.8 GHG emissions for the operation of the DS DCO-embedded by scope are presented in **Table 12.26.**

Table 12.26: DS DCO-embedded emissions (by scope) (tCO_2e)

Scope	2027 (Year of capacity for the Phase 1)	2039 (Year of capacity for the Phase 2a)	2043 (Peak operation)	Worst case scenario (2043)	2050
Scope 1	2,767	1,902	106	106	106
Scope 2	2,098	501	392	392	221
Scope 3	1,441,802	1,811,805	2,136,371	2,136,371	2,124,621

12.9.9 **Table 12.27** presents a summary of emissions for the DS DCO-embedded scenario.

Table 12.27: DS DCO-embedded: Summary of GHG Emissions (tCO_2e)

Reporting Category	2027 (Year of capacity for the Phase 1)	2039 (Year of capacity for the Phase 2a)	2043 (Peak operation)	2050
Total excluding international air transport	295,007	334,195	287,070	274,868
Total including international air transport	1,462,763	1,823,447	2,137,386	2,125,184

12.9.10 In accordance with the ANPS **Table 12.28** provides a breakdown of GHG emissions split between traded and non-traded aviation emissions for year 2027 and 2043. Traded sector emissions are those which fall under the UK ETS. For the purpose of this assessment traded emissions includes emissions arising from domestic, Western Europe and Central and Eastern Europe; while non-traded as includes Middle East, North America, Turkey, Near East and North Africa. These include domestic and non-domestic intra-EEA aviation emissions. Emissions under UK ETS consider only CO_2 emissions (not the wider CO_2-equivalent emissions).

Table 12.28: DS DCO-embedded Breakdown of traded and non-traded emissions (tCO_2)

Reporting Category	2027 (Year of capacity for the Phase 1)	2043 (Peak operation)	2050
Total traded sector emissions	997,890	1,183,073	1,183,073
Non-traded sector emissions	182,352	679,268	679,268

12.9.11 As noted in **paragraph 12.7.9** above, the traded and non-traded sector emissions shown in **Table 12.28** are based purely on the ATM forecast data provided by the Applicant, and do not take account of the inevitable downward pressure on emissions from the future operation of the UK ETS. The importance of the UK ETS (and other potential mechanisms), as a means to meet national carbon budgets and the target of net zero emissions by 2050 as obligated by the Climate Change Act 2008, is further discussed in **paragraph 12.2.16**.

Comparison with Baseline

12.9.12 **Table 12.29** provides a summary of GHG emissions for each scenario along with a comparison between scenarios to identify the GHG impact of the Proposed Development. As **paragraph 12.9.11** notes, the impact of future government strategy, for example Jet Zero, is not fully presented in this summary. Description of Jet Zero and other Government interventions and obligations and how they are anticipated to positively impact on the Proposed

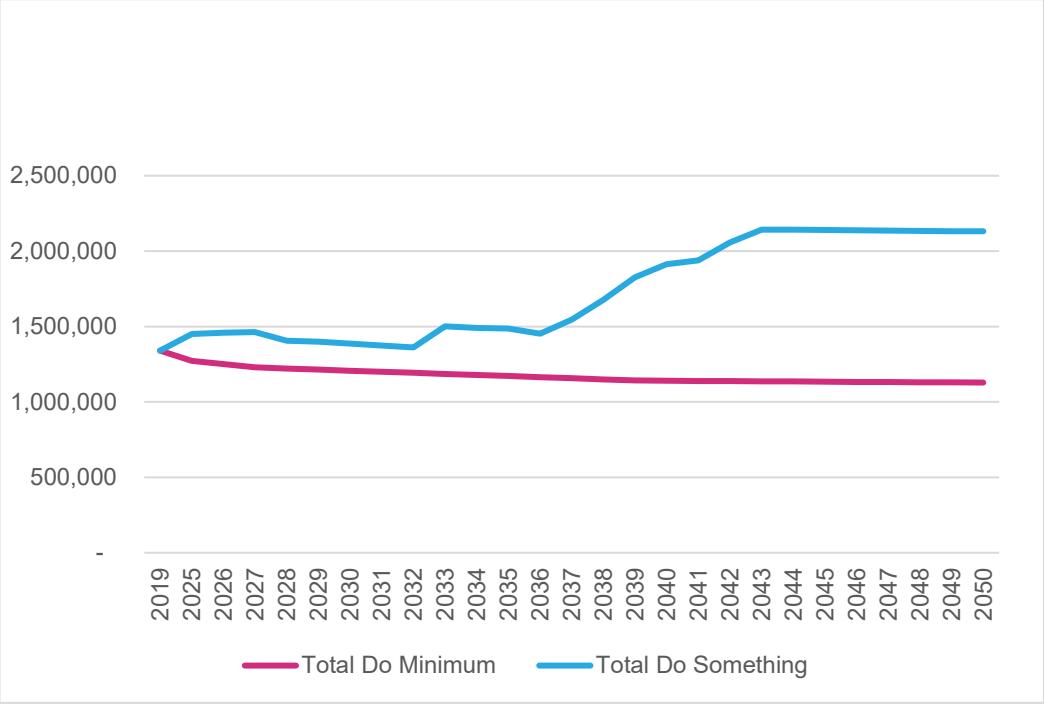
Development are discussed in **paragraph 12.2.5** through to **paragraph 12.2.17**.

Table 12.29: Summary of additional GHG emissions from the Proposed Development (tCO_2e)

Reporting Category	2019 (Baseline)	2027 (Year of capacity for the Phase 1)	2039 (Year of capacity for the Phase 2a)	2043 (Peak operation)	2050
DM	1,340,238	1,228,774	1,142,612	1,135,901	1,128,575
DS DCO-embedded mitigation	1,340,238	1,462,763	1,823,447	2,137,386	2,125,184
Proposed Development effect: i.e. DM vs DS DCO-embedded	0	233,990	680,835	1,001,486	996,609

12.9.13 **Inset 12.3** presents total GHG emissions for each scenario for the baseline year and period between 2025 to 2050.

Inset 12.3 Total GHG emissions for DM and DS DCO-embedded scenarios



12.9.14 **Table 12.30** presents the breakdown of total GHG emissions for the DM and DS DCO-embedded scenarios by scope.

