September 2026

Advice to the UK Government on proposed Heathrow Airport expansion

Climate Change Committee

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16 September 2026

This report is available online at: www.theccc.org.uk/publications.

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The Committee

The Climate Change Committee (CCC) is an independent, statutory body established under the Climate Change Act 2008. Our purpose is to advise the UK and devolved governments on emissions targets and to report to Parliament on progress made in reducing greenhouse gas emissions and preparing for and adapting to the impacts of climate change.

Members of the Committee include:

Nigel Topping CMG, Chair
Nigel Topping was appointed by the UK Prime Minister as UN Climate Change High Level Champion for COP26. In this role Nigel mobilised global private sector and local government to take bold action on climate change, launching the Race to Zero and Race to Resilience campaigns and, with Mark Carney, the Glasgow Financial Alliance for Net Zero.

Professor Keith Bell FRSE
Keith Bell is a co-Director of the UK Energy Research Centre (UKERC), a Chartered Engineer and a Fellow of the Royal Society of Edinburgh. He has been at the University of Strathclyde since 2005, was appointed to the Scottish Power Chair in Smart Grids in 2013 and has been involved in energy system research in collaboration with many academic and industrial partners.

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Laura Díaz Anadón is the Chaired Professor of Climate Change Policy at the University of Cambridge and Director of the Centre for Environment, Energy and Natural Resource Governance (CEENRG), also at the University of Cambridge. She is a leading global expert on climate and energy policy.

Professor Piers Forster CBE FRS
Piers Forster is Director of the Priestley Centre for Climate Futures and Professor of Physical Climate Change at the University of Leeds. He has played a significant role authoring Intergovernmental Panel on Climate Change (IPCC) reports, and is a coordinating lead author role for the IPCC's sixth assessment report.

Dr Steven Fries
Steven Fries is a Senior Associate Fellow at the Institute for New Economic Thinking at the Oxford Martin School, University of Oxford, and Nonresident Senior Fellow at the Peterson Institute for International Economics. Steven has previously held roles as group chief economist at Shell and chief economist at the Department of Energy and Climate Change.

Professor Andrew Jordan
Andrew Jordan is Director of the Tyndall Centre for Climate Change Research at the University of East Anglia. With more than 30 years working in environmental and climate policy, he is internationally recognised for his research on how governments design, coordinate, and innovate public policies for sustainability, particularly within the European Union.

Emily Norton

Emily Norton has over 25 years of experience in the food and farming sector. After qualifying as a lawyer, Emily undertook an MSc in Sustainable Agriculture and has expertise in natural capital influences on land, food, and farming.

Professor Swenja Surminski is also a member of the Climate Change Committee. Due to a conflict of interest, she did not participate in the production of this advice.

Acknowledgements

The Committee would like to thank:

The team that prepared this report and its analysis. This was led by Emma Pinchbeck, James Richardson, Eoin Devane, Sophie Vipond, Owen Bellamy, Rose Armitage, and Grace Macready; and included Sandra Bogelein, Marta Calore, Rachel Carr-Whitworth, Joshua Deru, Stephen Dillon, Kieron Driscoll, Ariana Jessa, Steffi Johns, Sam Karslake, Miriam Kennedy, Adam Khan, Margot MacMahon, Harley McCourt, Moryse McInniss, Aaron McMahon, Bea Natzler, Sarah Nelson, Emily Nurse, Maria Reboredo Prado, Andrew Romang, Miranda Schroder, Rachel Sewell, Bryony Sheridan, Jamie Tarlton, Felicity Taylor, Seán Taylor, Scarlett Walker, Eveline White, Hannah Williams, Kirsty Wivell, Louis Worthington, and Fergal Wraith.

Our previous Committee member, Professor Corrine Le Quéré FRS.

Our previous expert advisor on the role of households and the public in the Net Zero transition, Professor Rebecca Willis.

A range of organisations and individuals who participated in workshops, engaged with us, submitted evidence, or met with the Committee bilaterally.

Executive summary

Greenhouse gas (GHG) emissions from UK aviation have more than doubled since 1990, while those across the economy as a whole have halved. Until the world reaches Net Zero CO_2 emissions, with deep reductions in emissions of other GHGs, global temperatures – and the impacts of climate change in the UK – will continue to rise. To contribute to achieving this goal, the aviation sector needs to take responsibility for its emissions reaching Net Zero by 2050.

The UK Government has asked the Climate Change Committee (CCC) to provide advice on the draft Heathrow Expansion National Policy Statement (HENPS) and the wider role of aviation in meeting cross-economy carbon budgets in the context of Heathrow expansion. This report sets out our response to the Government's request.

Heathrow is the UK's largest airport, accounting for nearly one-quarter of UK flights and around half of UK aviation emissions. Any Heathrow expansion must be consistent with the UK's legislated 2050 Net Zero target. Before granting a development consent order for Heathrow expansion, the UK Government should legislate policies that require the aviation sector to abate 100% of emissions by 2050, either directly or by purchasing engineered removals. This is the only way that the proposed Heathrow expansion could be considered consistent with the UK's carbon budgets and Net Zero.

- Even before considering Heathrow expansion, there is currently insufficient policy in place to decarbonise aviation. Under current policy, aviation emissions would not fall at all from 2025 levels by 2050. This is putting carbon budgets and the 2050 Net Zero target at risk.

- Expanding Heathrow will make it harder to achieve the Seventh Carbon Budget and the 2050 Net Zero target. The total impact of the proposed Heathrow expansion would increase whole-economy residual CO_2 emissions by 6.9% of expected 2050 levels.

- By 2050, aviation will be such a large part of the UK's remaining emissions, that it will not be able to rely on action elsewhere in the economy to meet the UK's 2050 Net Zero target (Figure 1). The aviation sector will have to reach Net Zero itself, both by reducing its direct emissions and by paying to offset any remaining emissions through engineered removals.

- The most efficient way to achieve a Net Zero aviation sector is for the cost of decarbonising aviation to be reflected in the cost of flying. Building on existing policy progress, this 'polluter pays' approach will both provide funding for sustainable aviation fuels (SAF) and engineered removals, and help manage growth in demand. This approach both makes the problem smaller and pays for the solution.

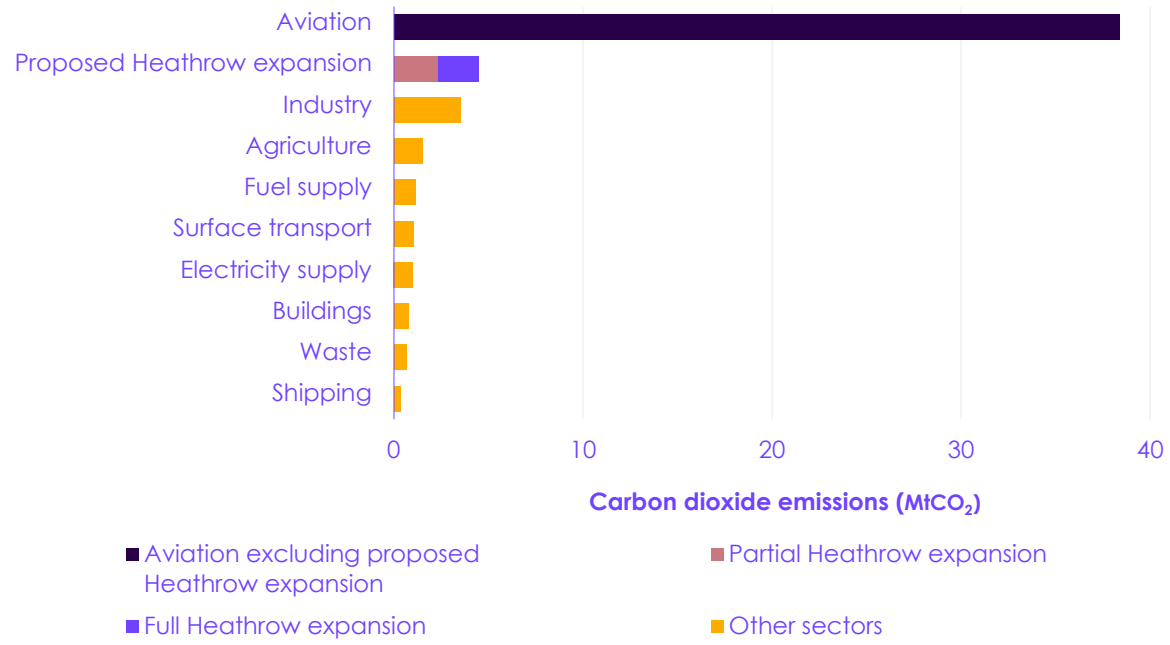
- The alternative, of limiting airport capacity, would likely lead to an increase in costs for consumers, which would help moderate demand growth. However, the profits from constraining capacity would accrue to the aviation industry, rather than providing resources for decarbonisation. Additional resources would be needed from elsewhere for SAF and engineered removals.

- To meet climate targets, demand for flying can only increase once there is progress on clean technology to decarbonise and remove residual emissions from flights.

The draft HENPS climate test sets out how the Secretary of State for Transport will decide whether Heathrow expansion can be carried out in a way that is consistent with the UK's legally binding emissions reduction obligations. It currently only considers the emissions impact of proposed Heathrow expansion on carbon budgets. Given the clear implications for levels of emissions in 2050

and beyond, the climate test must be strengthened to explicitly include the 2050 Net Zero target and consider the emissions impact of the full scope of expansion, proposed for 2054. Regardless of when this is completed, these emissions will need to be addressed, as UK emissions will need to remain at or below Net Zero beyond 2050 to avoid further contributing to climate change.

Figure 1 Sources of residual CO_2 emissions in 2050



Description: Almost all CO_2 emissions in 2050 will be from aviation, and CO_2 emissions from full Heathrow expansion alone would be larger than CO_2 emissions from any other sector of the economy.
Source: CCC (2025) *The Seventh Carbon Budget*; DfT (2026) *Draft Heathrow Expansion National Policy Statement appraisal report*; CCC analysis.
Notes: (1) Aviation bar excludes proposed Heathrow expansion emissions and uses draft HENPS Current Trends scenario. (2) 2050 residual CO_2 emissions are calculated using the CCC Seventh Carbon Budget advice Balanced Pathway for all sectors other than aviation.

Implications of Heathrow expansion for carbon budgets and Net Zero

The proposed expansion of Heathrow is planned to open in phases. The first phase is during the Seventh Carbon Budget period (2038 to 2042), with additional expansion in 2049 and completing in 2054. Expansion could therefore have implications for meeting legislated carbon budgets and the 2050 Net Zero target.

Existing policy in the aviation sector is insufficient. Under current government policy and even without Heathrow expansion, aviation emissions are projected to increase from 37 $MtCO_2e$ in 2025 to 39 $MtCO_2e$ in 2050.

Even these policies face significant delivery risk. In our 2026 Progress in reducing emissions report, we assessed that only 32% of aviation and 1% of engineered removals emissions reductions in the Sixth Carbon Budget period (2033 to 2037) are supported by credible plans.

Expanding Heathrow would compound the problem, adding 0.4 $MtCO_2e$ to emissions in 2040, rising to 2.4 $MtCO_2e$ in 2050, and 4.5 $MtCO_2e$ when expansion is complete in 2054 (Table 1).

The draft HENPS states that an assessment should be made using 'the percentage impact on economy-wide carbon budgets.' Because the UK's legally binding 2050 target is zero, it is not possible to calculate a percentage impact on the basis of whole-economy GHG emissions. Table 1 sets out a range of possible alternative metrics that could be used instead.

Table 1
The impact of proposed Heathrow expansion on emissions and possible measures of materiality

	Seventh Carbon Budget (2038–2042 annual average)	2050 (in-year)	Total Heathrow expansion impact (in-year)*
Proposed Heathrow expansion emissions impact ($MtCO_2e$)	0.4	2.4	4.5
Share of whole-economy net GHG emissions (%)	0.4%	n/a	n/a
Share of whole-economy residual GHG emissions (%)	0.3%	2.4%	4.5%
Share of whole-economy residual CO_2 emissions (%)	0.4%	3.7%	6.9%
Share of residual aviation GHG emissions (%)	1.2%	5.7%	10.3%

Source: DfT (2026) *Draft Heathrow Expansion National Policy Statement appraisal report*; CCC (2025) *The Seventh Carbon Budget*; CCC analysis.
Notes: (1) This table does not include proposed Heathrow expansion emissions from surface access, airport operations, or construction. (2) Whole-economy net GHG emissions in the Seventh Carbon Budget period are assumed to equal the legislated target of 535 $MtCO_2e$. (3) Analysis uses CCC Seventh Carbon Budget Balanced Pathway emissions for non-aviation sectors and the draft HENPS Current Trends scenario for aviation emissions. On this basis, 2050 whole-economy residual emissions are 97 $MtCO_2e$ and 2050 whole-economy residual CO_2 emissions are 63 $MtCO_2e$. (*) The draft HENPS assumes proposed Heathrow expansion will be completed in 2054. Here we have assessed what the impact would be if expansion were instead completed by 2050 (or equivalently if whole-economy emissions were to continue unchanged between 2050 and 2054, once the 2050 Net Zero target has been met), by comparing the full impact with 2050 residual emissions.

A Net Zero aviation pathway

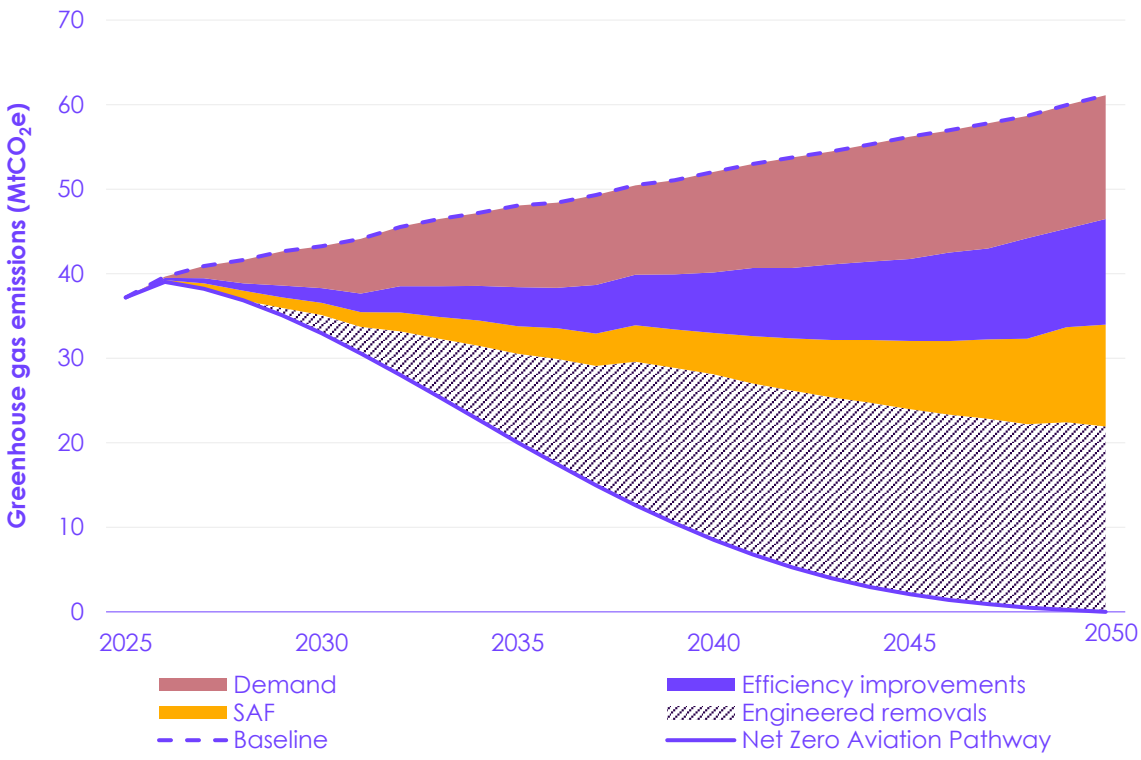
Further policy action is needed. Aviation emissions can be reduced by greater efficiency and managing demand growth. A small number of flights could shift to rail or to electric or hydrogen aircraft. But these can only go so far, so reaching Net Zero will also require a mix of SAF and engineered removals. However, nature-based removals, such as trees, are not suitable for offsetting residual aviation emissions because they lack the permanence needed to match very long-lived CO_2 emissions. SAF and engineered removals must be sufficient to eliminate all aviation emissions.

In this report, we set out a Net Zero Aviation Pathway which would achieve this (Figure 2). This incorporates the polluter pays principle, covering all UK aviation emissions. Industry would pay for SAF and engineered removals. Demand growth reflects the costs of these, which are assumed to be passed onto ticket prices. In this pathway, the aviation sector reaches Net Zero emissions in 2050. The emissions impact of Heathrow expansion, if these solutions were implemented, would also be zero in 2050.

As part of our advice on the Seventh Carbon Budget, we convened a citizens' panel which considered aviation decarbonisation, though not the specific issue of Heathrow expansion. The panel favoured a polluter pays mechanism and felt that responsibility for reducing emissions should sit with the aviation industry. They felt that those who do not fly should not face additional costs associated with removals. In the Net Zero Aviation Pathway, we estimate that ticket prices could increase by around £150 for a return trip to Alicante and £400 for a return trip to New York by 2050, around 6–9 pence per mile – similar to fuel duty on petrol and diesel today.

A credible and robust Net Zero policy framework for aviation should be set out in the revised Jet Zero Strategy planned for 2027. An implementation plan will also be needed. This should set out policies, timelines, funding, financing, and risk management for delivery of Net Zero aviation emissions. The framework should be developed jointly by the Department for Transport (DfT) and the Department for Energy Security and Net Zero (DESNZ), given DESNZ has responsibility for engineered removals.

Figure 2 The Net Zero Aviation Pathway



Description: Aviation emissions reach Net Zero in 2050. In 2050, engineered removals account for 36% of abatement, lower demand growth 24%, efficiency improvements 20%, and sustainable aviation fuel (SAF) 20%. Abatement is calculated compared to our baseline scenario, which assumes no further action to decarbonise aviation.
Source: CCC analysis.
Notes: (1) This pathway is shown including proposed Heathrow expansion and excludes military aviation emissions. (2) The solid colours represent the emissions reductions within the aviation sector. The hatched shading represents the residual emissions that are offset by engineered removals.

Early, long-term, and stable policy is needed alongside strong commitments from industry. This will give supply chains confidence to invest in and commercialise technologies now, to deliver Net Zero aviation solutions at scale from the 2030s. The key considerations for the UK Government are to:

- **Require industry to pay the costs of decarbonisation.** Industry should be facing the full costs of decarbonisation no later than 2050. These need to be phased in, starting soon. Options

for how this approach could be introduced in practice include technology mandates, UK ETS scope expansion, and other forms of carbon pricing.

  - By acting now, costs can be phased in gradually, avoiding disruption and sudden jumps in ticket prices. This could also generate revenues that can support early-stage technology development, as well as managing demand growth in the years before full-scale solutions are available.