Table 12.30: Total GHG emissions for DM and DS DCO-embedded scenarios by scope

Scope	Total DM emissions (tCO_2e)	Total DS DCO-embedded mitigation (tCO_2e)
Out of Scope	0	243,559
Scope 1	83,333	35,207
Scope 2	18,926	23,159
Scope 3	30,307,414	44,864,663
Total	30,409,673	45,166,588

12.9.15 The GHG emissions arising from the Proposed Development between 2025 and 2050, in total, are 14,756,915 tCO_2e above the baseline assessment. Increased emissions by category are presented in the **Inset 12.4**, these includes:

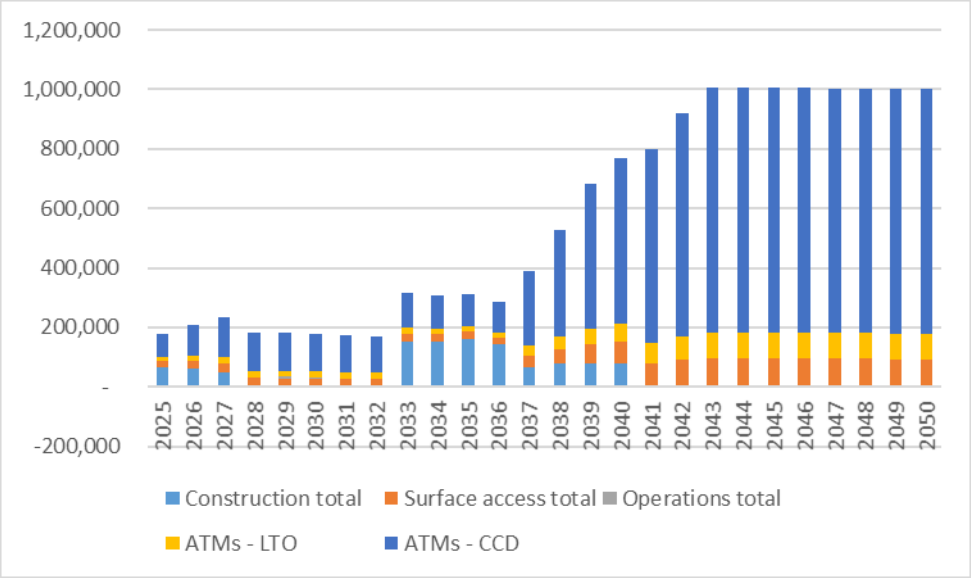
a. The highest increase of 12,271,000 tCO_2e is in the aviation emissions of which accounts for 81.7% of total increased emissions. Of this 11,014,405 tCO_2e is from ATMs CCD and 1,256,595 tCO_2e from ATMs LTO.

b. The second highest increase comes from surface access emissions which are predicted to increase by 1,473,456tCO_2e and accounts for 9.8% of total increased emissions.

c. Construction emissions are predicted to increase by 1,082,369tCO_2e, which accounts for 7.2% of total increased emissions.

d. Airport operation emissions are predicted to increase by 37,292 tCO_2e, which accounts for 0.25% of total increased emissions, reflecting the greater opportunity for delivery of lower carbon energy systems arising under the Proposed Development scenario.

Inset 12.4: Increased emissions by category (tCO_2e)



12.9.16 It is important to note that the quantitative emissions data presented here do not take account of anticipated technological improvements (SAFs; zero-emissions aircraft) or of the impact of market-based mechanisms (UK ETS etc) or other government policies designed to mitigate aviation emissions consistent with the UK Government's legally-binding duty to meet carbon budgets from the 6th Carbon Budget onwards and the UK's net zero target for 2050.

Significance of Effects

12.9.17 A qualitative assessment of significance has been undertaken. In this PEIR the assessment has considered the GHG impact between the DM and the DS DCO-embedded scenario. The method applied is consistent with the AoS (Ref. 12.64) as described in **Section 12.5**. Definitions from the AoS used to assess the significance of the effects are presented in **Table 12.10**. The outputs of the significance assessment are presented in **Table 12.31.**

Table 12.31: Significance of Effect

Description of effect	Rationale	Effect Criteria
Direct/indirect	Direct GHG emissions will result from the construction and operation of the Proposed Development (buildings/airport infrastructure) as well as from the increase in surface access journeys and air traffic movements.	Construction: Direct Operation: Direct
Cumulative	The nature of greenhouse gases is such that their impact on receptors (the global climate) is not affected by the location of their source. For this reason, cumulative emissions from proposed developments spatially adjacent to Luton Airport have the same relevance as any other emissions	Construction: High Operation: Very High

Description of effect	Rationale	Effect Criteria
	elsewhere in the UK or around the world. Cumulative emissions at a national scale are monitored against the UK's carbon budget. Comparison against the UK's 4th, 5th and 6th Carbon Budgets is included in the PEIR.	
Risk	The risk associated with the impacts of the Proposed Development on climate change are likely to be high.	Construction: High Operation: High
Duration (Short/medium/long term) Frequency (continual/intermittent)	Construction works are temporary but long term therefore the impact of GHG emissions arising during construction will occur over a longer period and are permanent. Emissions from operations of the Proposed Development including additional surface access journeys will have a medium-term continual impact which reduces over time with decarbonisation of electric and fuels. GHG emissions from additional air traffic movements are likely to have a long-term continual impact.	Construction: Long term duration, continual frequency Operation: long term duration, continual frequency
Probability	There is a high probability that the construction and operation of the Proposed Development will increase GHG emissions.	Construction: High Operation: High
Permanent / temporary Reversible /irreversible	The Proposed Development is anticipated to be permanent, and the impacts will be irreversible. Construction activities will have a temporary irreversible impact.	Construction: Temporary, irreversible Operation: Permanent, irreversible
Spatial extent (International, National, regional local) Magnitude (Very low, low medium, high)	Any emissions contribute to increases in global levels of GHG. The spatial extend of the impact of the Proposed Development is therefore International. Carbon emissions from international flights arriving at the airport represent the largest proportion of GHG footprint.	Construction: International spatial extent, High magnitude Operation: International spatial extent, High magnitude

12.9.18 Based on a comparison of the DM scenario with the DS DCO-embedded scenario with currently identified embedded/good practice mitigation only, the

Proposed Development is considered likely to have a **significant adverse** effect in terms of GHG emissions impact during construction. Although, the construction period is temporary it is long term and the GHG impacts are identified as long term and permanent with a high magnitude.

12.9.19 Based on a comparison of the DM scenario with the DS DCO-embedded scenario with currently identified embedded mitigation only, the Proposed Development is considered likely to have a **significant adverse** effect in terms of GHG emissions impact during operation. Impacts are identified as being direct, long term and irreversible with an international spatial coverage and high magnitude.

12.9.20 This assessment of significance does not take into account the fact that the aviation sector's GHG emissions, including many of those arising from Airport operation, are controlled nationally by the Government. They will have decreased by 2050 in order for the UK to meet its commitments under carbon budgets from the 6th Carbon Budget onwards, and to achieve its legally-binding net-zero target.

12.9.21 It is important to note that aviation's share of total UK emissions are likely to increase as those of other sectors across the economy decrease towards 2050. For example, due to the decarbonisation of the national electricity grid. This relative increase in emissions share will be accompanied by an absolute reduction in aviation emissions as technological advances (SAFs; zero-emissions aircraft) and market-based mechanisms such as the UK ETS act to reduce overall emissions from the aviation sector driven by the UK Governments obligation to meet its carbon budgets and net-zero target.

Assessment of significance: the impact on the ability of Government to meet its carbon reduction targets

12.9.22 An assessment has been undertaken to identify the impact of the Proposed Development on the UK meeting its five-yearly carbon reduction targets. This is in line with the ANPS, paragraph 5.67, which states *"The applicant should provide evidence of the carbon impact of the project (including embodied carbon), both from construction and operation, such that it can be assessed against the Government's carbon obligations, including but not limited to carbon budgets."*

12.9.23 When assessing the impact of the project on the UK carbon budgets paragraph 5.82 of the ANPS states: *"Any increase in carbon emissions alone is not a reason to refuse development consent, unless the increase in carbon emissions resulting from the project is so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets, including carbon budgets*." This test is also applied.

12.9.24 The UK government has set legally binding five-year carbon budgets which restrict the amount of GHGs the UK can emit during each budget period. The UK is currently in the third carbon budget period (2018 to 2022) with the carbon budgets set until 2037.

12.9.25 The 6th carbon budget (years 2033-37) for the first time incorporates the UK's share of international aviation emissions. Therefore, for the 6th budget period the UK's national carbon budget itself is used as the comparator (**Table 12.32**).

12.9.26 Prior to the 6th carbon budget, only domestic aviation emissions had been included in published budgets. Usefully, the Committee on Climate Change (Ref. 12.65) has assigned "an appropriate planning assumption" for aviation emissions of 37.5 $MtCO_2$/yr, and this figure can be used as a comparator for the 4th and 5th carbon budget periods. This is equivalent to 187.5 $MtCO_2$ (five years of the planning assumption) for each budget period and has been used as the comparator (**Table 12.32**).

12.9.27 In summary, total GHG emissions arising from the construction and operation of the Proposed Development during each carbon budget period have been compared against the five yearly planning assumption figure for the 4th and 5th carbon budget periods, and against the UK national carbon budget itself for the 6th carbon budget period. The result of this assessment is presented in **Table 12.32.**

Table 12.32: DS DCO-embedded emissions in comparison with national carbon budgets

Carbon budget period	Relevant carbon budget ($MtCO_2e$)	DS DCO- embedded total emissions during budget period tCO_2e	Proposed Development as a % of relevant carbon budget
Planning assumption for 4th carbon budget period (2023 to 2027)	187.5	4,369,948	2.331%
Planning assumption for 5th carbon budget period (2028 to 2032)	187.5	6,920,207	3.691%
6th carbon budget period (2033 to 2037)	965	7,465,011	0.774%

12.9.28 As presented in **Table 12.32** total GHG emissions from the Proposed Development would represent between 2.331% and 3.691% of five yearly planning assumption figure for the 4th and 5th carbon budget periods, and 0.774% of the UK 6th carbon budget for years 2033- 2037.

12.9.29 As previously discussed, the emissions figures presented in this assessment represent an inherently conservative forecast. This is because they do not take account of either technological improvements (SAFs or zero-emissions aircraft), or the impact of the UK ETS or other market-based mechanisms designed to mitigate emissions in line with UK carbon budgets and the net-zero target.

12.9.30 Therefore, the emissions estimated for the Proposed Development in this assessment for any reported year (i.e. 2,125,184 tCO_2e in 2050) can be

considered as unmitigated by these factors. And that when they come to bear, we can expect the emissions outturn of the Proposed Development to be reduced over that reported here. The legal context for this is further discussed in **paragraph 12.2.16**.

12.9.31 It is therefore reasonable to conclude, that the whilst emissions from the Proposed Development are estimated to be significant, they will not be so significant as to materially impact Government's ability to meet its 2050 carbon reduction targets, including carbon budgets as defined in paragraph 5.82 of the ANPS.

Sensitivity Analysis

12.9.32 There are certain known scenarios or risks that may occur that could influence the conclusions of the core assessment. These scenarios and the general approach to considering them in this assessment are described in **Section 5.4** of **Chapter 5** of this PEIR.

12.9.33 **Table 12.33** provides a qualitative assessment of any likely changes to the conclusions of the assessment reported in this chapter, in the event that that scenario or risk is realised.

Table 12.33: Qualitative Sensitivity Analysis

Sensitivity scenario	Potential impact and change	Likely effect
1. 19 mppa application	Should the current operator's planning application (Ref. 12.66) to increase the current passenger limit from 18 mppa to 19 mppa be granted, this would lead to change in the baseline capacity, therefore the total emissions attributable to the Proposed Development would be reduced by a proportion associated with 1 mppa passengers.	In the DM baseline scenario this would result in a marginal increase of emissions. In the DS DCO-embedded there would be no change to emissions profile; and the relative increase would be smaller, with the effect remaining significant.
2. Faster growth	ATM data has been provided for a faster growth in passesnger demand compared to core planning case forecast, but remaining capped at 32 mmpa. Emissions from ATMs has been provided in **Table 12.34** below for the baseline year, first years of capacity for Phases 1 and 2a, year of peak capacity and 2050. In this scenario, operational and surface access emissions could also be expected to increase in line with passenger	Increase in emissions relative to DS DCO-embedded, effect remains **significant**.