  - The Government should set out what it sees as its role, the role of the aviation industry, and the role of SAF and engineered removals developers, including how early-stage development will be funded and financed.

  - Policies should be designed to manage mismatches between when revenues are raised and when SAF and engineered removals become available. Delivery risk should not be a reason to delay the phasing in of responsibilities for the industry. Instead, revenues could be banked for when supply is available or used to support early-stage technology development.

  - The Government should consider whether to implement policies to influence any distributional impacts of higher costs on lower-income groups. This would be in line with the views of the public in the citizens' panel from our Seventh Carbon Budget advice and the UK Citizens' Assembly.

- **Ensure contingency for technology delays.** While SAF and engineered removals are proven to be technically viable, there remains uncertainty around their deployment at scale on the timelines required. Contingency policies will be needed to allow for delays, including further demand growth management.

- **Manage competitiveness and carbon leakage risks.** Increased costs on the aviation sector could impact competitiveness and lead to carbon leakage, although the extent of this is uncertain. Policies should be designed to mitigate these risks, including through cooperation with the European Union (EU) on Emissions Trading Scheme (ETS) alignment, and by continuing to champion global aviation decarbonisation through the International Civil Aviation Organisation (ICAO).

- **Address commercial risks.** A key commercial risk for airport operators is the level of long-term aviation demand. If airport expansions are to be permitted, then the commercial risks related to demand should sit with investors. To allow investors to properly assess these risks, the Government needs to provide a robust policy framework for ensuring the aviation sector reaches Net Zero. These commercial risks apply across all airports, not just those considering expanding.

Draft Heathrow Expansion National Policy Statement

The draft HENPS covers a wide range of economic, social, and environment impacts from the proposed Heathrow expansion. That includes impacts at the national level and on local communities. It covers climate change mitigation and adaptation. In line with the Government's request, we have assessed proposed amendments to the climate change mitigation section of the draft HENPS.

The UK Government's climate test for Heathrow expansion is that 'the increase in carbon emissions resulting from any proposed scheme must not be so significant that it would have a material impact on the UK's legally binding carbon budgets.'

The Committee's view is that the climate test must be strengthened to ensure the emissions impact on all the UK's legislated targets, including the 2050 Net Zero target, is properly assessed and understood. This should include consideration of the emissions impact of full Heathrow expansion, currently planned for 2054.

- **2050 Net Zero target:** the Government and applicants should present analysis of the 2050 in-year impact of Heathrow expansion that can be directly compared to the 2050 Net Zero target. There are a range of potential metrics that could be used to assess the impact on the 2050 Net Zero target, including comparing to whole-economy residual CO_2 emissions, in both absolute and relative terms. This would be in line with the Committee's Seventh Carbon Budget advice.

- **Full proposed Heathrow expansion emissions:** the Government and applicants should present analysis of the emissions impact of the full scope of expansion plans on the 2050 Net Zero target. Under the plans set out in the draft HENPS, the full scope of Heathrow expansion is expected to be completed in 2054. Regardless of when the full expansion is completed, these emissions will need to be addressed, as UK emissions will need to remain at or below Net Zero beyond 2050 to avoid further contributing to climate change.

- **Estimates of other emissions impacts:** the assessment of non-CO_2 effects and surface access and construction emissions should be expanded and updated.

  - Non-CO_2 effects should be quantitatively assessed in a way that reflects the scientific uncertainty on the magnitude of these effects. The draft HENPS currently only requires a qualitative assessment.

  - The assessment of surface access and construction emissions should be updated to reflect developments since the 2018 Airports National Policy Statement (ANPS), including the introduction of the Zero Emission Vehicle (ZEV) mandate. This should be presented for carbon budget periods and 2050, to allow comparison to legislated targets.

- **Whole-economy emissions:** the Secretary of State for Energy Security and Net Zero is responsible for the delivery of legislated climate targets and engineered removals policy. They should therefore have a defined role in judging the materiality of Heathrow expansion, as well as in developing a robust policy framework covering all aviation emissions consistent with Net Zero.

Chapter 1: Trends in aviation demand, emissions, and climate impacts

In 2025, the UK Government announced plans to support a third runway at Heathrow Airport. In 2026, it published an updated Airports National Policy Statement (ANPS), now called the draft Heathrow Expansion National Policy Statement (HENPS).[1] This is the statutory document outlining how the Secretary of State for Transport will assess applications for a development consent order to expand Heathrow Airport.

The UK Government asked the Climate Change Committee (CCC) to provide advice on 'proposed amendments to the relevant sections of the ANPS and the wider role of aviation in meeting cross-economy carbon budgets in the context of Heathrow expansion, building on the CCC's Carbon Budget 7 advice.'[2]

This report sets out our response to the Government's request. It covers greenhouse gas (GHG) emissions from domestic and international civil aviation. Domestic aviation emissions are included within the scope of the UK's carbon budgets and the 2050 Net Zero target. The UK Government has recently legislated for the inclusion of international aviation emissions in the Sixth Carbon Budget (2033 to 2037), all subsequent carbon budgets, and the 2050 Net Zero target.[3]

In this chapter, we describe UK aviation demand and airport capacity. We then discuss the UK's historic aviation emissions and how they compare to progress in other sectors of the economy.

1.1 UK aviation demand and airport capacity

1.1.1 UK aviation demand

UK aviation passenger demand increased by 192% between 1990 and 2025, from 102 million to 299 million passengers per year. The total distance travelled by passengers (passenger-km) has also increased significantly over this period (Figure 1.1).[*;4]

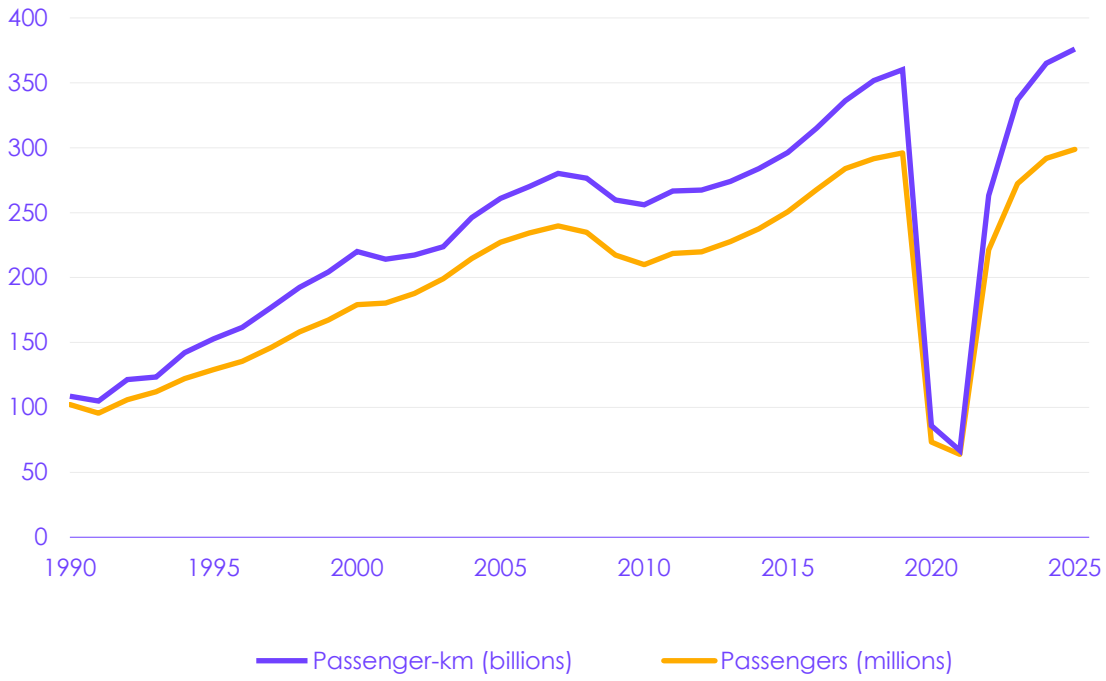
- The majority of the increase in demand has been from international short-haul trips.
  - Domestic demand increased from 25 million to 36 million passengers per year, accounting for 6% of the total increase.
  - Short-haul international demand increased from 55 million to 195 million passengers per year, accounting for 71% of the total increase.[†;5]
  - Long-haul international demand increased from 22 million to 68 million passengers per year, accounting for 23% of the total increase.

[*] UK aviation passenger demand and passenger-km include inbound and outbound passengers travelling to and from the UK, as well as transit passengers.

[†] This includes flights to European destinations, as well as Türkiye.

- Passenger-km increased by 247%. This is more than the increase in overall passenger flight demand, reflecting that average flight distances have increased.

Figure 1.1 Change in the number of passengers and distance flown (1990–2025)



Description: The total distance travelled by passengers (passenger-kms) has increased at a higher rate than the number of passengers, reflecting that average flight distances have increased.
Source: Civil Aviation Authority (2026) *UK airport data*.
Notes: Data include inbound and outbound passengers travelling to and from the UK, as well as transit passengers.

Flying is heavily concentrated within the population, with relatively small numbers of people making up a large proportion of the total number of flights abroad (Figure 1.2).[*;6]

- 48% of the population in England did not fly abroad in 2024.
- 80% of all flights abroad were taken by the 28% of people who took two or more flights abroad in 2024 (Figure 1.3).
- 33% of all flights abroad were taken by the 5% of people who took five or more flights abroad in 2024 (Figure 1.3).

Flying has become more widespread in the population. More people fly each year and the average number of flights abroad per person in England has increased since 2011. However, most of the increase in the number of flights taken has been driven by repeat and frequent flyers.

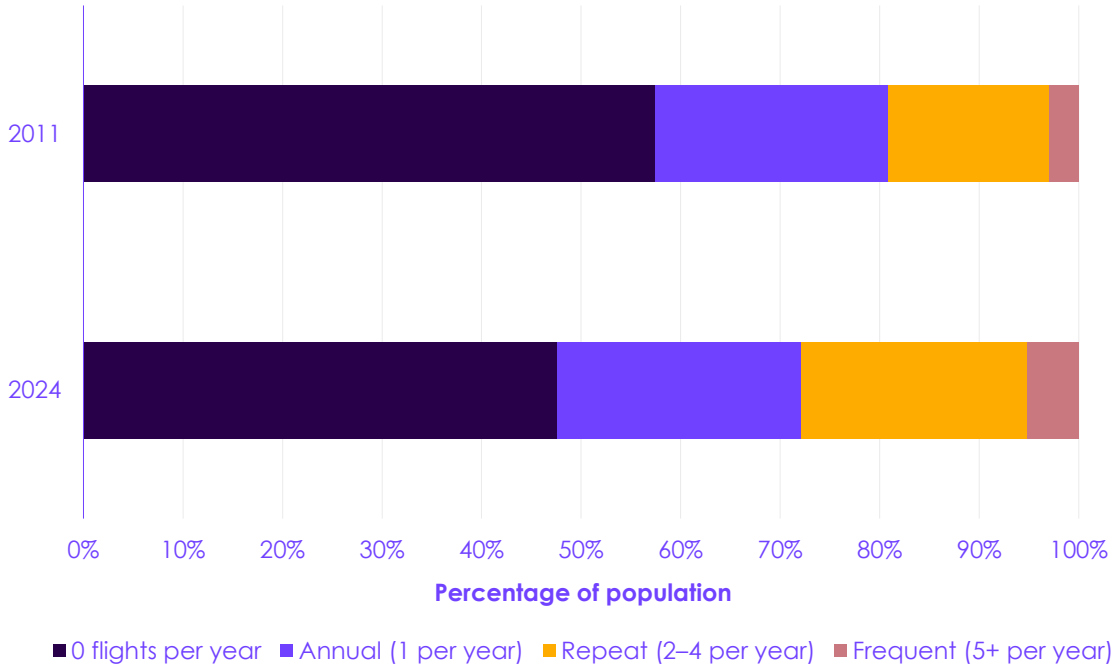
[*] National Travel Survey data cover international outbound flights made by residents of England. It does not include air travel within Great Britain, connecting flights, or inbound flights.

- The proportion of the UK population who fly abroad each year has increased from 43% in 2011 to 52% in 2024.
- The average number of flights abroad increased from 0.9 to 1.2 per person per year between 2011 and 2024.
- People who fly abroad more than once per year accounted for 92% of the increase in flights between 2011 and 2024. 37% of the increase was from people who fly abroad five or more times per year.

Flying is also concentrated by income, especially in the case of frequent flyers (Figure 1.4).

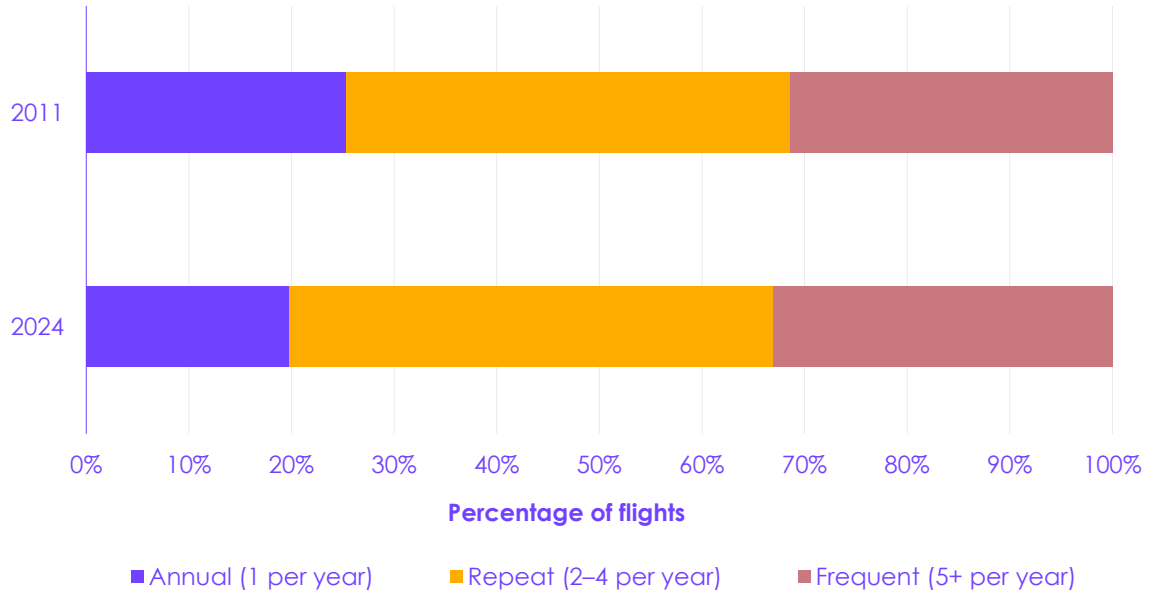
- People in the highest income quintile took 38% of all flights abroad in 2024, four times as many flights as people in the lowest income quintile.
- Frequent flyers in the highest income quintile took 53% of all flights abroad by frequent flyers. This is seven times as many flights as frequent flyers in the lowest income quintile, and accounts for 18% of all flights abroad across the whole population.
- Around 29% of the increase in flights abroad between 2011 and 2024 was from individuals in the highest income quintile, compared to 10% for those in the lowest income quintile.

Figure 1.2 How often people in England fly abroad



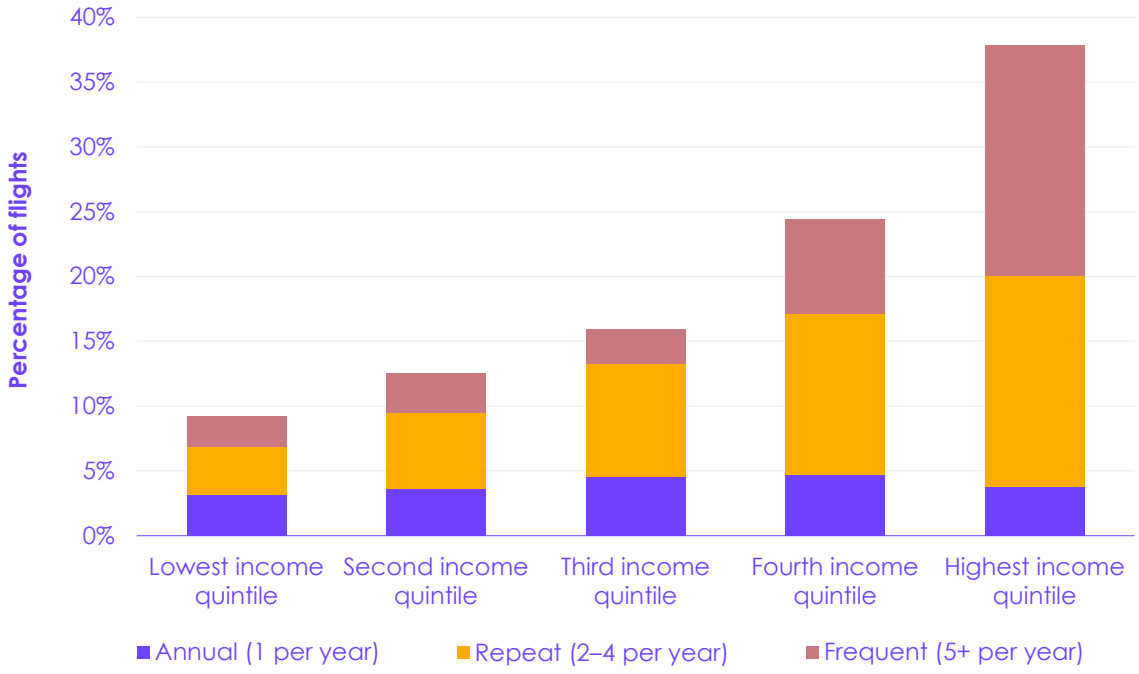
Description: Between 2011 and 2024, the proportion of the population who are repeat or frequent flyers increased, while the proportion of the population who do not fly abroad each year decreased. The proportion of the population who fly abroad once per year stayed approximately the same.
Source: DfT (2026) *National Travel Survey, 2002-2024;* CCC analysis.
Notes: Analysis includes flights abroad only and is based on a survey of residents of England.

Figure 1.3 Share of flights abroad by people who fly



Description: Between 2011 and 2024, the proportion of flights abroad taken by repeat and frequent flyers increased, while the proportion taken by people who take one flight abroad per year decreased.
Source: DfT (2026) *National Travel Survey, 2002-2024*; CCC analysis.
Notes: Analysis includes flights abroad only and is based on a survey of residents of England.

Figure 1.4 How often people of different income levels fly abroad (2024)



Description: People in the highest income quintile take significantly more flights abroad than people in the lowest income quintile, with the majority of flights taken by repeat and frequent flyers.
Source: DfT (2026) *National Travel Survey, 2002-2024*; CCC analysis.
Notes: Analysis includes flights abroad only and is based on a survey of residents of England.

1.1.2 UK airport capacity

Total theoretical UK airport runway capacity is around 5.2 million air transport movements (ATMs) per year, which includes all take-offs and landings.[*] There is a tendency for demand to concentrate at major hubs, given the potential for inter-connecting between different routes. As a result, capacity utilisation varies widely across UK airports. It also varies seasonally, with peak use mostly coinciding with holiday periods.

- Heathrow made up 23% of UK ATMs and 28% of all passengers in 2025.
- The UK's four largest airports – Heathrow, Gatwick, Manchester, and Stansted – made up over half (54%) of all ATMs and nearly two-thirds (63%) of all passengers in 2025.
- Passenger demand in 2025 was 50% higher in July to September than between January to March.[7]

While Heathrow is effectively operating at full capacity, total annual runway capacity utilisation across the UK is around 40% (Table 1.1).[†] Capacity at individual airports can be limited by factors beyond runway capacity, such as terminal capacity, but most airports in the UK currently operate below capacity.

Flight numbers, and hence emissions, are therefore primarily determined by demand for flying, rather than the overall capacity of UK airports. The net impact of proposed Heathrow expansion on total UK flight numbers would not be the same as the additional capacity added at Heathrow. For instance, some flights might take place from Heathrow that would have otherwise flown from a different UK airport. Equally, if the proposed Heathrow expansion does not go ahead, the total number of flights may still increase if there is sufficient demand at other UK airports.

There is also an international dimension. Some passengers transfer at UK airports between flights whose origin and destination both lie outside the UK. This is known as hubbing. Increases in UK airport capacity might displace some transfers from hub airports in other countries and likewise a lack of UK capacity might displace some transfers from UK airports to other countries. The Department for Transport's (DfT) aviation modelling suite (which we use in this report) models demand at four competing international hub airports and calculates the resulting impact of displaced UK demand on UK territorial emissions.[8]

[*] Airport capacity refers to the maximum number of flights or passengers an airport can accommodate. An air transport movement (ATM) is a single take-off or landing by a plane. ATM capacity describes how many flights an airport can accommodate, excluding some types of flights, such as maintenance flights and emergency landings.

[†] This represents runway capacity utilisation across the 28 UK airports explicitly modelled in DfT's UK aviation forecast 2026. These airports accounted for 97% of total UK airport ATMs and over 99% of total passengers in 2025.

Table 1.1

UK runway and passenger capacity and utilisation in 2025

Airport	Runway ATMs			Passengers		
	Capacity (thousands)	Actual use (thousands)	Utilisation (%)	Capacity (millions)	Actual use (millions)	Utilisation (%)
Heathrow	480	484*	101%	86	84	99%
Gatwick	290	262	90%	55	43	78%
Manchester	362	197	54%	38	32	84%
Stansted	264	189	72%	43	30	69%
Edinburgh	188	121	64%	18	17	94%
Luton	171	105	62%	21	18	85%
Birmingham	205	93	46%	32	14	43%
Bristol	86	72	84%	12	11	90%
Glasgow	226	69	31%	15	8	55%
Belfast International	260	49	19%	23	7	30%
Other airports†	2,692	374	14%	75	35	47%
Total (all modelled airports)†	5,223	2,015	39%	417	298	72%
Total (all UK airports)	n/a	2,085	n/a	n/a	299	n/a

Source: DfT (2026) *Draft Heathrow Expansion National Policy Statement appraisal report*; Civil Aviation Authority (2026) *UK airport data 2025*.

Notes: (1) Passengers include inbound and outbound passengers, as well as transit passengers. (2) Totals may not sum due to rounding. (*) Heathrow airport operated above its official capacity of 480,000 Air Transport Movements (ATMs) due to non-commercial flights which are not counted against the limit. (†) 'Other' and 'total (all modelled airports)' capacity and actual use data reflect the 28 UK airports modelled in DfT's UK aviation forecast 2026. These airports accounted for 97% of total UK airport ATMs and over 99% of UK passengers in 2025.

1.2 UK aviation emissions

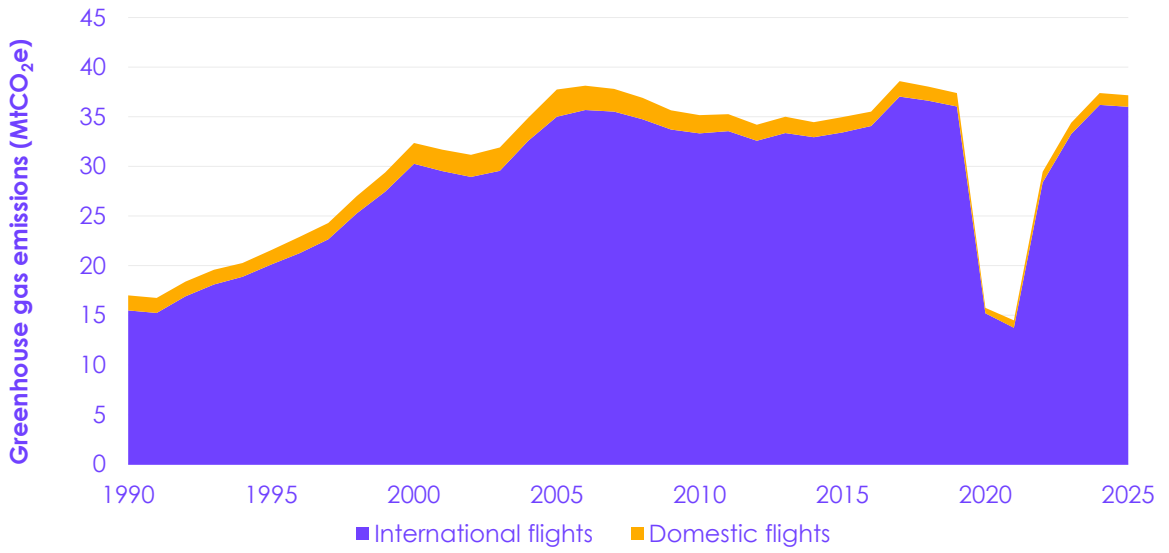
1.2.1 Trends in UK aviation emissions

UK civil aviation emissions are provisionally estimated at 37.2 $MtCO_2e$ in 2025.[*;9;10] This is 119% higher than 1990 levels, reflecting the growth in demand for flying (Figure 1.5).[11]

- Emissions have been relatively flat since 2005, except for between 2020 and 2023, when they declined due to restrictions in place during the COVID-19 pandemic. Emissions returned to pre-COVID-19 levels in 2024.
- The fuel intensity of aviation has halved from 0.83 kWh/passenger-km in 1990 to 0.40 kWh/passenger-km in 2025.[12;13]
- Approximately 62% of aviation emissions are from long-haul international flights, despite these making up 23% of passengers (Figure 1.6).[†] This reflects the longer distance and therefore higher fuel use of these flights.

Around half of aviation emissions in 2025 resulted from use of Heathrow airport.[14] This reflects the larger share of long-haul flights departing from Heathrow compared to other UK airports.

Figure 1.5 UK aviation emissions (1990–2025)

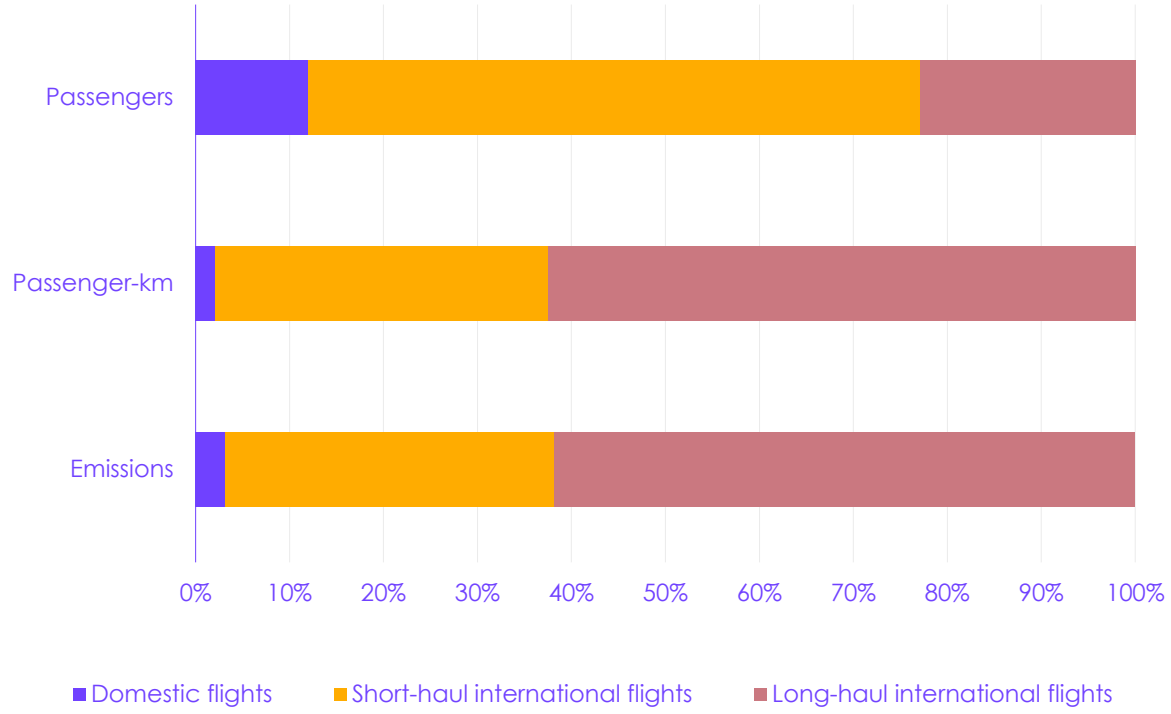


Description: UK aviation emissions have increased since 1990, driven by demand for international flights.
Source: DESNZ (2026) *Provisional UK GHG emissions statistics 2025*; DESNZ (2026) *Final UK GHG emissions national statistics: 1990 to 2024*; CCC analysis.
Notes: Military emissions are excluded.

[*] Aviation emissions are measured in the emissions inventory based on UK aviation fuel sales. This closely corresponds to modelled emissions from flights departing UK airports. More information is set out in DfT's aviation modelling suite documentation.

[†] We estimate the emissions split between short-haul and long-haul flights using the passenger-km split between them.

Figure 1.6 How different flight lengths contribute to aviation emissions and demand



Description: Around two-thirds of aviation emissions are from long-haul international flights, despite these flights making up only one-quarter of all passengers. This reflects the longer distance and therefore fuel use of these flights.
Source: Civil Aviation Authority (2026) *UK airport data 2025;* DESNZ (2026) *Provisional UK greenhouse gas emissions statistics 2025;* CCC analysis.
Notes: (1) Data include inbound and outbound passengers travelling to and from the UK, as well as transit passengers. (2) We estimate the emissions split between short-haul and long-haul international flights using the passenger-km split between short-haul and long-haul flights. (3) Data shown for 2025.

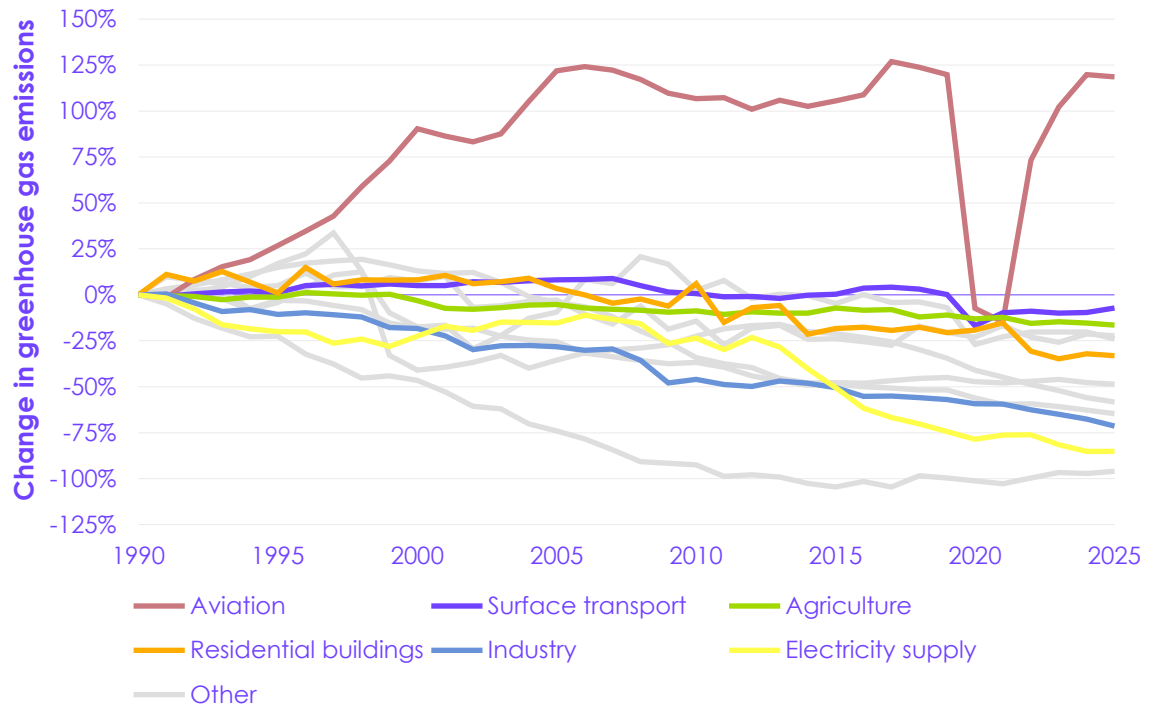
1.2.2 Aviation emissions compared to other sectors of the UK economy

Since 1990 aviation emissions have more than doubled, while all other sectors have reduced their emissions (Figure 1.7).[15;16] Aviation is now the UK's fifth highest-emitting sector.

Total UK emissions have fallen by 50% between 1990 and 2025, from 813 $MtCO_2e$ to 407 $MtCO_2e$, according to provisional 2025 emissions estimates.

- Aviation emissions make up an increasing share of total UK economy-wide emissions. In 2025, aviation made up 9% of total UK emissions based on provisional estimates, up from 3% in 1990.

Figure 1.7 Changes in emissions since 1990, by sector



Description: Since 1990, aviation emissions have more than doubled, while all other sectors have reduced their emissions.
Source: DESNZ (2026) *Provisional UK greenhouse gas emissions statistics 2025;* DESNZ (2026) *Final UK greenhouse gas emissions national statistics: 1990 to 2024;* CCC analysis.
Notes: (1) Today's top six highest-emitting sectors are shown in colour. (2) 'Other' sectors shown in grey include fuel supply, F-gases, land-use, shipping, waste, and non-residential buildings. (3) Aviation emissions reduced between 2020 and 2023 due to the COVID-19 pandemic. (4) Military aviation emissions are excluded.

1.2.3 Non-CO_2 effects of the aviation sector and Heathrow Airport

In addition to GHG emissions from fuel combustion, aviation has a range of non-CO_2 climate effects that contribute to global warming (Box 1.1). Given uncertainty and challenges over their measurement, these have not yet been included within the scope of international climate treaties or the UK's Climate Change Act. This should not prevent ambitious action to begin to tackle non-CO_2 effects (see Section 3.3).

Box 1.1
Heathrow Airport's contribution to UK and global non-CO_2 effects

In addition to CO_2 warming effects, aviation has further climate impacts that are not included in national emissions inventories and are outside the scope of international climate treaties. These result from nitrogen oxides (NO_x), water vapour, black carbon (soot), and sulphur dioxide (SO_2) emissions. These pollutants affect the climate in different ways. For example, nitrogen oxides are expected to have a warming effect and sulphur dioxide a cooling effect. Water vapour from planes can also create contrails, which are long trails of cloud caused by aircraft flying through supersaturated air, depending on the local atmospheric conditions. These high-altitude contrails can contribute to the formation of cirrus clouds, which typically have a relatively large warming effect on global surface air temperature.

Taken together, non-CO_2 effects are likely to have a high warming effect. Although the level of impact of some non-CO_2 effects on temperature change is uncertain, non-CO_2 effects are estimated to contribute around two-thirds of aviation's total effective radiative forcing globally. The global warming impact from non-CO_2 effects also lasts for around 10 to 20 years, while CO_2 emissions are much longer-lived.[17]

This means that the aviation sector's climate impact derives from a combination of all historic CO_2 emissions, but only more recent non-CO_2 effects. The policy implications of this are:

- Aviation's CO_2 and non-CO_2 effects need to be addressed to mitigate aviation's climate impact.
- Any action to reduce CO_2 emissions will have a lasting climate benefit.
- In contrast, any action to reduce non-CO_2 effects could have a large short-term benefit but will only create an overall net positive climate benefit if the action persists, such as contrail avoidance.
- Actions to reduce aviation's non-CO_2 effects should not lead to any significant increase in CO_2 emissions, for example due to longer flight paths. Mitigation actions for non-CO_2 effects must be trialled, monitored, and tested, and provide a net positive climate benefit.

Persistent contrail formation and warming impact from Heathrow Airport flights

The dominant non-CO_2 effect from flying is from contrail formation. UK flights across the North Atlantic and to/from East Asia have been shown to produce a significantly higher share of persistent contrails and resulting contrail warming impact relative to their flight distance, compared to other UK flights.[18] It is therefore likely that flights to and from Heathrow Airport account for a higher proportion of contrail warming relative to their flight distance, due to the flight routes the airport serves.

- Persistent contrail formation depends on factors such as geographical location, time of day they are formed, and weather conditions. For cross-North Atlantic flights, this is partly due to the Gulf Stream transporting warm water, which enhances evaporation and provides humid air at cruising altitudes, and because flights are predominantly flown at cruising altitudes.
- It is estimated that in 2019, flights across the North Atlantic accounted for 5% of global annual flight distance flown but contributed 10% of the global annual persistent contrails formed and 11% of global annual contrail warming impact.
- In 2019, Heathrow Airport provided flights for 74% of UK passengers travelling to Canada and the United States, and 90% of UK passengers travelling to East Asia.[19] In 2025, these shares were 85% and 81% respectively.

Endnotes

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[11] Department for Energy Security and Net Zero (2026) *Final UK greenhouse gas emissions national statistics: 1990 to 2024*. https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-statistics-1990-to-2024.

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[13] Department for Energy Security and Net Zero (2026) *Energy Trends: UK oil and oil products. Supply and use of petroleum products: latest quarter (ET 3.4 – quarterly)*. https://www.gov.uk/government/statistics/oil-and-oil-products-section-3-energy-trends.

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[15] Department for Energy Security and Net Zero (2026) *Provisional UK greenhouse gas emissions statistics 2025*. https://www.gov.uk/government/statistics/provisional-uk-greenhouse-gas-emissions-statistics-2025.

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Chapter 2: Aviation emissions under current government policy

In this chapter, we set out the range of measures available for decarbonising aviation. We examine the policies currently in place to deliver these, and we assess what the impact of proposed Heathrow expansion would be under them.

In this assessment, we use:

- The Government's Current Trends scenario, published alongside the draft Heathrow Expansion National Policy Statement (HENPS), as the estimate for the extent to which existing policy decarbonises aviation emissions.[1;2] This ensures consistency between our analysis and the Government's.