Sensitivity scenario	Potential impact and change	Likely effect
	numbers. Overall construction emissions would be expected to remain unchanged.	
3. Slower growth	Should passenger demand rise more slowly than anticipated in the DS DCO-embedded scenario, this would be expected to result in lower emissions from operations, surface access and ATMs, with the change being broadly proportionate to overall passenger numbers. Construction emissions expected to remain unchanged.	Marginal decrease in emissions relative to DS DCO-embedded, effect remains **significant**.
4. A321neo acoustic performance	Not relevant to GHG emissions, no change	Not relevant to GHG emissions, no change
5. Next Generation Aircraft	An alternative long term fleet mix has been prepared which takes into account the next generation of aircraft (rather than existing new generation, such as the Max and Neo), which would have better environmental performance. The information considered assumed 3 types of next generation aircraft: a. powered completely by Sustainable Aviation Fuels (SAFs), these are not assumed to be zero emissions and are based on further refinement of existing types of engine (albeit newer and more efficient/quieter); b. powered by Hydrogen which will be zero emissions in flight; and c. powered by electric motor which will be zero emissions in flight.	Substantial decrease in emissions relative to DS DCO-embedded; effect remains **significant**.

12.9.34 **Table 12.34** summarises ATM emissions (LTO and CCD) for the "Faster Case" expansion scenario. ATM emissions for 2027 and 2039 are higher than under the DS DCO-embedded scenario, but for the other years they are unchanged. Within the Faster Case, overall ATM emissions for the period 2025-2050 are 3.83% higher (LTO) and 4.39% higher (CCD) relative to the equivalent emissions for the DS DCO-embedded scenario.

Table 12.34: ATM emissions under the Faster Case expansion scenario

Reporting Category	2019 (Baseline)	2027 (Year of capacity for the Phase 1)	2039 (Year of capacity for the Phase 2a)	2043 (Peak operation)	Worst case scenario (2043)	2050
Air traffic movements (LTO)	153,293	175,183	198,028	224,584	224,584	224,584
Air traffic movements (CCD)	993,114	1,078,633	1,409,067	1,675,505	1,675,505	1,675,505

Non-CO_2 emissions

12.9.35 Emissions from aviation have both direct (CO_2, CH_4 and N_2O) and indirect (non-CO_2 emissions such as water vapour, contrails, NOx) climate change effects. The UK Government dataset of emissions factors for company reporting provides two sets of emissions factors for aviation; one set that includes these additional indirect effects and one set that includes direct effects only. In the 2021 emissions factors dataset, these emissions factors that include additional indirect effects are 89% higher than the factors that only include the direct effects (Ref. 12.67).

12.9.36 The UK Government, acknowledges that there is significant scientific uncertainty around the magnitude of the indirect effects of non-CO_2 aviation emissions, and that it is an active area of research. Part of the uncertainty arises from the difficulty of comparing short-lived climate forcers, and their indirect warming effects, with long-lived greenhouse gases such as carbon dioxide (Ref. 12.68).

12.9.37 Improved engine design can help to reduce the formation of contrails and their associated warming impact (Ref. 12.69). The so-called climate-optimised routing of aircraft can also help to reduce the formation of contrails (Ref. 12.70).

12.9.38 Indirect emissions from aviation are not included in the basket of gases covered by the Kyoto Protocol, and The Committee on Climate Change excludes these indirect warming effects from consideration when setting provisional carbon budgets (Ref. 12.58). For this reason only the direct effects are taken into account when comparing emissions against the UK's carbon budgets. Throughout this chapter the indirect effects of aviation have been excluded from the quantitative analysis of the Proposed Development.

12.10 Additional mitigation

12.10.1 This section describes the mitigation measures identified as a result of the assessment process, that are proposed in addition to those already considered to be in place as described in **Section 12.8** (Embedded and good practice mitigation measures). These are proposed to reduce or mitigate the effects of GHG emissions as a result of the construction and operation of the Proposed Development.

Design

12.10.2 New buildings and assets to be designed to consider whole life carbon including design, construction and operation: a requirement for energy efficient, low carbon design in buildings/new assets proposed as part of the Draft GHG Management Plan (including building envelope and building services i.e. heating, ventilation, air conditioning,, lighting etc.). Building services will be designed to minimise the release of fugitive emissions.

12.10.3 Water conservation technologies (aerators, low flush toilets, motion sensors on taps) will be incorporated into new buildings.

12.10.4 The T2 building will include automatic climate control and building management control systems that will increase the efficient use of energy and minimise emissions.

12.10.5 All new airfield lighting will be LED and any new or refurbished buildings will have LED lighting.

12.10.6 Highly energy efficient terminal equipment and system choices in T2 and T1 upon replacement at the end of their lifecycle (e.g. lifts, escalators, baggage handling etc.)

12.10.7 Infrastructure has been designed, and will continue to be developed, to enable the uptake of sustainable aviation fuels.

Construction

12.10.8 Construction materials with lower embodied carbon will be used where feasible.

12.10.9 Specification of materials with lower embodied GHG emissions within contractor contracts (where practical, materials with a higher recycled content, and locally sourced materials etc) will be used. Where feasible design for end-of-component reuse and use offsite manufacture of design elements.

12.10.10 The contractor will be required to demonstrate to the Applicant that materials with lower embodied carbon emissions have been specified where feasible.

Operation

12.10.11 To minimise GHG emissions from the operation of airport buildings and assets targets will be set to:

a. reduce operational energy demand;

b. purchase a percentage of energy from low carbon and renewable energy sources;

c. generate a percentage of low carbon/renewable energy on-site; and

d. reduce operation water consumption.

12.10.12 Measures to reduce emissions from surface access will include the incentivisation of uptake of low emission transportation for freight entering/leaving the airport for example HGV using low carbon technologies.

12.10.13 T2 buildings will be designed to at least 2013 BREEAM ‘Excellent Status’ to be energy efficient with appropriate installations and equipment together with thermally efficient materials and shading. Other new buildings will be designed to BREEAM 'Excellent Status' except where the building typology dictates that it is not practical.

12.10.14 All diesel generators to be removed by 2040 where regulations allow.

12.10.15 Provision of electric vehicle (cars, taxis, buses and coaches) charging infrastructure for both staff and passengers.

12.10.16 Investigate participating in a car sharing service, including for electric cars, and having a number of dedicated bays at the airport for the car sharing service.

12.10.17 All new contracts with Ground Handling Agencies to require electric vehicles, or other zero carbon energy options.

12.10.18 All new and replacement Luton fleet light and medium duty vehicles to be zero carbon (electric /hydrogen).

12.10.19 Provide infrastructure to facilitate the use of low emission airside equipment, such as electric vehicles; including for example, the provision of charging points within Ground Support Equipment (GSE) compounds; hydrogen fuelling etc subject to low carbon vehicle strategy established.