- Our Balanced Pathway, from our advice on the Seventh Carbon Budget, to estimate emissions in sectors other than aviation for 2050.[3] The full scope of proposed Heathrow expansion is scheduled for 2054, but we do not have an economy-wide emissions pathway that extends beyond 2050. We therefore also compare the 2054 full-scope emissions against whole-economy emissions in 2050. This reflects the impact if the full scope of proposed expansion were to be completed by 2050, or equivalently if whole-economy emissions were to continue unchanged between 2050 and 2054, once the 2050 Net Zero target has been met.

- A baseline, which assumes no further decarbonisation action compared to today. This provides a point of comparison with our Seventh Carbon Budget advice. However, the baseline does not itself form part of our assessment of the impact of proposed Heathrow expansion on emissions.

2.1 Measures for decarbonising aviation

2.1.1 Available measures

Reaching Net Zero aviation emissions will require a combination of measures across demand management, fuel efficiency improvements, sustainable aviation fuels (SAF), and engineered removals.

Moderating growth in demand and improving the fuel efficiency of planes can help reduce emissions, but they cannot be a complete solution to reaching Net Zero. People will continue to fly even if demand growth is managed. Fuel efficiency improvements can reduce, but not eliminate, the use of fossil fuels.

- **Aviation demand:** projected growth in aviation demand is predominantly driven by increases in people's expected incomes and changes in the expected price of flying. Government has a range of policy instruments that could be used to manage this demand growth (see Box 3.2). These are likely to impact demand for different flights and different groups of flyers, for example those who fly most frequently. Ultimately, however, most policies would operate by changing the price of flying, which is how they are modelled in this analysis. We also include a small effect from diverting some flights to rail.

  - Policies can have a direct or indirect impact on demand. Direct demand impacts would arise from policy that is primarily intended to manage demand, for example a tax on kerosene. Indirect demand impacts arise where policy to abate emissions also impacts on demand. For example, if the additional costs of SAF and engineered removals are paid for by the aviation industry and passed through to ticket prices, this will also help manage demand growth, as well as abating emissions.

  - In this analysis, we only model indirect demand management impacts which arise from applying a polluter pays approach to the costs of reaching Net Zero in the aviation sector. However, if technology is not on track in the near term to deliver what is required for the Seventh Carbon Budget and Net Zero, or if aviation sector emissions are not developing in line with Net Zero, government and industry will need to be ready to implement more demand management policy (see Chapter 3).

- **Fuel efficiency improvements:** these can continue to be delivered through measures such as improved aircraft designs and engines, more efficient airline operations, and airspace modernisation. The aviation industry faces strong incentives to pursue efficiency, since fuel costs are a significant part of operating costs.[4] Applying a polluter pays approach would further strengthen these incentives. New aircraft types, including the potential for hybrid-electric, battery-electric, and hydrogen aircraft, may play a role but likely in limited numbers and mainly for shorter routes.[5] They are therefore unlikely to contribute significant emissions reductions by 2050.

Hydrocarbons will be the only viable fuel for most flights, at least in the period to 2050. In the medium term, viable scalable routes to Net Zero will therefore depend on removing carbon from the atmosphere and either storing it underground to offset fossil hydrocarbon use or turning it into a replacement hydrocarbon fuel, known as SAF.

- **Permanent engineered removals:** engineered removals are measures which remove CO_2 from the atmosphere to permanent storage. They include direct air carbon capture and storage (DACCS) and bioenergy with carbon capture and storage (BECCS). Emissions from use of fossil hydrocarbons need to be offset by removing an equivalent amount of carbon from the atmosphere to reach Net Zero.

- **Sustainable aviation fuel:** SAF can reduce emissions by providing drop-in alternatives to fossil jet fuel. The two main types of SAF are biofuels and synthetic fuels.

  - **Biofuels:** currently all UK SAF is provided by biofuels made from waste fats and oils.[6] In the future, biomass can also be a source of SAF feedstock. However, availability of biomass-based SAF will be limited by land and competing uses, meaning long-term scalable supply will likely be provided by synthetic fuels. Biofuel carbon intensity varies widely and is dependent on a variety of factors, such as the feedstock used, indirect land-use change, and production technology.[7] It is unlikely that bio-based SAFs will reduce the lifecycle emissions impact of aviation fuel by 100% compared to fossil kerosene.[8]

  - **Synthetic fuels:** these are produced by combining low-carbon hydrogen with a source of captured carbon. They are sometimes called e-fuels or power-to-liquid fuels. If the carbon is captured from the atmosphere, then the resulting fuel can be considered carbon neutral, provided the production and distribution process is also zero carbon. Synthetic fuels that use fossil carbon captured from waste industrial processes are less carbon intensive than fossil kerosene, but on a lifecycle emissions basis are not carbon neutral.

The overall balance of measures that will be most effective and efficient to reach Net Zero aviation emissions by 2050 is uncertain. Ultimately the mix will be decided in the market, as technologies develop and relative costs become clearer. There are also clear similarities between production

processes for synthetic fuels and engineered removals, given that they both use sources of captured atmospheric carbon.

- **Captured carbon:** direct air capture is an input into the production of synthetic fuels and engineered removals using DACCS. Both technologies can deliver carbon-neutral outcomes.

- **Costs:** because producing synthetic fuels requires a source of low-carbon hydrogen and additional processing steps, current evidence suggests that these fuels are likely to be more expensive than engineered removals. However, this will also depend on future prices for fossil kerosene and costs of geological storage for CO_2.

2.1.2 Need for permanent removals

Use of greenhouse gas (GHG) removals in aviation should only focus on permanent engineered removals, not nature-based removals:

- **Permanent engineered removals:** CO_2 emissions from aviation are the result of fossil fuel combustion. These emissions will raise atmospheric CO_2 concentrations and contribute to warming for centuries into the future. These long-lived emissions should therefore only be offset by removals measures that are at least equivalently permanent: engineered removals.

- **Nature-based removals:** these measures, such as tree planting, have shorter lifetimes that cannot be guaranteed beyond decadal timescales. They are appropriate for offsetting emissions of shorter-lived GHGs which have atmospheric lifetimes also on decadal timescales, such as methane. They cannot be considered appropriate for offsetting CO_2 emissions from fossil fuel combustion.

Reflecting this, in our advice on the Seventh Carbon Budget, Net Zero is achieved by offsetting land-based emissions – mostly methane from agriculture – with nature-based removals, and offsetting emissions from other sectors – mostly CO_2 from aviation – by engineered removals (Figure 2.1).

Figure 2.1 Sources of emissions and negative emissions in the Balanced Pathway in 2050

Description: Net Zero is achieved by balancing remaining emissions from areas that cannot feasibly be decarbonised in our pathway with a combination of engineered and land-based removals. Nature-based removals offset residual emissions from agriculture, while engineered removals offset residual emissions from the remaining sectors (in particular aviation).
Source: CCC (2025) *The Seventh Carbon Budget*.

2.2 Overview of current government policy

The UK Government has legislated carbon budgets covering the period to 2042, on the pathway to Net Zero in 2050. Each carbon budget covers a five-year period, with the Seventh Carbon Budget covering 2038 to 2042. The UK's long-term legislated climate target is for whole-economy Net Zero emissions by 2050. The Government has legislated to include international aviation and shipping emissions from the Sixth Carbon Budget (2033 to 2037) onwards.[9]

Based on the draft HENPS, the proposed third runway at Heathrow airport would be built by 2035, if approved. Airport capacity would then increase in stages, starting in 2038, with additional expansion in 2049 that finishes in 2054.[10] The proposed opening is therefore during the Seventh Carbon Budget period, but it is also important that any assessment takes into account later impacts as expansion would continue increasing emissions even beyond the 2050 Net Zero target date.

The Government currently has two main policies for decarbonising aviation: carbon pricing and the SAF Mandate. International policies also apply to UK aviation (Box 2.1).

- **Carbon pricing:** emissions from domestic flights, and flights to countries within Europe, are included in the UK Emissions Trading Scheme (UK ETS).* Airlines must purchase ETS allowances to cover their annual emissions. In 2025, the average auction price was £48/tCO_2.[11] Engineered removals will be included in the UK ETS from 2029, allowing removals providers to sell negative emissions into the scheme and obtain a source of revenue.

- **SAF Mandate:** the UK has implemented an obligation on jet fuel suppliers to progressively reduce the lifecycle carbon intensity of aviation fuel, by including a proportion of SAF within the fuel they supply.[12] This SAF Mandate increases incrementally from 2% of aviation fuel needing to be SAF in 2025 to 17% in 2040.† There is also a synthetic fuel obligation (known as the power-to-liquid obligation) within the SAF Mandate, requiring 3.5% of fuel to be synthetic fuels by 2040. According to the latest provisional statistics, in 2025, SAF accounted for 2.3% of UK aviation fuel use.[13]

  - Heathrow provides an incentive for airlines operating out of the airport to use a greater proportion of SAF, so that SAF made up 3.1% of aviation fuel uplifted from Heathrow in 2025.[14] The airport aims to increase this to 11% by 2030.

  - The UK Government, the Scottish Government, the Welsh Government, and the Department of Agriculture, Environment and Rural Affairs for Northern Ireland have consulted on how the UK ETS should treat the emissions reduction claims from SAF. Considerations regarding SAF and UK ETS interaction are explored in Section 3.3.

Both SAF and engineered removals are nascent technologies. They are likely to require a range of support to accelerate their development at scale. The Government has some policy in place here too, but further action is needed to build on this and address significant risks in a number of areas.

- **Funding for SAF and engineered removals:** a SAF revenue certainty mechanism has been legislated and the Government is aiming to award contracts by the end of 2028, which will help fuel producers secure investment to increase UK SAF production. The Government has also finalised a business model for engineered removals and set out an ambitious pathway for removals in the Carbon Budget and Growth Delivery Plan (CBGDP).[15] However, no source of funding has yet been identified, other than inclusion in the UK ETS, which is unlikely to generate sufficient revenues in the short to medium term.

- **Assessment of policies and plans:** in our Progress in reducing emissions – 2026 report to Parliament, we assessed that only 32% of aviation and 1% of engineered removals emissions reductions required between now and 2037 in the CBGDP are supported by credible plans. Further action is therefore needed to ensure existing policy is credible. In addition, existing policy is insufficient to meet Net Zero by 2050, even if it is successfully implemented (see Chapter 3).

* The exact scope is domestic flights and flights from the UK to Gibraltar, Switzerland, and the European Economic Area (EEA).

† The mandate sets a GHG emissions saving target. The volume of SAF required to deliver the mandate depends on the emissions intensity of the certified SAF. Assuming SAF achieves 70% lifecycle GHG savings implies SAF will make up 22% of fuel use in 2040. In the 2026 Department for Transport (DfT) projections, SAF delivers an average of more than 70% lifecycle GHG savings, meaning the emissions saving target can be met with 17% uptake of SAF.

Box 2.1
International aviation policy

International policy

Global action to reduce aviation emissions is coordinated by the International Civil Aviation Organization (ICAO). Through the ICAO, member states have agreed to several aspirational climate targets:

- A collective long-term global aspirational goal of Net Zero carbon emissions by 2050.[16]
- Carbon-neutral global international aviation growth above 85% of 2019 emission levels.[17]
- 2% annual fuel efficiency improvements through to 2050 and a 5% reduction in emissions by 2030 through uptake of SAF compared to a counterfactual scenario where only fossil kerosene is used.[18]

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is the primary delivery mechanism for the ICAO's aspirational targets, complementing other aviation emissions reduction efforts. It is a global offsetting scheme requiring participating member state airlines to offset growth in CO_2 emissions above 85% of 2019 levels. From 2027, scheme participation becomes mandatory. The CORSIA scheme is currently due to end in 2035.

Linking emissions trading schemes (ETS) is another international mechanism. Linking creates larger and more liquid carbon markets, which has benefits such as increasing business certainty and reducing costs. In 2025, the UK and EU committed to linking the UK and EU emissions trading schemes, which is now subject to negotiation.[19] The UK ETS has domestic and European Economic Area (EEA) departing flights in scope and the EU ETS has EEA departing flights in scope. In 2026, the EU Commission proposed to include departing flights within a 5,000 km radius of Frankfurt Airport.[20]

Technology considerations

Two of the key technology groups for reducing emissions from international aviation are SAF and engineered removals. Within these, synthetic fuels and DACCS merit particular considerations in an international context.

- **UK suitability for DACCS:** the UK has several positive features which could support the development of a domestic DACCS industry, including plentiful and accessible geological CO_2 storage and a supportive policy agenda.
- **Geographic siting:** both technologies are energy-intensive and therefore likely to be most competitively produced in regions with abundant low-cost energy. Energy costs, along with accompanying factors such as business conditions, policy, labour cost, and CO_2 infrastructure and storage capacity, are likely to be key drivers of where production is sited. Box 7.12.2 of our Seventh Carbon Budget (2025) advice explores potential low-cost DACCS locations globally.
- **International trading:** the Committee does not recommend that the UK Government plan to use international DACCS at this stage, but it could be considered if the right conditions develop. If the UK is to purchase credits internationally, robust rules must be in place and confidence in access to the credits must be assured. For international synthetic fuel, GHG accounting guidelines need to be clarified, as it is currently unclear whether they require emissions savings for captured carbon to be accounted in the country where capture takes place.
- **Implications for the UK:** while these technologies are at an early stage of development both in the UK and globally, the Government should carefully consider the extent to which international synthetic fuel and DACCS can be relied upon for delivery. The UK must also avoid a scenario where countries choose to sell DACCS credits which might otherwise have increased their domestic delivery.

2.3 Future aviation emissions under current government policy

In this section, we assess aviation sector and proposed Heathrow expansion emissions impacts using the Government's latest projections of aviation emissions.[21] We use the Government's 'Current Trends' scenario, which is the draft HENPS core scenario for estimating future aviation emissions under current government policy. The key assumptions of the Current Trends scenario are:

- **Airport capacity:** approved expansions and proposed Heathrow Airport expansion proceed. Scenarios are also presented where the proposed Heathrow expansion does not proceed.

- **Sustainable aviation fuel:** the SAF Mandate is met. Because the level of the mandate is only set to 2040, uptake is assumed to remain constant from 2040 onwards.

- **Carbon pricing:** UK ETS and CORSIA carbon pricing is assumed in the modelling, respectively reaching £125/tCO_2e and £17/tCO_2e by 2050. These impact modelled demand by being applied to ticket prices. This assumes that the CORSIA scheme continues beyond 2035, its current end-date.

Beyond the ETS, there is no link between current government policy for engineered removals and emissions from the aviation sector. We have therefore not assumed any use of removals in our assessment of current aviation policy, in line with the Government's own projections published alongside the draft HENPS.

The draft HENPS also includes a 'Technology Development' scenario. Alongside more optimistic efficiency assumptions, this scenario assumes substantial further policy development. Uptake of SAF is assumed to reach 33% by 2050, compared to 17% under existing policy, and more ambitious CORSIA obligations are also assumed. This scenario cannot therefore be considered as modelling current government policy and we do not assess it.

We assess aviation and proposed Heathrow expansion emissions against the level of legislated carbon budgets and the 2050 Net Zero target. The draft HENPS states that the comparison should be made using 'the percentage impact on economy-wide carbon budgets.' We consider this and alternative metrics.

- **The Seventh Carbon Budget:** the Seventh Carbon Budget (2038 to 2042) emissions limit is set at 535 MtCO_2e. We compare the impact in this period against this required level of whole-economy GHG emissions.

- **Net Zero:** the UK's legally binding 2050 Net Zero target requires that all positive sources of residual emissions are balanced by equivalent GHG removals. Because the overall target is zero, it is not possible to calculate a percentage impact on the basis of whole-economy GHG emissions.

  - There are a range of possible alternative metrics that could be used instead to assess the impact on the UK's 2050 Net Zero target (Table 2.1).

  - Aviation emissions are 99% CO_2, a long-lived GHG that should be offset by permanent engineered removals (see Section 2.1). On this basis, residual CO_2 emissions provide an appropriate reference point for understanding the 2050 impact of aviation emissions.

Under the plans set out in the draft HENPS, the full scope of proposed Heathrow expansion is completed in 2054. The draft HENPS allows for flexibility regarding how and when each aspect of the expansion project is delivered. To assess the potential full extent of the emissions impact, we therefore assess the emissions implications of the full scope of expansion alongside the expected impacts by the Seventh Carbon Budget period (2038 to 2042) and 2050.

2.3.1 Aviation demand and emissions under current government policy

Under the Current Trends scenario, aviation sector emissions remain relatively constant from 2025 to 2040, both with and without proposed Heathrow expansion (Figure 2.2). From 2040 onwards, emissions increase as uptake of SAF under the SAF Mandate flattens out while demand continues to grow. This impact is larger with proposed Heathrow expansion. By 2050, with proposed Heathrow expansion, current policies are insufficient to avoid aviation sector emissions increasing beyond today's levels. Engineered removals are not included in the DfT scenarios to offset residual aviation emissions.

- **Aviation demand:** demand grows from 299 million passengers in 2025 to 474 million in 2050 without proposed Heathrow expansion (a 58% increase), and 491 million in 2050 with proposed Heathrow expansion (a 64% increase).

- **Seventh Carbon Budget period emissions:** over the Seventh Carbon Budget period (2038 to 2042), annual average aviation emissions are 37.0 $MtCO_2e$ without proposed Heathrow expansion and 37.5 $MtCO_2e$ with proposed Heathrow expansion. Provisional aviation emissions in 2025 were 37.2 $MtCO_2e$.

- **2050 emissions:** aviation emissions reach 38.8 $MtCO_2e$ without proposed Heathrow expansion and 41.1 $MtCO_2e$ with proposed Heathrow expansion, a 4% and 11% increase on provisional 2025 aviation emissions, respectively. In either case, the aviation sector accounts for the vast majority of total 2050 residual CO_2 emissions (Figure 2.3).

- **Full scope of proposed Heathrow expansion emissions:** in 2054, aviation emissions reach 39.4 $MtCO_2e$ without proposed Heathrow expansion and 43.9 $MtCO_2e$ with proposed Heathrow expansion, a 6% and 18% increase on provisional 2025 emissions, respectively.

2.3.2 Proposed Heathrow expansion under current government policy

Under the Current Trends scenario, proposed Heathrow expansion would make it harder to achieve the Seventh Carbon Budget and the UK's 2050 Net Zero target (Figure 2.2). The total impact of proposed Heathrow expansion would increase residual CO_2 emissions by 6.9% of 2050 levels. Table 2.1 presents a range of metrics that show the impact of expansion. The results show:

- **Seventh Carbon Budget period emissions:** over the Seventh Carbon Budget period, 2038 to 2042, annual average additional emissions from proposed Heathrow expansion are 0.4 $MtCO_2e$. These additional emissions account for 0.4% of whole-economy net GHG emissions allowed under the legislated level of the carbon budget, 0.3% of whole-economy residual GHG emissions, 0.4% of whole-economy residual CO_2 emissions, and 1.2% of aviation emissions.

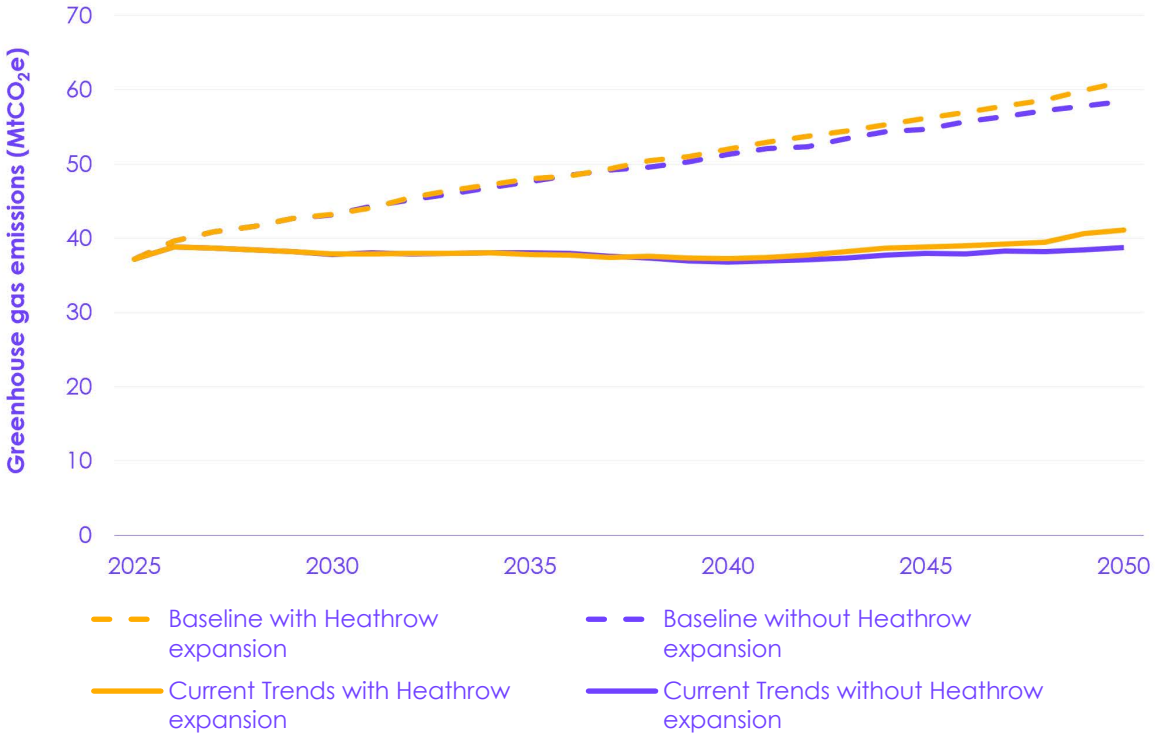
- **2050 emissions:** in 2050, additional emissions from proposed Heathrow expansion are 2.4 $MtCO_2e$. These account for 2.4% of whole-economy residual GHG emissions, 3.7% of whole-economy residual CO_2 emissions, and 5.7% of aviation emissions.

- **Full scope of proposed Heathrow expansion:** additional emissions from proposed Heathrow expansion in 2054 are 4.5 $MtCO_2e$, nearly double the impact in 2050. This is larger than the 2050 residual CO_2 emissions from any other sector outside of aviation (Figure 2.3). If the full scope of expansion were to be completed by 2050, then this level of additional emissions

would account for 4.5% of whole-economy residual GHG emissions, 6.9% of whole-economy residual CO_2 emissions, and 10.3% of aviation emissions.

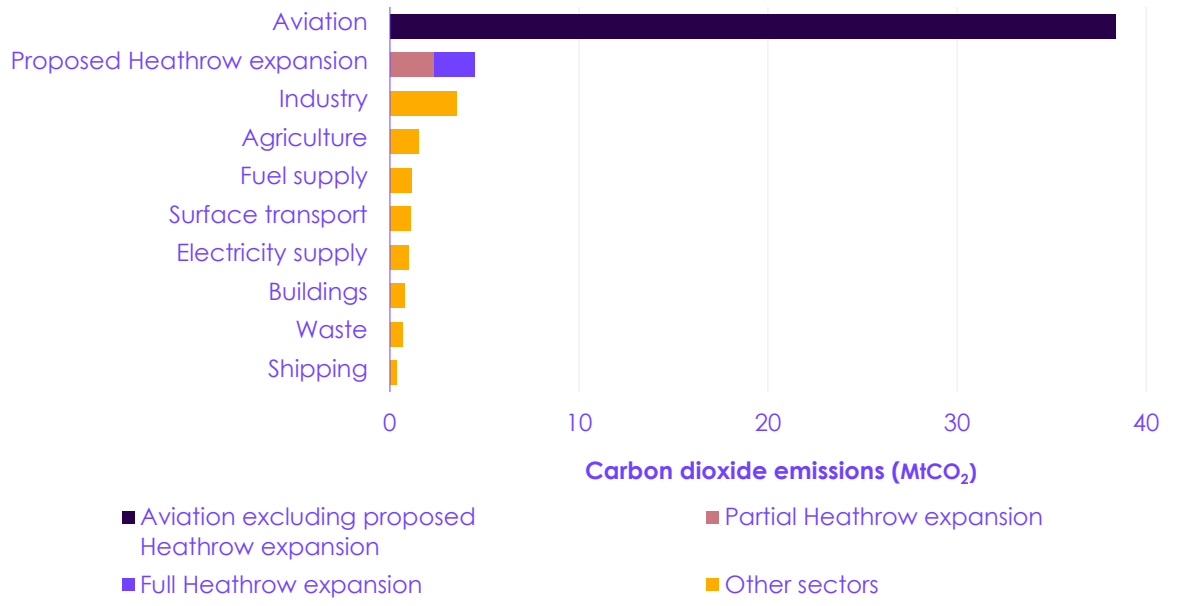
The draft HENPS also sets out an assessment of surface access, construction, and airport operation emissions. We have reviewed this evidence and how it should be improved in Box 2.2.

Figure 2.2 Proposed Heathrow expansion impact on aviation emissions under baseline and Current Trends scenarios



Description: Heathrow expansion increases aviation emissions from 2038.
Source: DfT (2026) *Draft Heathrow Expansion National Policy Statement appraisal report*; CCC analysis.
Notes: (1) This chart presents aviation sector emissions for the baseline and draft HENPS Current Trends scenario with and without proposed Heathrow expansion and excluding military aviation emissions. (2) Our baseline assumes that there is no further decarbonisation action compared to today. Over the period 2038–2042, annual average additional emissions from proposed Heathrow expansion are 0.9 $MtCO_2e$ in the baseline scenario, representing a 0.9% impact on Seventh Carbon Budget emissions.

Figure 2.3 Sources of residual CO_2 emissions in 2050



Description: Almost all CO_2 emissions in 2050 will be from aviation, and CO_2 emissions from full proposed Heathrow expansion alone would be larger than CO_2 emissions from any other sector of the economy.
Source: CCC (2025) *The Seventh Carbon Budget*; DfT (2026) *Draft Heathrow Expansion National Policy Statement appraisal report.*
Notes: (1) Aviation bar excludes proposed Heathrow expansion emissions and uses draft HENPS Current Trends scenario. (2) 2050 residual CO_2 emissions are calculated using the CCC Seventh Carbon Budget advice Balanced Pathway for all sectors other than aviation.

Table 2.1
The impact of proposed Heathrow expansion on emissions and possible measures of materiality

	Seventh Carbon Budget (2038–2042 annual average)	2050 (in-year)	Total Heathrow expansion impact (in-year)*
Proposed Heathrow expansion emissions impact ($MtCO_2e$)	0.4	2.4	4.5
Share of whole-economy net GHG emissions (%)	0.4%	n/a	n/a
Share of whole-economy residual GHG emissions (%)	0.3%	2.4%	4.5%
Share of whole-economy residual CO_2 emissions (%)	0.4%	3.7%	6.9%
Share of residual aviation GHG emissions (%)	1.2%	5.7%	10.3%

Source: DfT (2026) *Draft Heathrow Expansion National Policy Statement appraisal report*; CCC (2025) *The Seventh Carbon Budget*; CCC analysis.
Notes: (1) This table does not include proposed Heathrow expansion emissions from surface access, airport operations, or construction. (2) Whole-economy net GHG emissions in the Seventh Carbon Budget period are assumed to equal the legislated target of 535 $MtCO_2e$. (3) Analysis uses the CCC's Seventh Carbon Budget Balanced Pathway emissions for non-aviation sectors and the draft HENPS Current Trends scenario for aviation emissions. On this basis, 2050 whole-economy residual emissions are 97 $MtCO_2e$ and 2050 whole-economy residual CO_2 emissions are 63 $MtCO_2e$. (*) The draft HENPS assumes proposed Heathrow expansion will be completed in 2054. Here we have assessed what the impact would be if expansion were instead completed by 2050 (or equivalently if whole-economy emissions were to continue unchanged between 2050 and 2054, once the 2050 Net Zero target has been met), by comparing the full impact with 2050 residual emissions.

Box 2.2
Draft HENPS assessment of surface access, construction, and airport operation emissions

We have qualitatively reviewed the draft HENPS evidence on surface access, construction, and airport operation emissions. These emission sources are expected to account for around 10% of total emissions from proposed Heathrow expansion.[22] While this is a minority of the total emissions impact from expansion, these non-aviation emission sources could still affect the overall assessment of impact on legislated climate targets. In addition, the estimates of these emissions presented in the draft HENPS will be used as a benchmark to assess applicants' submissions for development consent. It is therefore important that the emissions assessments use the best available evidence. In some areas the assessments rely on outdated evidence which risks providing an inaccurate benchmark level.

The emissions assessments for non-aviation sources of emissions should be improved in the following ways:

- **Present emission impacts in relation to carbon budgets.** Currently, it is unclear what time period the emissions assessments apply to. The Heathrow Expansion Appraisal Report suggests a 60-year appraisal period but does not define a start date, and the Appraisal of Sustainability report assesses these emissions between 2024 and 2095.[23;24] All emission source impacts should be clearly presented in terms of legislated carbon budget periods and 2050 Net Zero impact.
- **Reflect new technology and policy developments.** The evidence used to assess non-aviation emission sources is out of date and incomplete. The surface access and airport operation emissions assessment uses 2018 evidence, and the construction emissions assessment uses 2014 evidence. This means key technology and policy developments in these sectors, such as the zero-emission vehicle (ZEV) mandate, are not quantitatively accounted for. Freight emissions have also not been assessed. These assessments should not be used to assess the impact of proposed Heathrow expansion on legislated climate targets and instead should be quantitatively updated.
  - **Surface access emissions assessment:** surface access emissions are estimated by DfT to be 9.5 $MtCO_2e$ over the 60-year appraisal period. For road transport emissions, progress in the electric vehicle (EV) transition should mean that the carbon impact for passenger vehicles is lower than the stated estimate. The Government must maintain ambitious national policies to support the rapid adoption of EVs, namely the ZEV mandate and commitment to the phaseout of petrol and diesel cars by 2030 and vans by 2035. DfT's vision to make 'public transport first choice' and inclusion of explicit targets for public transport mode share are welcome, although the draft HENPS no longer references Heathrow Airport's previously stated ambition to not increase road traffic. The carbon impact estimate for surface access should be updated to reflect progress in electric vehicles and include an estimate of emissions from additional freight movements. Without this, it is not possible to assess the net impact of surface access emissions on carbon budgets.
  - **Construction emissions assessment:** construction emissions are estimated to be 11.3 $MtCO_2e$ over the 60-year appraisal period. This assessment will not account for sector changes since the 2014 evidence this is based on, such as decreasing construction material carbon emissions intensity, and should be updated. We support the draft HENPS mitigations to undertake a whole life carbon assessment, maximise resource efficient design and use low carbon materials.
  - **Airport operations emissions assessment:** emissions from the electricity grid, heat, and airside vehicles have the potential to be fully electrified. Therefore, we expect these emission sources to be low. In the draft HENPS assessment, they are estimated to be 2.7 $MtCO_2e$ over the 60-year appraisal period. It is unclear how much decarbonisation this assessment assumes. It is welcome that the draft HENPS requires applicants to demonstrate evidence and consideration of electric charging facilities for passenger, staff, and rental vehicles. This should also include provision for freight electric vehicle charging.[25] In their submissions, applicants should ensure on-site energy use, including heat and airside vehicles, is 100% electric.

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Chapter 3: Pathway to Net Zero aviation

In this chapter, we set out a pathway for aviation sector emissions that is consistent with cross-economy carbon budgets and the legally binding 2050 Net Zero target. We assume the aviation industry takes responsibility for its emissions reaching Net Zero by 2050. We assess the impact of proposed Heathrow expansion under the CCC's Net Zero Aviation Pathway, and we discuss implications for government policy.

3.1 Net Zero-consistent policy in the aviation sector

There is currently insufficient policy to decarbonise the UK aviation sector. Early, long-term, and stable policy is needed, alongside strong commitments from industry. These will give supply chains confidence to develop and commercialise technologies now to deliver Net Zero aviation solutions at scale from the 2030s.

Once demand management and efficiency improvements are accounted for, remaining emissions will need to be addressed by a combination of sustainable aviation fuel (SAF) and engineered removals. The most efficient way to achieve this would be through a polluter pays approach. Under this approach, the costs of reducing the sector's emissions impact to Net Zero, whether through direct emissions reductions or using permanent engineered removals to offset ongoing emissions, are borne by the aviation industry. We assume these costs will be passed on to consumers through ticket prices. This in turn will both reduce demand growth and generate revenues, so that the same policy instrument both reduces the size of the problem and serves to fund solutions.

At a high level, policies to deliver this should:

- **Include all UK aviation emissions within Net Zero-consistent decarbonisation policy.** The UK Emissions Trading Scheme (ETS) currently only covers 23% of UK aviation emissions, the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) offsetting requirements only apply to in-scope international emissions above 85% of a 2019 baseline, and the SAF Mandate only requires 17% of aviation fuel to be low carbon by 2040.[1;2;3] To reach Net Zero, all UK aviation emissions need to be fully in scope of policy.

- **Incentivise SAF and permanent engineered removals.** These will account for most of the required emissions reduction by 2050. They are nascent technologies that are not yet available at the scale required and will take time to develop and commercialise. These long lead times mean that action needs to be taken now.

  - Government will need to set out suitable business models that, combined, enable deployment of SAF and engineered removals at sufficient scale to ensure Net Zero for aviation by 2050.

  - Under the polluter pays approach, the revenues needed to support these business models, including start-up funding, could be generated from the aviation industry, avoiding the need for public funding.

There are several policy options that could implement this approach. Box 3.1 sets out the views from our Seventh Carbon Budget citizens' panel on managing aviation demand. Box 3.2 sets out the policy options for government for decarbonising aviation.

Box 3.1
Aviation demand in the Seventh Carbon Budget citizens' panel

As part of our advice on the Seventh Carbon Budget, the Committee convened a citizens' panel to explore what an accessible, attractive, and affordable vision of Net Zero looks like for households. Among other topics, the panel explored the acceptability and affordability of different policy options for managing aviation demand. In general, there was broad acceptance of the need to manage future demand.

Panel members:

- **Mostly saw flying as a choice rather than a necessity,** particularly as many UK citizens do not fly often or at all. There was generally a preference to moderate the flying of those who fly frequently, business flights, and private jet use.
- **Mostly felt that ticket prices increasing because of policy was acceptable.**
- **Emphasised the importance of protecting the ability of families to fly on holiday once per year,** including low-income families. There was a general preference for policy to target the most polluting flights.
- **Felt that responsibility for reducing emissions should sit with the airline industry.** There was strong disapproval of the idea of government- or taxpayer-funded engineered removals, as they felt that those who do not fly should not face additional costs associated with removals.

After discussing a range of policy options to manage aviation demand, panel members:

- **Most strongly supported a frequent flyer levy** or an emissions- or distance-based tax.
  - Many were supportive of aviation taxes being levied on the small share of the population that flies most frequently. Some were in favour of more polluting flights being more strongly disincentivised. Following deliberation, participants preferred a policy lever which would combine the two principles.
  - Tax exemptions were preferred for a passenger's first flight, for children (so as not to penalise family holidays), and for those living on remote islands. Some panel members suggested exemptions for emergency circumstances, although feasibility was not explored.
  - There was less support for a flat tax which does not differentiate by emissions or flight frequency.
- **Were less supportive of policy requiring airlines to offset their emissions,** which impacts demand through passing technology costs onto ticket prices. Some expressed discomfort about engineered removals from the perspective of efficacy and safety, as well as not being aligned with the principle of reducing emissions. They were concerned about monitoring and enforcement, with trust in airlines to carry out removals being low. For those who supported this policy, they felt it should have a supplementary role to other policy options to target demand, and a desire was also expressed for airlines to fund engineered removals and for minimising the costs passed onto consumers.
- **Supported information provision and bans on 'air miles' rewards,** which they saw as easy levers to implement. However, they felt that their impact would be small and insufficient to manage demand alone.
- **Supported policy to limit airport expansion and capacity.** These were viewed as effective levers and participants saw it as unfair for policy to only target individual flight behaviour, while allowing for the aviation industry to expand.
- **Had mixed views on restricting certain types of flights.** Some panel members felt that restricting very short flights (with a rail alternative under four hours) would be acceptable, while others were less supportive as they felt that it would have limited effectiveness compared to targeting longer flights. There was more support for banning or heavily taxing private jets due to a preference to target 'luxury' flying, although they recognised that this would impact a small share of aviation emissions.
- **Were supportive of improving rail alternatives** but had mixed views about the efficacy of this for managing aviation demand. Improving the cost and reliability of trains was seen as a necessary condition for restricting domestic flights. Panel members were supportive of improving rail regardless of its impact on aviation demand, as it was viewed as a necessary public good. However, they had mixed views about whether this lever would be effective at impacting flying behaviours.

Box 3.2
Policy options for decarbonising aviation

The Government has a range of options for implementing a polluter pays approach in aviation, including:

- **Mandates:** these require the industry to purchase SAF, removals or a mix of both. They could be integrated into existing policies or be separate. The Independent Review of Greenhouse Gas Removals proposed evolving the existing SAF Mandate into a Net Zero aviation mandate to allow both SAF and engineered removals to be used for compliance.[4] Alternatively, a separate engineered removals mandate could be established.[5] In either case, the combined SAF and engineered removals requirements should rise to cover 100% of aviation emissions by 2050.
- **UK Emissions Trading Scheme (ETS):** coverage could be expanded to include all international departing flights. With greenhouse gas (GHG) removals due to be integrated from 2029, this would ensure the whole aviation industry could purchase removals for all its emissions.[6] It is important that woodland creation is not included in the ETS, to avoid nature-based removals being used to offset residual fossil emissions instead of permanent engineered removals.[7] This approach would also depend on UK-EU ETS linking arrangements and EU plans for international aviation emissions. Aligning ETS scopes would help minimise competitiveness distortions.
- **CORSIA:** the CORSIA scheme could become a credible route to global markets in SAF and engineered removals for international flights. This would require significant strengthening of the scheme, including extending coverage to at least 2050 and implementing a Net Zero-consistent baseline. Only permanent engineered removals credits should be considered to offset residual fossil emissions.
- **Taxation policies:** a kerosene tax, air passenger duty (APD), and frequent flyer levies are other policies that could be used to ensure that the industry pays for its decarbonisation. These would require revenues to be used to purchase SAF and engineered removals. A frequent flyer levy and APD have the potential to address distributional concerns to ensure those who do not currently fly or are not frequent flyers are still able to, for instance, go on holiday abroad once a year. Our Seventh Carbon Budget citizens' panel preferred policies that target the most polluting flights and most strongly supported a frequent flyer levy (see Box 3.1).