12.10.20 Surface access journey targets to be set for:

a. percentage of passengers and employees travelling to and from the airport by public transport;

b. number of EV charging points available to passengers and employees; and

c. number of cycle spaces and associated facilities.

Emissions reductions from additional mitigation measures

12.10.21 A number of additional mitigation measures have been identified on which the initial preliminary assessment in **Section 12.9** is based. Therefore, the efficacy of these measures is not evident when considering residual effects after the application of additional measures design in this section. An indication of their efficacy and CO_2 saved is discussed in this section.

12.10.22 These measures represent a fundamental shift away from the use of fossil fuels within airport operations, both from buildings and vehicles. Transferring energy

use in buildings and vehicles to electricity from natural gas and diesel enables Scope 1 emissions to be reduced dramatically, with only a modest increase in Scope 2 emissions due to the projected decarbonisation of the UK electricity grid.

12.10.23 Scope 2 emissions are further reduced through the use of on-site photovoltaic installations mounted on roofs and car parks.

12.10.24 Scopes 1 and 2 represent the emissions over which the airport has maximum control, and it is in these scopes that the greatest savings have been achieved. **Table 12.35** below shows Scope 1 and 2 emissions for the DM Baseline and the DS DCO-embedded scenarios.

12.10.25 By 2043, total Scopes 1 and 2 emissions are expected to be 86% lower under the DS DCO-embedded scenario compared with DM Baseline; by 2050 the saving is projected to be 90%.

Table 12.35: Scope 1 and 2 emissions for the DM Baseline and DS DCO-embedded scenarios (tCO_2e)

Reporting Category	2019 (Baseline)	2027 (Year of capacity for the Phase 1)	2039 (Year of capacity for the Phase 2a)	2043 (Peak operation)	2050
DM Baseline Scope 1	2,965	3,215	3,215	3,215	3,215
DM Baseline Scope 2	4,981	2,158	302	236	135
DM Baseline Scopes 1 + 2	**7,946**	**5,373**	**3,516**	**3,451**	**3,350**
DS DCO-embedded mitigation Scope 1	2,965	2,767	1,902	106	106
DS DCO-embedded mitigation Scope 2	4,981	2,098	501	392	221
DS DCO-embedded mitigation Scopes 1 + 2	**7,946**	**4,866**	**2,403**	**497**	**327**

12.10.26 Other additional mitigation measures cannot be quantified, either because of a lack of quantifiable detail in the measures themselves, or because the available baseline data is not presented in a sufficiently granular form to allow specific savings to be quantified. But since they are not able to be included in the GHG assessment for the DS DCO-embedded, the emissions figures presented in this analysis are greater than expected and represent a worst case.

12.11 Residual effects

12.11.1 The quantification of additional mitigation measures in terms of GHG emissions reductions has not been carried out for this PEIR. This is governed by available detail on the Proposed Development (as defined by design detail and project description), as well understanding of future aviation policy, and how such information might support a more detailed quantitative analysis. As further details on the Proposed Development and policy landscape become available, the assessment will be updated for the Environmental Statement.

12.11.2 The residual effect remains as reported in **Section 12.9**.

Overall significance of effect

12.11.3 The emissions from the Proposed Development are estimated to be significant. However, they will not be so significant as to materially impact Government's ability to meet its 2050 carbon reduction targets, including carbon budgets. Accordingly in EIA terms the overall effect is considered **not significant**.

12.12 Offsetting

12.12.1 Following the application of mitigation measures to reduce the generation of CO_2 emissions as far as reasonably practicable, residual emissions remain associated with Proposed Development and continued operation of the airport as reported in **Section 12.11**.

12.12.2 The offsetting of residual emissions is required to achieve carbon neutrality and carbon removal to reduce emissions to net zero.

12.12.3 These residual emissions can be managed and potentially offset through different mechanisms depending on the activity that generated them and the regime under which they are, or will be, monitored, reported and controlled.

12.12.4 The Applicant has committed to achieving net zero ground operations, as defined by the Airport Carbon Accreditation scheme, by 2040. The offsetting mechanism or schemes by which this will be achieved is currently under review and will be developed and reported with the application for development consent.

12.12.5 The aircraft operators are responsible for carbon emissions associated with flights, and the UK policy and legislation regimes are under development to manage and control these emissions at a national and global level, within UK climate obligations and budgets. The UK has implemented UK ETS legalisation to cap and trade emission from domestic flights and those within much of EEA. The UK is also a contracting state to CORSIA and has already legislated for the monitoring, reporting and verification of CO_2 emissions aspects of CORSIA for international flights. The offsetting requirements of CORSIA to achieve its goal of carbon neutral growth from 2020 are expected to be implemented into UK law following consultation in 2022.

12.12.6 The UK Government has stated in its consultation on their strategy for net zero aviation, Jet Zero 2021, that it recognises the importance of international action to tackle emissions from international aviation and has been instrumental in

developing CORSIA. It will continue to work with other states through the International Civil Aviation Organization (ICAO), to agree ambitious emissions goals and effective mitigation measures for the entire global sector. This includes securing agreement to a global long-term goal for international aviation CO_2 emissions that is consistent with the Paris Agreement, negotiating for the strengthening of the CORSIA offsetting scheme. Action taken by the UK Government to address the climate impact of international aviation is consistent with the government's legal duty to achieve both the net-zero target for 2050, and the interim carbon budgets. International aviation is included from the 6th Carbon Budget onwards. Further development of this strategy and policy is expected in 2022.

12.13 In-combination climate change effects

12.13.1 This section provides a preliminary assessment of potential changes to the findings of the GHG assessment, taking into account the predicted future conditions as a result of climate change, known as In-combination Climate Change Impacts (ICCI).

12.13.2 This assessment has been undertaken using the methodology and climate change predictions described in **Chapter 9** of this PEIR. The results are provided in **Table 12.36** and no additional mitigation required.

Table 12.36: GHG in-combination climate change impacts

Climate hazard	Likely ICCI	Consequence of ICCIs considering embedded environmental measures/good practice	Significance of ICCI effects
Increased summer temperatures	Increased energy required for cooling in buildings. Increased ambient temperatures with lowers air density and requires higher fuel consumption to increase thrust.	Possible increase of GHG emissions	Negligible Not significant
Extreme weather events (including high winds)	Stronger winds and changing wind patters might lead to modifications of flight lengths and routings, resulting in increase in the fuel consumption.	Possible increase of GHG emissions	Negligible Not significant

12.14 Monitoring

Construction monitoring

12.14.1 As outlined in the Draft CoCP, the main contractor's EMS will consider the approach to:

a. monitor and report energy use from construction activities; and

b. monitoring type, quantities and disposal route of waste generated during construction operations.