There are also alternative approaches to polluter pays:

- **Limiting airport capacity:** limiting airport capacity would likely lead to an increase in costs for consumers, which would help moderate demand growth. However, the profits from constraining capacity would accrue to the aviation industry, rather than providing resources for decarbonisation, so additional resources would be needed from elsewhere for SAF and engineered removals. Because there is substantial unused capacity at UK airports (see Section 1.1.2), limits on capacity would not have a simple one-for-one effect on aviation emissions.
- **Restricting some domestic flights:** domestic flights accounted for around 3% of UK aviation emissions in 2025. Restrictions on domestic flights would need to be coupled with improving rail alternatives, which is high cost for the small share of aviation demand it would address.
- **Nudging and information policies:** approaches such as flight emissions labelling and restrictions on air miles rewards may be useful for supplementing other policy but would likely have limited impact alone.

Additional demand management may still be required if emissions do not begin to decrease in the short term, or as a long-term contingency measure (see Section 3.3).

3.2 A Net Zero pathway for aviation

In this section, we set out our analysis of the impact of proposed Heathrow expansion on aviation emissions, under a pathway consistent with meeting Net Zero. We compare this to the UK's legislated climate targets, and discuss key uncertainties and implications.

We have created a new Net Zero Aviation Pathway for this analysis. This is based on a similar methodology to the aviation component of the Balanced Pathway in our Seventh Carbon Budget advice. However, a key difference is that the Net Zero Aviation Pathway now includes the emissions reduction from engineered removals that are paid for by the aviation sector. Previously these were grouped separately. It therefore provides a more complete picture of how the aviation sector can decarbonise.

- The Net Zero Aviation Pathway incorporates deployment of sufficient SAF and engineered removals to abate 100% of aviation sector emissions, after allowing for demand effects and efficiency, by 2050.

- Levels of SAF and engineered removals increase over the pathway up to 2050, based on assumptions about the revenue raised to pay for them, and constraints for how quickly they can feasibly be deployed.

- The optimal balance between SAF and engineered removals is uncertain. To reflect this, we include both within the Net Zero Aviation Pathway. We assume uptake of SAF increases to 38% in 2050, with engineered removals providing the remaining abatement needed.

The Net Zero Aviation Pathway assumes the polluter pays approach, so that SAF and engineered removals costs are passed on to ticket prices.* This has the effect of moderating growth in demand and provides revenues to pay for the decarbonisation measures.

- Within the modelling, revenues are first used to pay for the assumed levels of SAF, with the remaining revenues used to fund deployment of engineered removals to 2050. Further details on the modelling approach and assumptions are set out in the Annex.

- The Net Zero Aviation Pathway assumes both synthetic fuel and engineered removals are produced within the UK, and some biofuel SAF is imported, consistent with the approach we took in our Seventh Carbon Budget advice. We test alternatives to this in our sensitivity analysis (Section 3.2.3).

For consistency with our Seventh Carbon Budget advice, we present the Net Zero Aviation Pathway compared to a baseline for emissions in which there is no further action to decarbonise aviation. This baseline is not the same as the draft HENPS Current Trends scenario discussed in Chapter 2. The Current Trends scenario includes emissions reductions from existing government policy, for example increases in the level of SAF under the existing SAF Mandate.

3.2.1 Aviation demand and emissions in the Net Zero Aviation Pathway

Under the Net Zero Aviation Pathway, net emissions from the aviation sector fall steadily, reaching zero by 2050 (Figure 3.1). There are contributions to this reduction in emissions from engineered removals, SAF, and efficiency improvements, as well as from demand effects. Demand grows more slowly than in the Current Trends scenario due to the costs of these decarbonisation measures being passed through to ticket prices.

- **Aviation demand:** demand is broadly flat until around 2040, at which point consumers are facing most of the costs of decarbonisation and low-carbon technologies are available at scale. Demand grows from 299 million passengers in 2025 to 351 million passengers in 2050 without proposed Heathrow expansion and 362 million with expansion. In the case with expansion, this is an increase of 21%, compared to 64% in the Current Trends scenario.

* We use the Department for Energy Security and Net Zero (DESNZ) high carbon value to represent SAF and engineered removals costs and non-CO_2 effects. We phase this in linearly from current UK ETS and CORSIA levels to 2045.

- **Aviation emissions:** net aviation emissions in the pathway reduce to zero by 2050, in line with the UK's 2050 Net Zero target. By the Seventh Carbon Budget period, annual net aviation emissions are 8.7 $MtCO_2e$ on average, 76% lower than in 2025.

  - In 2050, engineered removals account for 36% of emissions reduction compared to the baseline, lower demand growth 24%, efficiency improvements 20%, and SAF 20%.* The balance of these measures is uncertain and will emerge over time as technologies develop, but all are likely needed to ensure aviation reaches Net Zero.

  - In the Net Zero Aviation Pathway, net aviation emissions reduce at a similar pace to whole-economy emissions, but with reductions starting later (Figure 3.2). Compared to provisional 2025 levels, aviation emissions fall by 76% by the Seventh Carbon Budget period, compared to 74% for whole-economy emissions, based on the legislated level of this carbon budget. But compared to 1990 levels, the reduction in aviation emissions by this period is significantly lower than in most other sectors, reflecting the slower progress in the aviation sector to date.

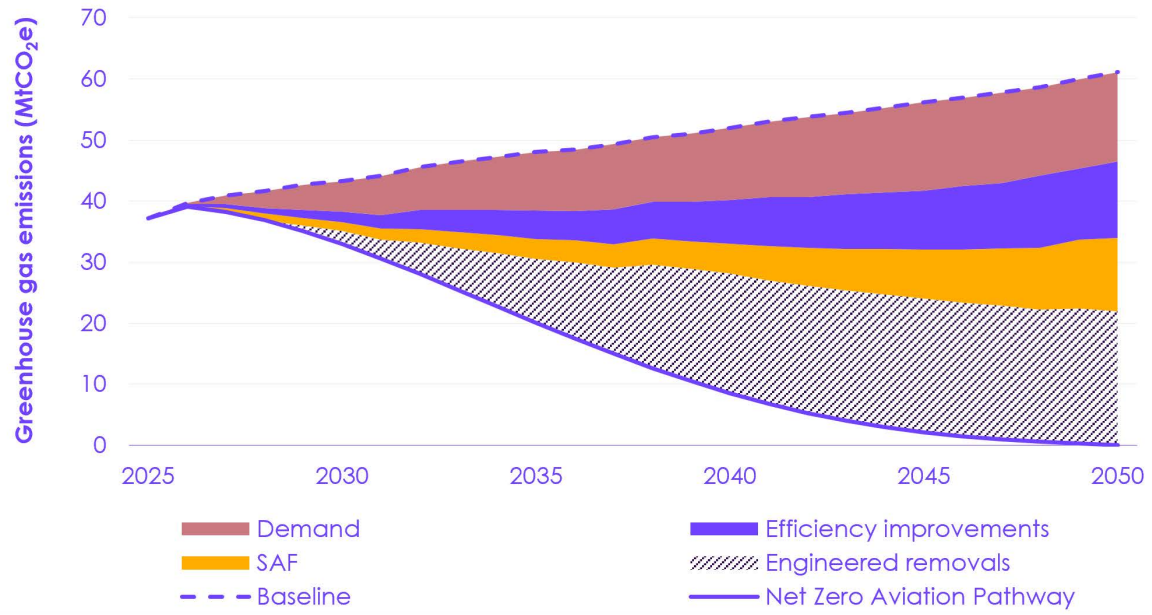
- **Ticket price impacts:** under the Net Zero Aviation Pathway, we estimate that ticket prices could increase by around £150 for a return trip to Alicante and £400 for a return trip to New York by 2050.† This is equivalent to 2% and 4%, respectively, of the estimated increase in annual real household disposable income per capita between 2026 and 2050. This equates to around 6–9 pence per mile, which is similar to fuel duty on petrol and diesel today.

- **Comparison with current government policy:** unlike the Current Trends scenario described in Chapter 2, in which emissions remain broadly flat, the Net Zero Aviation Pathway sees net aviation emissions fall to zero by 2050. This is mainly because aviation revenues fund the deployment of engineered removals, allowing these to be included in the pathway to offset residual emissions and limit demand growth. The Net Zero Aviation Pathway also assumes more uptake of SAF after 2040 (Figure 3.3).

* Emissions reductions are calculated compared to our baseline scenario, which assumes no further action to decarbonise aviation. The baseline adopts the same central modelling assumptions as set out in Table A.1 in the Annex.

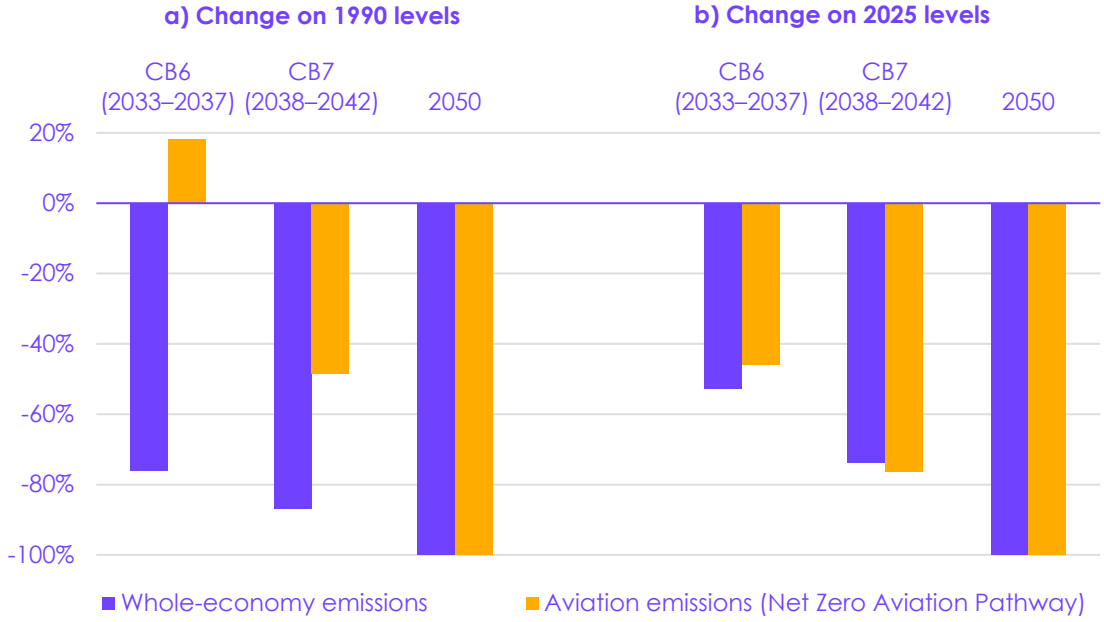
† In 2024 prices. Ticket price estimates are rounded to the nearest £50.

Figure 3.1 The Net Zero Aviation Pathway



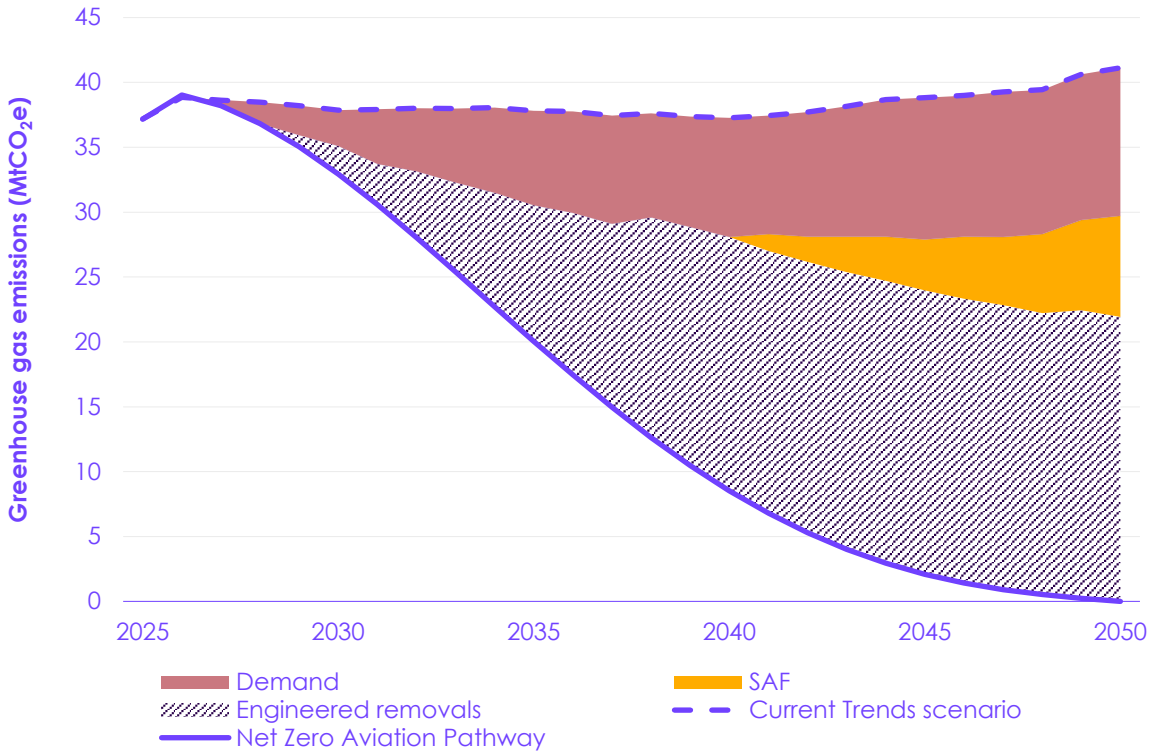
Description: Aviation emissions reach Net Zero in 2050. In 2050, engineered removals account for 36% of abatement, lower demand growth 24%, efficiency improvements 20%, and sustainable aviation fuel (SAF) 20%. Abatement is calculated compared to our baseline scenario, which assumes no further action to decarbonise aviation.
Source: CCC analysis.
Notes: (1) This pathway is shown including proposed Heathrow expansion and excludes military aviation emissions. (2) The solid colours represent the emissions reductions within the aviation sector. The hatched shading represents the residual emissions that are offset by engineered removals.

Figure 3.2 Pace of aviation emissions reduction compared to emissions reduction across the whole economy



Description: In the Net Zero Aviation Pathway, aviation emissions reduce at a similar pace to whole-economy emissions, but with reductions starting later. When compared to provisional 2025 levels, whole-economy emissions reduce by 74% by the Seventh Carbon Budget period, whereas aviation emissions fall by 76%.
Source: CCC analysis.
Notes: (1) 'CB6' and 'CB7' refer to the Sixth and Seventh Carbon Budget, respectively. These carbon budget period emissions use the five-year annual average emissions for the whole economy and the aviation sector. (2) In 2050, emissions are assumed to be zero, in line with the Net Zero target.

Figure 3.3 Emissions reduction in the Net Zero Aviation Pathway compared to the Current Trends scenario



Description: The additional emissions reductions in the Net Zero Aviation pathway compared to the draft HENPS Current Trends scenario are due to the deployment of engineered removals funded by aviation revenues, lower demand growth, and more SAF uptake after 2040.
Source: CCC analysis.
Notes: (1) For details of the assumptions used in each pathway, see the Annex. (2) The solid colours represent the emissions reductions within the aviation sector. The hatched shading represents the residual emissions that are offset by engineered removals.

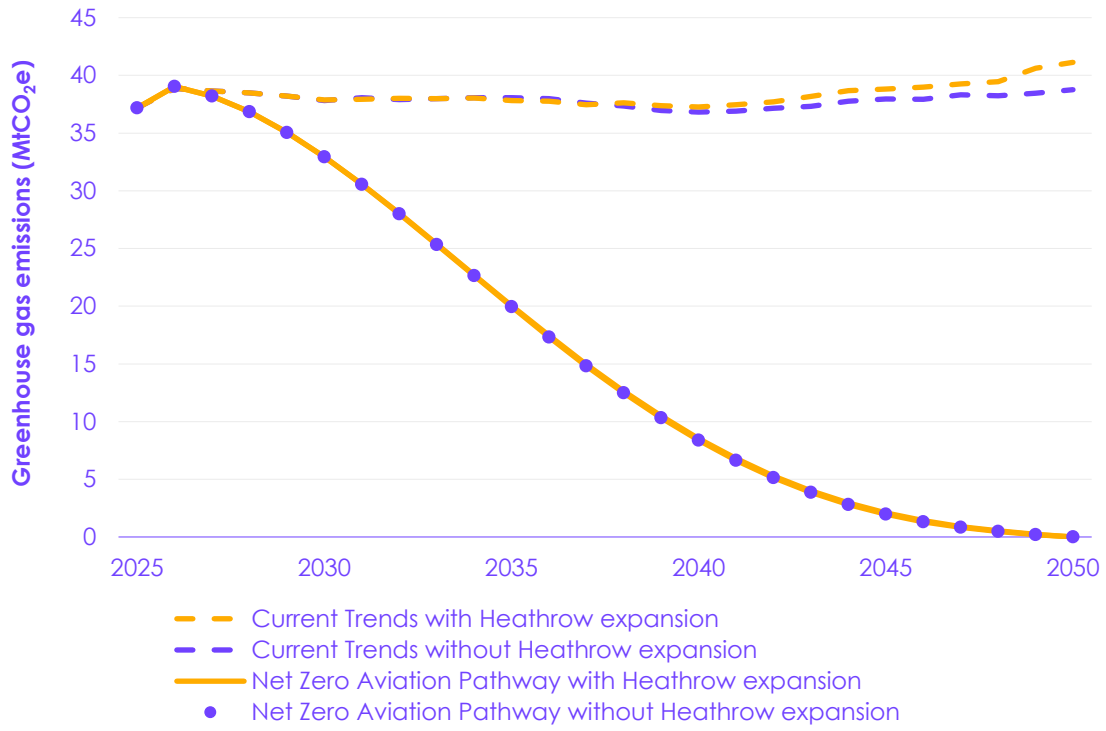
3.2.2 The impact of proposed Heathrow expansion in the Net Zero Aviation Pathway

In this scenario, the impact of proposed Heathrow expansion on carbon budgets and Net Zero would be much less significant than under current policy (Figure 3.4).

- **Seventh Carbon Budget period emissions:** in this scenario, the impact of proposed Heathrow expansion in the Seventh Carbon Budget period is on average 0.1 $MtCO_2e$ per year, equivalent to 0.1% of total economy-wide emissions over the budget period. This is one-third of the impact under the Current Trends scenario considered in Section 2.3.2.

- **2050 emissions:** the net emissions impact of proposed Heathrow expansion in 2050 is zero, as the additional aviation sector emissions that are generated are fully compensated for by additional deployment of SAF and engineered removals funded through the polluter pays approach.

Figure 3.4 Impact of proposed Heathrow expansion on aviation emissions under Net Zero Aviation Pathway and current policy



Description: Under the Net Zero Aviation Pathway, the impact of proposed Heathrow expansion in the Seventh Carbon Budget period is on average 0.1 $MtCO_2e$ per year. In 2050, the net impact is zero.
Source: Department for Transport (DfT) (2026) *Draft Heathrow Expansion National Policy Statement appraisal report;* CCC analysis.

3.2.3 Uncertainties and sensitivities

Future SAF and engineered removals uptake and costs are highly uncertain, as these are nascent technologies. We have undertaken a range of technology sensitivity model runs to explore how technology cost and uptake assumptions impact levels of demand, efficiency improvements, SAF uptake, and engineered removals.

- In the Net Zero Aviation Pathway, we proxy these uncertain technology costs when modelling the impact on demand and the revenues raised for the purchase of SAF and engineered removals. To do this, we use the Department for Energy Security and Net Zero (DESNZ) high carbon values as a proxy for the average technology costs. This is consistent with the approach we took in our Seventh Carbon Budget advice to reduce the dependence of our modelling on highly uncertain parameters.

- In these sensitivities, we instead use direct estimates of SAF and engineered removals technology costs.[8;9] It is important to note that uncertainty around these values remains high.[10;11]

  - In the first instance, these are based on estimates of the cost of UK-based production.

  - We also include a sensitivity based on estimates of the costs of imported SAF and international engineered removals. As we set out in our Seventh Carbon Budget advice, current international emissions reporting guidelines are unclear regarding reporting of emissions savings derived from imported synthetic fuels. In this sensitivity,

we assume that emissions savings would not be affected by the use of imported rather than domestically produced SAF.

The sensitivity scenarios we explored

- **Domestic technology costs:** the following scenarios use direct estimates of the costs for domestic production of SAF and engineered removals. We also vary the balance of SAF and engineered removals deployment.
  - **The direct technology costs scenario:** this uses our direct estimates of the costs of SAF and engineered removals, applied to the same SAF uptake pathway (38% in 2050) and the same deployment of engineered removals as used in the Net Zero Aviation Pathway.
  - **The high SAF, low engineered removals scenario:** this assumes SAF uptake reaches 50% by 2050. This requires the use of synthetic fuel beyond the minimum requirement in the existing SAF Mandate power-to-liquid obligation (see Section 2.2). Engineered removals are assumed to offset remaining emissions after SAF.
  - **The low SAF, high engineered removals scenario:** this adopts SAF and engineered removals technology based on the lowest marginal cost in each year, which is direct air carbon capture and storage (DACCS) from 2035. This scenario does not deploy synthetic fuel as it is always more expensive than engineered removals. It therefore does not meet the SAF Mandate power-to-liquid obligation. SAF uptake reaches 21% by 2050, which is entirely met by biofuels.
- **Imported SAF and international engineered removals scenario:** this uses projected international technology costs of synthetic fuel SAF and DACCS. These are based on estimates of the costs of imported synthetic SAF and carbon credits associated with international deployment of engineered removals. This scenario assumes the same SAF uptake (38% in 2050) and engineered removals deployment as the Net Zero Aviation Pathway.

More detail on the assumptions used in these scenarios is set out in Table A.3 in the Annex.

Net aviation emissions and the impact of proposed Heathrow expansion are the same across all the sensitivity scenarios in 2050 (Figure 3.5). Emissions differ in earlier years as costs and uptake of each decarbonisation measure vary, both of which are uncertain. Changes in the cost of decarbonisation measures impact the level of demand, and hence the total amount of SAF and engineered removals needed.

The results of our sensitivity analysis

- **Balance of measures:** these vary significantly by 2050, reflecting the different technology uptake assumptions and technology costs of the scenarios (Figure 3.5).
  - **Higher cost scenarios:** the direct technology costs scenario and the high SAF, low engineered removals scenario have relatively higher costs, and therefore higher demand abatement.
    - This reflects the high estimated costs of synthetic fuels in the modelling.
    - These higher costs are passed on to ticket prices, which leads to a higher demand suppression effect.

  - **Lower cost scenarios:** the imported SAF and international engineered removals scenario and the low SAF, high engineered removals scenario are associated with less demand abatement due to lower estimated costs.

    - For the low SAF, high engineered removals scenario, this is because engineered removals (DACCS) is estimated to have a lower cost compared to SAF (synthetic fuels).

    - The imported SAF and international engineered removals scenario is lower cost due to the UK potentially being a relatively more expensive country to produce SAF and deploy DACCS technologies compared to estimated global prices.

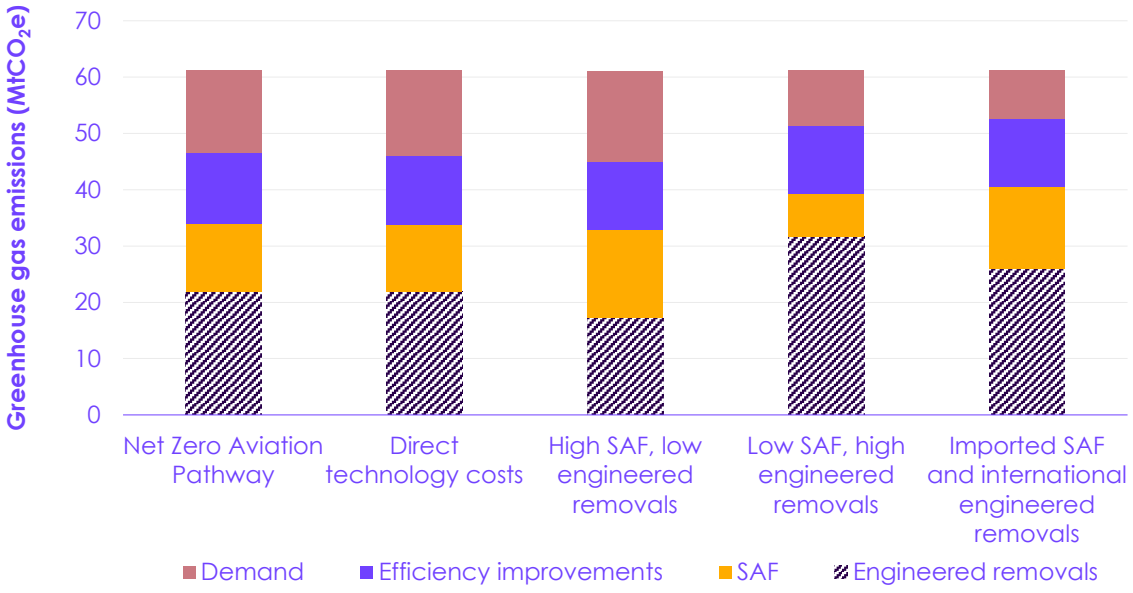
    - The lower costs in both scenarios leads to lower ticket prices and higher demand, which then requires more use of SAF and engineered removals to meet Net Zero.

- **Demand impact across airports:** demand at Heathrow Airport does not vary significantly across the sensitivities but does at the UK airport level (Figure 3.6). This shows that some airports are likely more sensitive to ticket price changes.

  - Together with the fact that Heathrow is currently effectively operating at full capacity (see Section 1.1.2), this suggests that there is demand for flying from Heathrow that is being constrained by its capacity. Expansion would allow more of this demand to be fulfilled, likely through a combination of additional flights and a shift in demand from other UK airports towards Heathrow.

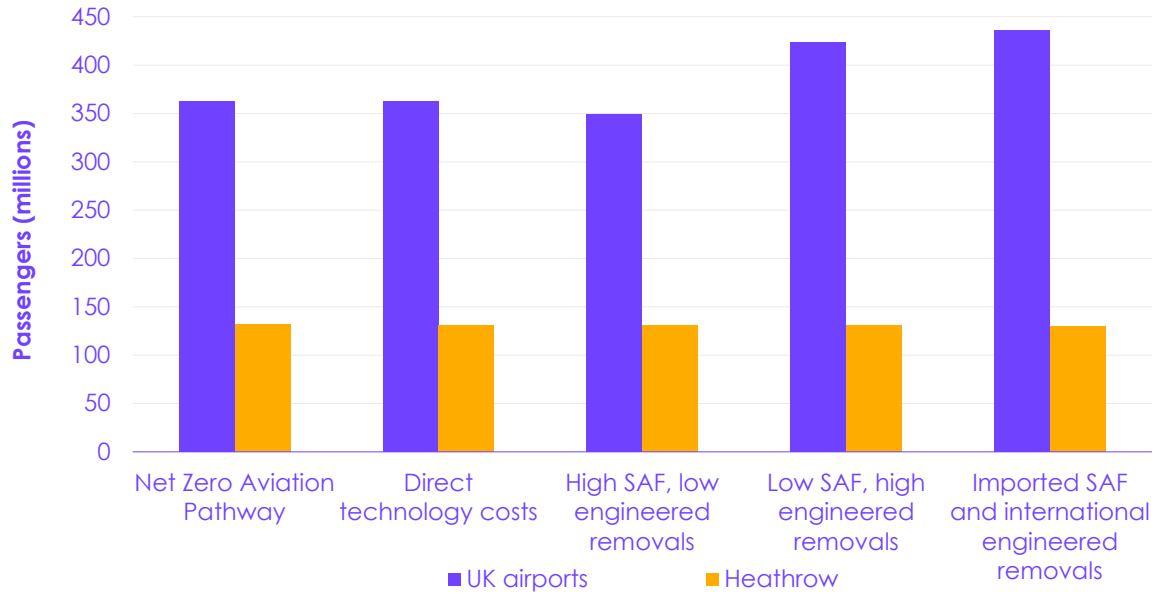
This increased demand at Heathrow is likely to be more resilient to increasing ticket prices, due to the markets that Heathrow serves and consumer incomes and preferences.

Figure 3.5 Sources of emissions reduction under each sensitivity scenario in 2050



Description: Net aviation emissions are the same across all of the sensitivity scenarios in 2050. However, the balance of abatement across measures can vary significantly. Under the Net Zero Aviation Pathway, engineered removals account for around one-third of total abatement, with the remainder split relatively evenly across demand, efficiency improvements, and SAF. Across the sensitivity scenarios, the contribution from engineered removals ranges from around one-quarter to half of total abatement.
Source: CCC analysis.
Notes: (1) The Net Zero Aviation Pathway and direct technology costs return approximately the same distribution of abatement across the measures, which reflects that they assume the same level of SAF uptake and suggests that the DESNZ high carbon value provides a good approximation of the impact of projected decarbonisation costs on demand in 2050. (2) All scenarios are shown including proposed Heathrow expansion. (3) The solid colours represent the emissions reductions within the aviation sector. The hatched shading represents the residual emissions that are offset by engineered removals.

Figure 3.6 How different sensitivity scenarios impact demand at UK airports in 2050



Description: Demand at Heathrow Airport does not vary significantly across the sensitivity scenarios, but demand does vary at the UK airport level.
Source: CCC analysis.
Notes: (1) UK airports category includes Heathrow passengers. (2) All scenarios are shown including proposed Heathrow expansion.

3.3 Implications for government policy

Current progress in decarbonising the economy is the result of policy decisions taken over many years by the current and previous governments. Similarly, it will take time for policies to incentivise and commercialise the technology solutions that are required to decarbonise aviation. This is why the Government needs to act now to enable future emissions reduction in aviation, building on existing efforts including the UK Emissions Trading Scheme (ETS), SAF Mandate, and SAF revenue certainty mechanism.

Before granting a development consent order for any proposed Heathrow expansion, the UK Government should legislate policies that require the aviation sector to abate 100% of emissions by 2050, either directly or by purchasing engineered removals. This is the only way that the proposed Heathrow expansion could be considered consistent with the UK's carbon budgets and Net Zero.

A credible and robust Net Zero policy framework for aviation should be set out in the revised Jet Zero Strategy planned for 2027. An implementation plan will also be needed. This should set out policies, timelines, funding, financing, and risk management for delivery of Net Zero aviation emissions. The framework should be developed jointly by the Department for Transport (DfT) and DESNZ, given DESNZ has responsibility for engineered removals.

The key considerations for the UK Government are to:

- **Require industry to pay the costs of decarbonisation.** Fully applying the polluter pays principle to all aviation emissions is the most efficient way to deliver a Net Zero aviation sector, regardless of airport expansion. Industry should be facing the full costs of decarbonisation no later than 2050. These need to be phased in, starting soon. Options for how this approach could be introduced in practice include technology mandates, UK ETS scope expansion, and other forms of carbon pricing (Box 3.2).
  - **Phasing in costs:** the additional costs of SAF and engineered removals should be borne by the aviation sector. By acting now, costs can be phased in gradually, avoiding disruption and sudden jumps in ticket prices. This could also generate revenues that can support early-stage technology development, as well as managing demand growth in the years before full-scale solutions are available.
  - **Setting out an implementation pathway:** the Government should set out a clear pathway for the development of sufficient capacity of SAF and engineered removals to meet the needs of aviation. In particular, the Government should set out what it sees as its role, the role of the aviation industry, and the role of SAF and engineered removals developers, including how early-stage development will be funded and financed.
  - **Including flexibility on timing:** the uncertain pace of technological development of SAF and engineered removals mean that balancing supply and demand may be difficult in the short term. Delivery risk should not be a reason to delay the phasing in of responsibilities on the industry. At the same time, the aviation industry cannot buy products if they are not available. Some flexibility on timing is therefore likely to be needed. These flexibilities could be incorporated into mandates or market-based mechanisms, for example using revenues from a well-designed opt-out fee or carbon pricing. Some initial revenues could be invested in early-stage development of SAF and engineered removals. This could avoid the need for taxpayer funding. Revenues could also be used for advance procurement of future supply, avoiding having to spend revenues at the same time as they are raised and providing a bankable demand signal.

- **Managing distributional impacts:** ensuring industry pays for the cost of decarbonisation is likely to increase ticket prices (see Section 3.2), although it is difficult to predict how price increases will be distributed across consumers and journeys. The Government should consider whether to implement policies to influence any distributional impacts of higher costs on lower-income groups (for example, through a frequent flyer levy). This would be in line with the views of the public in the citizens' panel from our Seventh Carbon Budget advice and the UK Citizens' Assembly.[12] In addition, exemptions or protections could be put in place for certain consumers or journeys, including journeys between Northern Ireland and Great Britain, and between islands and the mainland.

- **Ensure contingency for technology delays.** While SAF and engineered removals are proven to be technically viable, there remains uncertainty around their deployment at scale on the timelines required. Contingency policies will be needed to allow for delays, including further demand growth management. The potential for direct trade-offs in other sectors to compensate for higher aviation emissions is likely to be extremely limited (see Section 2.1).

  - **Contingencies for the Seventh Carbon Budget:** by the Seventh Carbon Budget period (2038 to 2042), UK emissions will be 87% below 1990 levels and most sectors will be well advanced in their decarbonisation journey. Action in these sectors could be accelerated at a cost to provide some contingency (see Chapter 6 of our Seventh Carbon Budget advice). However, this option should be reserved for managing unexpected future developments, in aviation and in other sectors, not banked now as part of a plan for decarbonising aviation.

  - **Contingencies for Net Zero:** by 2050, all other sectors except agriculture will be almost fully decarbonised, so the potential for other sectors to compensate for higher aviation emissions is extremely limited.

- **Manage competitiveness and carbon leakage risks.** Increased costs on the aviation sector could impact competitiveness and lead to carbon leakage, although the extent of this is uncertain. Policies should be designed to mitigate these risks, including through cooperation with the EU on ETS alignment and by continuing to champion global aviation decarbonisation through the International Civil Aviation Organisation (ICAO).

  - **Carbon leakage risk:** carbon leakage in the aviation sector refers to emissions from flying being transferred from somewhere with more stringent climate policy to somewhere with weaker climate policy. Evidence is inconclusive on the extent to which increased costs on the aviation sector will impact competitiveness and lead to carbon leakage.[13;14;15]

    - Research suggests that the most likely carbon leakage risk is from the re-routing of connecting Heathrow hub traffic to hub airports in South-Eastern Europe and the Middle East. There is also a risk that departing international long-haul flights from Heathrow add stopovers to limit the share of the total journey which is subject to UK policy.

  - **UK-Europe alignment:** currently, the stringency of climate policy in the UK and Europe is relatively aligned and there is little evidence of carbon leakage to European airports.[16] However, leakage risks are possible if the UK implements substantially more stringent policy than applies in Europe, or vice versa. This indicates a strong rationale for closely aligning aviation climate policy, which should be possible given the UK and Europe's relatively aligned headline climate ambitions. The UK and EU are currently in formal negotiations to link their emission trading systems.

- **Address commercial risks.** A legislated policy framework, together with an implementation plan, would give clarity to investors about the economic framework within which any airport expansion will need to make a commercial return. Early, long-term, and stable policy

is needed, alongside strong commitments from industry. These will give supply chains confidence to invest in and commercialise technologies now to deliver Net Zero aviation solutions at scale from the 2030s.

  - **Long-term levels of aviation demand:** expansion brings commercial opportunities and risks for airport operators. A key commercial risk is the level of long-term aviation demand, which should fully account for decarbonisation costs to ensure it is consistent with achieving Net Zero. If airport expansions are to be permitted, then the commercial risks related to demand should sit with investors, not consumers. For example, regulated airport charges should be structured so that investors carry most of the risks if demand is lower than expected.

  - **Ensuring investor confidence:** to allow investors to properly assess these risks, the Government needs to provide a robust policy framework for ensuring the aviation sector reaches Net Zero. These commercial risks apply across all airports, not just those considering expanding.

Action is also needed across other areas of aviation policy, including on the UK ETS and non-CO_2 effects.

- **UK ETS:** future decisions on the UK ETS, such as the treatment of SAF, will need to balance the advantages of potential EU ETS alignment, domestic policy consistency with the UK SAF Mandate, and opportunities to lead international action on emissions reduction in aviation. The UK Government, the Scottish Government, the Welsh Government, and the Department of Agriculture, Environment and Rural Affairs for Northern Ireland have consulted on how the UK ETS should treat the emissions reduction claims from SAF.[17] The consultation included consideration of the SAF GHG emissions savings threshold and how eligible SAF is recognised under the UK ETS.

  - **EU alignment:** continuing to align with the EU on the SAF GHG emissions savings threshold will likely better support high-quality SAF investment and deployment. The UK and EU ETS threshold is currently set at 65% GHG emissions saving against a 94 gCO_2e/MJ fossil fuel comparator. The UK SAF Mandate is currently set at 40% compared to an 89 gCO_2e/MJ fossil fuel comparator.

  - **International leadership:** recognising SAF on a lifecycle assessment basis would be in line with the polluter pays principle as it more accurately reflects and rewards the emissions savings achieved by SAF. The UK and EU ETS currently zero rate SAF emissions, meaning the net CO_2 impact of SAF is not reflected.