12.14.2 The monitoring process will evaluate the effectiveness of mitigation measures and the potential impact of construction operations associated with the Proposed Development. Consideration will also be given to those additional actions that may be necessary to ensure compliance.

Operational monitoring

12.14.3 The airport will continue to carry out annual monitoring and reporting of operational GHG emissions in line with the carbon accounting principles as defined in the GHG Protocol (Ref. 12.71).

12.14.4 In line with existing legislation aeroplane operators' are required to monitor and report on aviation emissions, this is regulated by CORSIA for international flights, and UK ETS for domestic and EEA flights.

12.15 Preliminary assessment summary

12.15.1 **Table 12.37** provides a summary of the identified impacts, mitigation and likely effects of the Proposed Development in relation to GHG.

Table 12.37: GHG preliminary assessment summary

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation and how secured	Residual Effect	Overall significance of effect
Construction							
Emissions of GHGs	Measures to reduce waste generated and resource use during construction. Site Waste Management Plan	High	N/A	Direct High Risk Long term duration, continual frequency High Probability Temporary, irreversible Construction: International spatial extent, High magnitude **Significant adverse**	Construction materials with lower embodied carbon will be used where feasible. Specification of materials with lower embodied GHG emissions within contractor contracts (where practical, materials with a higher recycled content, and locally sourced materials etc) will be used. Where feasible design for end of component reuse and use offsite manufacture of design elements.	No quantifiable change **Significant adverse**	The emissions from the Proposed Development are estimated to be significant. However, they will not be so significant as to materially impact Government's ability to meet its 2050 carbon reduction targets, including carbon budgets. Accordingly in EIA terms the overall effect is
	The lead contractors will develop and implement a Carbon Efficiency Plan, as part of the Construction Environment Management Plan (CEMP) will be developed and implemented to manage/reduce carbon emissions and promote good practice. Draft CoCP		N/A				

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation and how secured	Residual Effect	Overall significance of effect
	The contractor will set targets to minimise potable water use during construction. Draft CoCP		N/A		The contractor will be required to demonstrate to the Applicant that materials with lower embodied carbon emissions have been specified where feasible.		considered **not significant**
	A landscaping strategy to offset any loss of vegetation. Landscape and Biodiversity Management Plan		N/A				
Operation							
Emissions of GHGs	The new terminal building will utilise efficient building design. Contracts, Draft GHG Management Plan	High	N/A	Direct High Risk Long term duration, continual frequency High Risk Permanent, irreversible International spatial extent, High magnitude	Terminal 2 buildings will be designed to at least 2013 BREEAM 'Excellent Status' to be energy efficient with appropriate installations and equipment together with thermally efficient	No quantifiable change **Significant adverse**	The emissions from the Proposed Development are estimated to be significant. However, they will not be so significant as to materially impact Government's
	Measures incorporated into the design to reduce waste. Design, Site Waste Management Plan		N/A				

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation and how secured	Residual Effect	Overall significance of effect
	The New T2 will: a. be designed with Passivhaus principles, where practicable; b. include equator-facing glazing to minimise heat gain; c. maximises daylighting; d. incorporate greywater recovery and re-use incorporated; e. increase airtightness and reduce thermal bridges. Design		N/A	**Significant adverse**	materials and shading. Other new buildings will be designed to BREEAM 'Excellent Status' except where the building typology dictates that it is not practical. All diesel generators to be removed by 2040 where regulations allow. All new contracts with Ground Handling Agencies to require electric vehicles, or other zero carbon energy options. All new and replacement Luton fleet light and medium duty vehicles to be zero carbon		ability to meet its 2050 carbon reduction targets, including carbon budgets. Accordingly in EIA terms the overall effect is considered **not significant**.
	The design has the flexibility to allow		N/A				

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation and how secured	Residual Effect	Overall significance of effect
	for battery storage for electricity to be accommodated in the future. Design				(electric /hydrogen).		
	The design incorporates stormwater capture and treatment. Design		N/A				
	Options for low carbon renewable energy generation/or procurement, and options to incentivise the future uptake of low and zero carbon fuels for both vehicles using the airport and aircraft. Design		N/A				
	Energy use will from local networks		N/A				

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation and how secured	Residual Effect	Overall significance of effect
	supplemented by solar photovoltaic cells built where practical over car parking and on roofs over the construction period to 2037; ground source heat pumps; and battery storage for back-up power rather than relying on diesel generators. Contracts, Draft GHG Management Plan						
	Surface Access Strategy provides the medium to long term direction for a shift away from private car use to public transport. Where private cars are used it will incentivise low/zero carbon		N/A		Provision of electric vehicle (cars, taxis, buses and coaches) charging infrastructure for both staff and passengers. Investigate participating in a		

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation and how secured	Residual Effect	Overall significance of effect
	private transport options. Traffic Assessment and Travel Plan				car sharing service, including for electric cars, and having a number of dedicated bays at the airport for the car sharing service. Measures to reduce emissions from surface access will include the incentivisation of uptake of low emission transportation for freight entering/leaving the airport for example HGV using low carbon technologies.		
	Steps to reduce emissions from aircraft during the landing and take-off (LTO) cycle will		N/A		Provide infrastructure to facilitate the use of low emission airside		

Impact	Embedded/Good Practice Mitigation and how secured	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation and how secured	Residual Effect	Overall significance of effect
	be considered as part of the developing operational strategy. Draft GHG Management Plan				equipment, such as electric vehicles; including for example, the provision of charging points within GSE compounds; hydrogen fuelling etc subject to low carbon vehicle strategy established.		
	LLAOL to encourage take up of sustainable aviation fuels/newer aircraft through operating policy/strategy. Draft GHG Management Plan		N/A				

12.16 Completing the assessment

12.16.1 The following activities will be undertaken to complete the assessment, the results of which will be presented in the submission ES.

12.16.2 The forecast GHG emissions will be reviewed in preparation for the ES. Specifically, the following may be considered should further detail be available:

a. the scale of aircraft emissions will be reviewed to take into account the likely evolution and use of sustainable aviation fuels, and to reflect expected gradual transition to electric / hybrid aircraft in use on some domestic and short haul routes;

b. more developed data on the design of buildings and infrastructure, and a more informed estimate of the material requirements and waste arisings from the construction of the Proposed Development;

c. improved information from the strategic transport modelling to inform the assessments of surface access emissions;

d. confirmation of the mitigation measures to be implemented and their effect on reducing the emissions arising from the Proposed Development;

e. new government policy including the Jet Zero Strategy resulting from the Jet Zero consultation.

12.16.3 Next steps will also see close working with the Project design teams to confirm the adoption of mitigation measures through design of the airport facilities and highways infrastructure, optimisation of material sourcing and recycling of cut/fill materials and management of construction stage emission.

COMPETENT EXPERTS

Topic	Role	Company	Qualifications/competencies/experience of author
Climate Change	Author	AECOM	MSc International Marketing Management with Sustainability, BSc Economics, 8 years of experience working in the sustainability sector
Climate Change	Author	AECOM	BSc Environmental Management and Technology; 20+ years' experience working in sustainability sector, MIEMA, CEnv
Climate Change	Technical reviewer	AECOM	BA (Hons) Environmental and Social Values. 20 years' experience working in the sustainability sector.
Climate Change	Technical reviewer	Arup	MEng Civil Engineering, Eng. Doctorate in Environmental Technologies, MIEMA, Chartered Environmentalist (CEnv) more than 20 years of professional experience in the field of climate change

GLOSSARY AND ABBREVIATIONS

Term	Definition
T2	Terminal 2
ANPS	Airports National Policy Statement
AoS	Appraisal of Sustainability
ATM	Air Traffic Movements
BEIS	Department for Business, Energy & Industrial Strategy
CAA	Civil Aviation Authority
CBC	Central Bedfordshire Council
CCC	Climate Change Committee
CCD	Climb, Cruise, Descent
CoCP	Code of Construction Practice
CORSIA	Carbon Offsetting Reduction Scheme for International Aviation
DCO	Development Consent Order
DfT	Department of Transport
DM	Do-Minimum scenario
DS DCO-embedded	Do-Something DCO scenario with embedded mitigation
EASA	European Union Aviation Safety Agency
ES	Environmental Statement
EEA	European Economic Area
EIA	Environmental Impact Assessment
EMEP/EEA	European Monitoring and Evaluation Programme/European Environment Agency
EV	Electric Vehicle
GHG	Greenhouse Gas
Ground Support Equipment	GSE
HCC	Hertfordshire County Council
ICAO	International Civil Aviation Organisation
IEMA	Institute of Environmental Management and Assessment
LBC	Luton Borough Council
LLAOL	London Luton Airport Operations Limited
LTO	Landing Take-Off
MPPA	Million Passengers Per Annum

NHDC	North Hertfordshire District Council
NPPF	National Planning Policy Framework
PEIR	Preliminary Environmental Information Report
RICS	Royal Institution of Chartered Surveyors
SAF	Sustainable Aviation Fuels
UK ETS	UK Emission Trading Scheme
UNFCCC	United Nations Framework Convention on Climate Change

REFERENCES

Ref 12.1 United Nation (2015) Paris Agreement [Accessed: 12 October 2021]
Ref 12.2 UK Government (2017) The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 [Accessed: 16 September 2021]
Ref 12.3 HM Government (2008) Climate Change Act 2008 [Accessed: 16 September 2021]
Ref. 12.4 UK Government (2021) The Carbon Budget Order 2021 [Accessed 15 September 2021]
Ref 12.5 Climate Change Committee (2020) The Sixth Carbon Budget Aviation [Accessed 30 September 2021]
Ref 12.6 UK Government (2021) The Air Navigation (Carbon Offsetting and Reduction Scheme for International Aviation) Order 2021 [Accessed 20 September 2021]
Ref 12.7 ICAO (2019) Climate Change Mitigation: CORSIA [Accessed 1 October 2021]
Ref 12.8 UK Government (2020) The Greenhouse Gas Emissions Trading Scheme Order 2020 [Accessed 16 September 2021]
Ref 12.9 Department for Transport (2021) Consultation outcome. Implementing the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA): UK government response [Accessed at: 16 September 2021]
Ref 12.10 UK Government (2020) United Kingdom of Great Britain and Northern Ireland's Nationally Determined Contribution [Accessed: 16 September 2021]
Ref 12.11 Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework [Accessed: 15 September 2021]
Ref.12.12 Department for Transport (2018) Airport National Policy Statement: new runway capacity and infrastructure at airports in the South East of England [Accessed 30 September 2021]
Ref 12.13 Department for Environment, Food & Rural Affairs (2018) A Green Future: Our 25 Year Plan to Improve the Environment [Accessed: 20 September 2021]
Ref 12.14 UK Government (2013) Aviation Policy Framework [Accessed 20 September 2021]
Ref 12.15 Department for Transport (2018) Beyond the Horizon. The future of UK aviation: making best use of existing runways [Accessed 20 September 2021]
Ref 12.16 UK Government (2018) Aviation 2050. The future of UK aviation [Accessed 21 September 2021]
Ref 12.17 Department for Transport (2021) Transport Decarbonisation Plan, Decarbonising Transport: a better, greener Britain [Accessed 21 September 2021]
Ref 12.18 Department for Transport (2021) Jet zero: our strategy for net zero aviation [Accessed 21 September 2021]
Ref 12.19 Department for Transport (2014) National Policy Statement for National Networks [Accessed 19 November 2021]
Ref 12.20 Luton Borough Council (2017) Local Luton Plan 2011-2031 [Accessed 23 September 2021]
Ref 12.21 Luton Borough Council (2021) My climate action plan. Becoming a carbon neutral borough by 2040 [Accessed 23 September 2021]
Ref 12.22 Central Bedfordshire Council (2021) Local Plan 2015-2035 [Accessed 23 September 2021]
Ref 12.23 North Hertfordshire District Council (2016) Proposed Submission Draft Local Plan 2011-2031 [Accessed 23 September 2021]
Ref 12.24 Department for Transport (2018) Airport National Policy Statement: new runway capacity and infrastructure at airports in the South East of England [Accessed 30 September 2021]
Ref.12.25 Ministry of Housing, Communities & Local Government (2019) National Planning practice guidance [Accessed 7 October 2021]
Ref. 12.26 IEMA (2017) Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance [Accessed 28 September 2021]
Ref. 12.27 World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) (2015) Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard [Accessed 28 September 2021]
Ref 12.28 BSI (2016) Publicly Available Standard 2080: Carbon Management in Infrastructure.
Ref 12.29 BSI (2011) BS EN 15978:2011 Sustainability of construction works - assessment of environmental performance of buildings - calculation method. London: British Standards Institute [Accessed 19 November 2021]
Ref 12.30 European Environment Agency (2019) EMEP/EEA air pollutant emission inventory guidebook 2019. Technical guidance to prepare national emission inventories [Accessed 1 September 2021]