    - Current sources of SAF rely on biomass. Most bio-based SAFs under development today are unlikely to reduce the carbon intensity of aviation fuel by 100% due to factors such as the feedstock used, indirect land-use change, and production technology.[18]

    - Additionally, the UK is committed to, and the EU is considering, integrating removals into the UK and EU ETS respectively. In this context, continuing to zero rate SAF could lead to competitive distortions that may undermine incentives for airlines to purchase technologies that offer the most cost-effective net emissions reduction.

- **Ambitious efficiency improvements:** high levels of efficiency improvements will be challenging to achieve without airspace modernisation and increased uptake of ultra-efficient aircraft. If the Government chooses to include ambitious efficiency improvements in its plans, it should be clear on how and by when they will be achieved.

- **Non-CO_2 effects:** the proposed expansion of Heathrow Airport is an opportunity for government and industry to advance non-CO_2 effects research and trials of potential

mitigation measures. The Government should commit, as a minimum, to preventing aviation's additional warming impacts from non-CO_2 effects increasing after 2050. The Government and industry should begin to monitor these impacts and support investigation, development, and trial of mitigation options. Actions to reduce aviation's non-CO_2 effects should not lead to any significant increase in CO_2 emissions, for example due to longer flight paths, and should provide a net positive climate benefit overall.

Aviation is an international sector that requires international action and delivery to reach Net Zero. Therefore, alongside domestic policy, the UK Government should seek to strengthen the ambition and effectiveness of ICAO objectives and the CORSIA scheme. It should also seek opportunities to form alliances with countries who are aligned with the UK to go further than ICAO on both emissions and non-CO_2 effects.

Endnotes

[1] UK Government (2026) *UK ETS Public Reports.* https://reports.view-emissions-trading-registry.service.gov.uk/ets-reports.html.

[2] International Civil Aviation Organization (no date) *CORSIA Periodic Review*. https://www.icao.int/CORSIA/corsia-periodic-review. (Accessed: 20 August 2026).

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Chapter 4: Draft Heathrow Expansion National Policy Statement amendments

This chapter sets out the context for the draft Heathrow Expansion National Policy Statement (HENPS) and the Committee's view on proposed amendments to relevant HENPS sections.[1]

4.1 The draft Heathrow Expansion National Policy Statement

The Planning Act 2008 specifies that airport capacity expansions of at least ten million passengers per year are considered a nationally significant infrastructure project.[2] Nationally significant infrastructure projects are often accompanied by a national policy statement (NPS).[3] These are statutory documents that set out the policy rationale and need for a development, and how the relevant Secretary of State will assess an application for a development consent order. An NPS must account for policy relating to the mitigation of, and adaptation to, climate change.

The UK Government reviewed the 2018 Airports NPS and published an updated version as the draft HENPS in June 2026.[4] For climate change mitigation, it sets out:

- The UK Government's legal obligations to reduce greenhouse gas (GHG) emissions under the Climate Change Act.
- Estimated GHG emissions impacts of proposed Heathrow Airport expansion.
- What applicants for Heathrow expansion must set out in their carbon impact assessments.
- Mitigation measures for emissions.
- How the Secretary of State for Transport will assess climate change impacts in their decision on development consent for Heathrow expansion.

4.2 Draft Heathrow Expansion National Policy Statement proposed amendments

In line with the Government's request, we have considered the proposed amendments to the climate change mitigation section of the draft HENPS. These are the climate test, inclusion of non-CO_2 effects, emissions scope, and provision of climate mitigation measures.

4.2.1 Climate test amendment

The climate test sets out how the Secretary of State for Transport will decide whether proposed Heathrow expansion can be carried out in a way that is consistent with the UK's legally binding emissions reduction obligations. The test for climate change mitigation is that 'the increase in carbon emissions resulting from any proposed scheme must not be so significant that it would have

a material impact on the UK's legally binding carbon budgets.' Given the clear implications for levels of emissions in 2050 and beyond, the Committee's view is that the climate test must be strengthened to explicitly include the 2050 Net Zero target and consider the emissions impact of the full scope of expansion, proposed for 2054.

- **2050 Net Zero target:** the climate test must ensure that the emissions impact on all the UK's legislated targets is fully assessed and understood. The UK's legally binding 2050 Net Zero target should therefore explicitly be included within scope of the climate test and the HENPS. The Government and applicants should present analysis of the 2050 in-year emissions impact of expansion that can be directly compared to the 2050 Net Zero target.

  - The draft HENPS stipulates that an assessment should be made using 'the percentage impact on economy-wide carbon budgets.' Because the UK's 2050 target is zero, it is not possible to calculate a percentage impact on the basis of whole-economy GHG emissions. Nevertheless, there are a range of possible alternative metrics that could be used instead to assess the impact on the UK's 2050 Net Zero target (see Section 2.3).

  - This includes comparing to whole-economy residual CO_2 emissions, in both absolute and relative terms. Comparing against residual CO_2 emissions would be in line with the Committee's advice on the Seventh Carbon Budget, which advised that residual fossil CO_2 emissions should be offset by permanent engineered removals rather than nature-based removals (see Section 2.1.2).[5]

- **Full proposed Heathrow expansion emissions:** the Government should ensure that the full emissions impact of expansion must be considered within the climate test. Under the plans set out in the draft HENPS, the full scope of proposed Heathrow expansion is expected to be completed in 2054, although the draft HENPS allows for flexibility regarding how and when each aspect of the expansion project is delivered. Regardless of when the full expansion is completed, these emissions will need to be addressed, as UK emissions will need to remain at or below Net Zero beyond 2050 to avoid further contributing to climate change. Therefore, the Government and applicants should present analysis of the emissions impact of the full scope of expansion plans on the 2050 Net Zero target.

- **Whole-economy emissions:** the Secretary of State for Energy Security and Net Zero is responsible for the delivery of legislated climate targets and engineered removals policy. They should therefore have a defined role in judging the materiality of proposed Heathrow expansion, as well as in developing a robust policy framework covering all aviation emissions consistent with Net Zero.

  - From the Seventh Carbon Budget period (2038 to 2042), aviation will be one of the UK's highest emitting sectors. Under the draft HENPS Current Trends scenario, the sector accounts for 35% of whole-economy net GHG emissions across the period. By 2050, under the Current Trends scenario, the sector will account for 65% of whole-economy residual CO_2 emissions.

  - Therefore, any substantial increases in aviation emissions are likely to present a risk to the Seventh Carbon Budget and the 2050 Net Zero target. Most other sectors will be well advanced in their decarbonisation journey by the Seventh Carbon Budget period and almost fully decarbonised by 2050 (see Section 3.3).

- **Surface access, construction, and airport operation emissions:** in addition to the full appraisal period, the HENPS should present emissions from surface access, construction, and airport operations for carbon budget periods and 2050, to allow comparison to legislated targets.[6] The emissions assessment for surface access and construction should also be updated to account for policy developments since the 2018 Airports NPS, such as the introduction of the zero-emission vehicle mandate (see Box 2.2).

4.2.2 Non-CO_2 effects amendment

Non-CO_2 effects are now in scope of the draft HENPS, and applicants are required to submit a qualitative assessment of these. This amendment is a positive step in recognising the importance of tackling non-CO_2 effects (see Box 1.1). As well as a qualitative assessment, the HENPS should require that applicants submit a quantitative assessment of non-CO_2 effects that reflects the scientific uncertainty of these effects.

4.2.3 Applicant emissions assessment scope amendment

The draft HENPS clarifies that emission scopes one, two, and three by emissions source must be in scope of the applicant's emissions assessment. Applicants should quantitatively assess all emissions sources and scopes using the latest available evidence and according to best practice.

4.2.4 Applicant mitigation measures amendment

The draft HENPS requires that applicants must submit evidence and consideration of a package of mitigation measures. Heathrow Airport has an important role to play in decarbonising the aviation sector. The amendment should clarify how these mitigation measures relate to UK Government policy. For instance, industry investment in engineered removals will need to align with future UK engineered removals policy and standards criteria.

Endnotes

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Annex: Modelling aviation emissions

This annex sets out our approach to modelling aviation emissions. It covers our methodology and key assumptions.

A.1 Methodology for modelling aviation emissions

- As in our advice on the Seventh Carbon Budget, we use the Department for Transport's (DfT) aviation modelling suite to produce our demand and emissions projections, and in-house analysis for sustainable aviation fuels (SAF), engineered removals, and technology costs. We input our own assumptions for key variables into the DfT model.

- We follow the main underlying assumptions of the DfT framework, including economic inputs, price and income elasticities, airport capacity assumptions, and fuel efficiency improvements.[1;2] Further details on the DfT aviation modelling suite and assumptions are set out in DfT's UK aviation forecast 2026.[3]

We use the DfT model for our analysis by inputting our own decarbonisation assumptions, including carbon values and choosing the fuel efficiency improvement scenario.

We use the latest version of the DfT model, in line with the draft Heathrow Expansion National Policy Statement (HENPS).[4] Updates since our Seventh Carbon Budget advice include rebased data, from 2019 to 2024, updated evidence on potential fuel efficiency improvements, and updated economic inputs.[5]

Our analysis covers domestic and international civil aviation flights departing from UK airports, including freight flights. It also includes emissions from passenger and freighter aircraft while on the ground (for example, while taxiing). Military aviation emissions are out of scope but were included in our Seventh Carbon Budget Balanced Pathway.

To produce the Net Zero Aviation Pathway, we follow broadly the same methodology as in our Seventh Carbon Budget advice.[6] Given uncertainties, we proxy the costs of SAF and engineered removals using the Department for Energy Security and Net Zero's (DESNZ) high carbon value.[7] This affects our estimates of demand and of the revenues generated from carbon pricing. We phase this carbon pricing in linearly to 2045, starting from current levels under the UK Emissions Trading Scheme (ETS) and under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). SAF deployment is based on our Seventh Carbon Budget Balanced Pathway.

- Carbon pricing beyond existing policy is phased in by 2045 instead of 2035, which we assumed in our Seventh Carbon Budget advice, to account for changes in DfT demand projections resulting from model updates, changes in economic forecast data, and carbon value implementation.[8]

- For engineered removals, in the Seventh Carbon Budget advice we presented an illustrative pathway in the aviation sector, based on aviation's share of engineered removals in 2050. In this report we have calculated an alternative indicative pathway:

  - We calculate the implied revenue raised by multiplying residual aviation emissions, after demand and efficiency abatement, by the high DESNZ carbon value. This implied revenue is first assigned to purchase SAF, at the marginal SAF cost. The remaining

revenue is then assigned to purchase removals, assuming the marginal engineered removals cost.

– To calculate engineered removals uptake, we apply constraints. In any given year, removals for the aviation sector do not exceed total Seventh Carbon Budget Balanced Pathway engineered removals for that year. All of the implied revenue generated is utilised across the period to 2050, but it is not necessarily utilised in the same year that it is generated. The aviation sector (including engineered removals) is constrained in the pathway to reach Net Zero in 2050.

We apply a guiding threshold of technology readiness level 6 for inclusion of emerging technologies in our pathway (see Section 1.5 of our Seventh Carbon Budget Methodology report).[9]

For the Net Zero Aviation Pathway sensitivities, we use alternative estimates of technology costs. We also test the impact of varying the technology mix between SAF and engineered removals. By using direct estimates of the costs, we can generate different modelled impacts on demand from different technology mixes.

UK-specific technology costs are assumed in every scenario except for the imported SAF and international engineered removals scenario. We estimated these direct technology costs using Seventh Carbon Budget advice research and analysis.[10] Table A.3 sets out sensitivity carbon price and technology cost assumptions in 2050.

- **Direct technology costs and imported SAF and international engineered removals scenarios:** these assume SAF uptake in line with our Seventh Carbon Budget Balanced Pathway (38% by 2050). The weighted average abatement cost of marginal SAF and engineered removals technology is calculated to produce carbon prices.

- **High SAF, low engineered removals scenario:** this assumes SAF uptake increases to 50% of total fuel supplied by 2050. The weighted average abatement cost of marginal SAF and engineered removals technology is calculated to produce carbon prices. Any additional abatement from SAF is assumed to lead to an equal reduction in abatement from engineered removals.

- **Low SAF, high engineered removals scenario:** this assumes deployment of whichever is the cheaper marginal unit, either of SAF or engineered removals, in each year. From 2035, this is engineered removals using direct air carbon capture and storage (DACCS). Carbon prices are then modelled using this lowest marginal cost. Synthetic fuel is not deployed in this scenario as it is modelled as always more expensive than engineered removals.

A.2 Key assumptions

Tables A.1 to A.3 set out:

- Central modelling assumptions (Table A.1).

- Modelling assumptions for the Climate Change Committee (CCC) Net Zero Aviation Pathway, CCC Baseline, and DfT Current Trends scenarios (Table A.2).

- Sensitivity scenario technology costs and carbon price assumptions (Table A.3).

Table A.1
Central modelling assumptions

	Assumption	2030	2040	2050	Source
Economic inputs*	Annual GDP growth	1.5%	2.0%	1.7%	2024–2030: OBR (2025) *Economic and fiscal outlook – November 2025.* [11] 2031–2050: OBR (2025) *Economic and fiscal outlook – March 2025: Long term economic determinants.* [12]
	Oil price (2024$/barrel)	78	93	93	DESNZ (2024) *Fossil fuel price assumptions: 2024.* [13]
Airport capacity (air transport movements)	UK total (thousands)	5,446	5,856	5,860	DfT (2026) *UK aviation forecast 2026.* [14]
	All airports excluding Heathrow† (thousands)	4,941	5,100	5,104	
	Heathrow Airport‡ (thousands)	505	756	756	
Airport capacity (passengers)	UK total (millions)	465	540	558	
	All airports excluding Heathrow† (millions)	373	424	428	
	Heathrow Airport‡ (millions)	92	116	130	

Notes: (*) These and other economic input assumptions, including foreign GDP and exchange rates, align with DfT draft HENPS analysis assumptions. (†) 'All airports excluding Heathrow' includes approved expansion in air transport movements at Gatwick, Luton, Cardiff, Manchester, Aberdeen, and Edinburgh airports, as well as increases in passenger capacity at London City, Stansted, Exeter, Norwich, Birmingham, East Midlands, Humberside, Glasgow, and Inverness airports. (‡) Heathrow airport capacity figures include proposed expansion.

Table A.2
CCC Net Zero Aviation Pathway, CCC baseline, and DfT Current Trends modelling assumptions

	Assumption	2030	2040	2050	Source
CCC Net Zero Aviation Pathway	Carbon price – flights within the UK ETS market* (£/tCO2e)	161	460	657	DESNZ (2023) *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal* – high carbon value series.[15]
	Carbon price – flights outside the UK ETS market* (£/tCO2e)	130	450	657	
	SAF uptake as a proportion of total jet fuel	6%	17%	38%	CCC (2025) *The Seventh Carbon Budget.*[16]
	Fuel efficiency improvement (average per year)†	0.9%			DfT (2025) *Revised Fuel Efficiency Assumptions for Future Aircraft Types in DfT's Aviation Modelling Suite* – 'central' efficiency scenario.[17]
CCC baseline	Carbon price – flights within the UK ETS market* (£/tCO2e)	48	132	227	DESNZ (2026) *Traded carbon values used for modelling purposes 2025.*[18]
	Carbon price – flights outside the UK ETS market* (£/tCO2e)	4	11	16	DfT (2025) *TAG data book* – low series.[19]
	SAF uptake as a proportion of total jet fuel	2%	1%	1%	DfT (2026) *Renewable Transport Fuel Obligation statistics 2024: data tables.*[20]
	Fuel efficiency improvement (average per year)†	0%			Not applicable.
DfT Current Trends	Carbon price – flights within the UK ETS market* (£/tCO2e)	79	129	125	DfT (2026) *UK aviation forecast 2026.*[21]
	Carbon price – flights outside the UK ETS market* (£/tCO2e)	21	29	30	
	SAF uptake as a proportion of total jet fuel	7%	17%	17%	
	Fuel efficiency improvement (average per year)†	0.9%			DfT (2025) *Revised Fuel Efficiency Assumptions for Future Aircraft Types in DfT's Aviation Modelling Suite* – 'central' efficiency scenario.[22]

Notes: (1) All prices are in £2024. (2) For operational efficiency, we use the evidence from the Aviation Impact Accelerator (2025), applying the 'central' scenario to our Net Zero Aviation Pathway. DfT apply the 'central' scenario for their Current Trends scenario. (3) The model run produced for the baseline includes the 'low' efficiency improvements scenario, which accounts for most projected efficiency improvements. To align with our definition of the baseline, we have adjusted the baseline to zero out these efficiency improvements. This allows the full emissions savings effect from efficiency improvements to be reflected in the CCC's Net Zero Aviation Pathway. This adjustment only affects the baseline and the distribution of emissions reductions between the various measures, not the resulting emissions pathway. (4) SAF emission savings vary by SAF type. (*) To reflect the current regional scope of the UK ETS, DfT's aviation modelling suite splits markets into two groups: regions covered and not covered by the UK ETS. UK ETS regions include UK domestic, Southern Europe, and Rest of Europe markets. For UK ETS regions, we phase in the DESNZ high carbon value from the 2026 UK ETS price forecast. For other regions, we phase in the DESNZ high carbon value from the 2026 estimated CORSIA price, reaching the DESNZ high carbon value by 2045 in both cases. (†) Fuel efficiency improvement is averaged annually over the full modelled period to 2050.

Table A.3
Sensitivity scenario technology costs and carbon price assumptions

		2050 (£/MtCO2e)
Marginal abatement cost*	Domestic SAF	1,170
	Domestic engineered removals	328
	International SAF	358
	International engineered removals	238
Carbon price†	Direct technology cost estimates scenario	649
	High SAF, low engineered removals scenario	750
	Low SAF, high engineered removals scenario	337
	Imported SAF and international engineered removals scenario	294

Notes: (1) All prices are in £2024. (*) Marginal abatement cost measures the cost of reducing one additional unit of CO_2e, which varies depending on technology deployment pathway. We assume that the cheapest technologies are deployed first, so marginal abatement costs are set by the most expensive technology in each category. For example, in 2050 the marginal abatement measure for SAF is synthetic fuel. For DACCs the marginal abatement measure is engineered removals. (†) The weighted average marginal abatement cost of SAF and engineered removals technology is calculated to produce carbon prices.

Endnotes

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[12] Office for Budget Responsibility (2025) *Long-term economic determinants - March 2025 Economic and fiscal outlook*. https://obr.uk/efo/economic-and-fiscal-outlook-march-2025/.

[13] Department for Energy Security and Net Zero (2024) *Fossil fuel price assumptions: 2024*. https://www.gov.uk/government/publications/fossil-fuel-price-assumptions-2024.

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[16] Climate Change Committee (2025) The *Seventh Carbon Budget*. https://www.theccc.org.uk/publication/the-seventh-carbon-budget/.

[17] Department for Transport (2025) *Revised Fuel Efficiency Assumptions for Future Aircraft Types in DfT's Aviation Modelling Suite*. https://www.gov.uk/government/publications/revised-fuel-efficiency-assumptions-for-future-aircraft.

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September 2026

Advice to the UK Government on proposed Heathrow Airport expansion

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