Ref 12.31 Department for Transport (2018) Airport National Policy Statement: new runway capacity and infrastructure at airports in the South East of England [Accessed 30 September 2021]
Ref 12.32 Department for Transport (2021) Jet zero: our strategy for net zero aviation [Accessed 21 September 2021]
Ref 12.33 Department for Transport (2021) Transport Decarbonisation Plan, Decarbonising Transport: a better, greener Britain [Accessed 21 September 2021]
Ref 12.34 UK Government (2020) The Greenhouse Gas Emissions Trading Scheme Order 2020 [Accessed 16 September 2021]
Ref 12.35 The Planning Inspectorate (2019) First Transboundary Screening [Accessed 12 October 2021]
Ref 12.36 Department for Transport (2018) Airport National Policy Statement: new runway capacity and infrastructure at airports in the South East of England [Accessed 30 September 2021]
Ref 12.37 Ricardo Energy & Environment (2021). London Luton Airport Footprint 2019. Unpublished.
Ref 12.38 World Business Council for Sustainable Development /World Resource Institute (2015) The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard [Accessed 15 October 2021]
Ref 12.39 World Business Council for Sustainable Development /World Resource Institute (2015) The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard [Accessed 15 October 2021]
Ref 12.40 Department for Business, Energy & Industrial Strategy (2021) Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal. Data tables 1 to 19: supporting the toolkit and the guidance. Table 1: Electricity emissions factors to 2100, $kgCO_2e/kWh$ [Accessed 1 October 2021]
Ref 12.41 London Luton Airport Operations Limited (2020) Annual Monitoring Report 2020 [Accessed 3 November 2021)
Ref 12.42 Department for Transport (2021) TAG data book Table A 1.3.9 [Accessed 13 October 2021]
Ref 12.43 European Environment Agency (2019). 1.A.3.a Aviation 1 Master emissions calculator 2019. [Accessed 31st August 2021]
Ref 12.44 Department for Business, Energy & Industrial Strategy (2021). Greenhouse Gas Reporting – Conversion Factors 2021. [Accessed 31st August 2021]
Ref 12.45 European Environment Agency (2019). 1.A.3.a Aviation 1 Master emissions calculator 2019. [Accessed 31st August 2021]
Ref 12.46 Department for Business, Energy & Industrial Strategy (2021) Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal. Data tables 1 to 19: supporting the toolkit and the guidance. Table 1: Electricity emissions factors to 2100, $kgCO_2e/kWh$ [Accessed 1 October 2021]
Ref 12.47 Department for Transport (2021) Transport Decarbonisation Plan, Decarbonising Transport: a better, greener Britain [Accessed 21 September 2021]
Ref 12.48 Department for Business, Energy and Industrial Strategy (2021) Participating in the UK Emissions Trading Scheme [Accessed 12 October 2021]
Ref 12.49 Sustainable Aviation, 2020, Decarbonisation Road Map: A Path to Net Zero [Accessed 14 October 2021]
Ref 12.50 EEA/EASA/Eurocontrol, 2019, European Environmental Aviation environmental Report
Ref 12.51 Department for Business, Energy and Industrial Strategy (BEIS), 2021, Conversion factors 2021 [Accessed 10 September 2021]
Ref 12.52 Circular Ecology, Dr Craig Jones (2019) Embodied Carbon - The Inventory of Carbon Energy (ICE) Database [Accessed 15 October 2021]
Ref 12.53 Ricardo Energy & Environment (2021). London Luton Airport Footprint 2019. Unpublished.
Ref 12.54 IEMA (2018) Assessing Greenhouse Gas Emissions and Evaluating their Significance [Accessed 28 September 2021]
Ref 12.55 Department for Transport (2018) Appraisal of Sustainability for Airports NPS Available [Accessed 6 October 2021]
Ref 12.56 Department for Business, Energy & Industrial Strategy (2021) Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal. Data tables 1 to 19: supporting the toolkit and the guidance. Table 1: Electricity emissions factors to 2100, kgCO2e/kWh [Accessed 1 October 2021]
Ref 12.57 Department for Transport (2021) Jet zero: our strategy for net zero aviation [Accessed 21 September 2021]

Ref 12.58 Climate Change Committee (2020) The Sixth Carbon Budget Aviation Sector Summary [Accessed 30 September 2021]
Ref 12.59 Department for Transport (2021) TAG data book Table A 1.3.9 [Accessed 13 October 2021
Ref 12.60 Department for Transport (2021) TAG data book Table A 1.3.9 [Accessed 13 October 2021
Ref 12.61 Ricardo Energy & Environment (2017) Carbon Abatement in UK Aviation [Accessed 2 November 2021]
Ref 12.62 Department for Business, Energy and Industrial Strategy (BEIS), 2021, Conversion factors 2021 [Accessed 10 September 2021]
Ref 12.63 Department for Transport (2017) UK Aviation Forecasts 2017 [Accessed 12 October 2021]
Ref 12.64 Department for Transport (2018) Appraisal of Sustainability for Airports NPS Available [Accessed 6 October 2021]
Ref 12.65 Committee on Climate Change (2013) Factsheet: Aviation [Accessed 1 December 2021]
Ref 12.66 LLAOL (2021) Variation of condition application to accommodate 19 mppa and to amend the day and night noise contours (21/00031/VARCON) [Accessed 22 November 2021]
Ref 12.67 Department for Business, Energy & Industrial Strategy (2021) Government Greenhouse Gas Conversion Factors for Company Reporting Methodology Paper for Conversion factors Final Report
Ref 12.68 Manchester Metropolitan University (2018) The current state of scientific understanding of the non-CO_2 effects of aviation on climate [Accessed 1 December 2021]
Ref 12.69 Cranfield University (2021) Contrail-induced global warming: why the aviation industry needs to be thinking beyond carbon emissions [Accessed 1 December 2021]
Ref 12.70 MDPI (2021) Analysis of Aircraft Routing Strategies for North Atlantic
Flights by Using AirTraf 2.0 [Accessed 1 December 2021]
Ref 12.71 World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) (2015) Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard [Accessed 28 September 2021]