JET ZERO

TASKFORCE GREENHOUSE GAS REMOVALS

TASK AND FINISH GROUP REPORT

Abstract

Recommendations of the Jet Zero Task and Finish Group on Greenhouse Gas Removals November 2025

Foreword

Until recently, policy frameworks to support the scaling of Greenhouse Gas Removals (GGRs) were largely absent. However, the acceleration of UK government action over the last two years — including the GGRs Business Model, planned integration of GGRs into the UK Emissions Trading Scheme, high integrity standards for voluntary and nature markets, increased R&D funding, the independent GGRs Review and the Carbon Budget action plan — have together built a much-needed framework of progressive thinking and policy and fiscal measures.

To date however, most government measures have focused on supporting the supply side. Our group's mission has therefore been to explore the opportunities for mobilising aviation buyers of GGRs on the demand side. Aviation is projected to be the UK sector with the largest demand for carbon removals by 2050. Over the last two years we have also seen increased corporate procurement of GGRs in aviation, notably by Airbus and British Airways, however significant barriers remain to scaling supply to meet future demand and creating the business case to act in the short term. Addressing this supply-demand gap is essential, not only for meeting climate goals, but also for unlocking the economic and jobs potential of this emerging sector. This is the core purpose of our group, detailed in section one of this report. Section two presents an innovative tangible step forward in shaping an industry joint voluntary purchase of carbon removals, while section three explores enabling policy and fiscal frameworks.

GGRs are an essential part of the UK's climate strategy and aviation's pathway to net zero, though awareness and understanding of their role remain limited. Removals are not a substitute for emissions reductions but are critical for climate stability. The IPCC estimates GGRs may account for a third of the global effort towards net zero. For aviation, GGRs are vital for addressing residual emissions in parallel with other decarbonisation techniques being deployed as well as for producing synthetic Sustainable Aviation Fuels and low carbon hydrogen. GGRs also offer a means to integrate domestic and international carbon pricing frameworks, including SAF policies, UK and EU ETS, and CORSIA, and provide potential for evolving compliance obligations.

I was pleased to see this GGRs group established and grateful for the opportunity to serve as Chair. The aviation sector's commitment to net zero, including landmark voluntary GGR purchases in 2024 and the initial, small-scale advanced market signal mobilised by Sustainable Aviation to support the work of this group, demonstrates the potential for UK-based GGR projects to drive climate action, innovation, and job creation. By raising the profile of GGRs and supporting their integration across aviation and other hard-to-abate sectors, we can collectively position the UK as a global leader in this field, helping secure aviation's path to net zero and making the UK a catalyst for global action.

I wish to acknowledge the significant contributions of group members, whose positivity and constructive engagement have been invaluable. I am grateful to all who have contributed, alongside their other demanding commitments. With much work still to do to ensure GGRs deliver the vital role for aviation and wider climate action in the coming years, our group members remain committed to working with government, industry and experts to shape a shared vision for scaling GGRs. We look forward to further contributing to effective solutions that benefit the UK, the global community, and our planet.

Carrie Harris

Chair, Jet Zero Taskforce Greenhouse Gas Removals Task and Finish Group

Executive Summary

Aviation has long accepted that Greenhouse Gas Removals (GGRs) are integral to its net zero pathway to 2050, due to it being a hard to abate sector. The Jet Zero GGRs Task and Finish group has considered: how to address the supply-demand gap; how the market to scale up GGRs supply might be stimulated through an Advanced Market Signal (AMS); and how enabling short term policy and fiscal frameworks might support GGRs supply and use.

The Group had six guiding principles: a desire to stimulate and grow GGRs supply for meeting aviation needs in the short (to 2030), medium (2030-2035) and longer term (2035 onwards); to consider both nature based and engineered GGRs; to clarify the current demand and supply status for aviation GGRs; to recognise aviation demand for removals could reach 23 million tonnes per year by 2050, potentially 60% of UK total removal demand. (CCC 7th Carbon budget); to explore UK job and economic potential in meeting GGRs aviation demand; and to explore pragmatic short-term actions and longer-term policy solutions that scale up GGRs to deliver climate impact reductions from aviation activity.

Size of the GGRs Prize

	2035	**2050**
Potential CO2 benefit from airline purchases of GGRs for flights departing the UK, if supportive policy framework established	**1 MtCO2 by 2030,** **3 MtCO2 by 2035[1]**	**Up to 23 MtCO2[2]**
GGR Job potential for the UK	**From 5,000 direct[3]** **to 135,000 total[4]**	**60,000 direct[5]**
Economic Opportunity for the UK	**£2 billion additional annual investment[3]** **and** **£1 billion additional tax revenue[4]**	**£18 billion** **additional tax revenue[6]**

- There is an urgent need to close the gap between GGRs demand and supply for aviation and ensure that investments can be made in a "pre-compliance" phase (next 2-3 years).

[1] SA Net Zero Carbon Roadmap Link
[2] Committee on Climate Change 7th Carbon Budget (2025) Link

[3] UK Carbon Budget Delivery and Growth Plan (2025) Link
[4] BeZero. From risk to reward: Making the UK the carbon markets capital of the world (May 2025) Link

[5] Carbon Gap. Growth through removals: Making Greenhouse Gas Removals a vibrant part of the UK economy (June 2025) Link

[6] CNE. The Growth Potential of the UK Greenhouse Gas Removals Industry Link

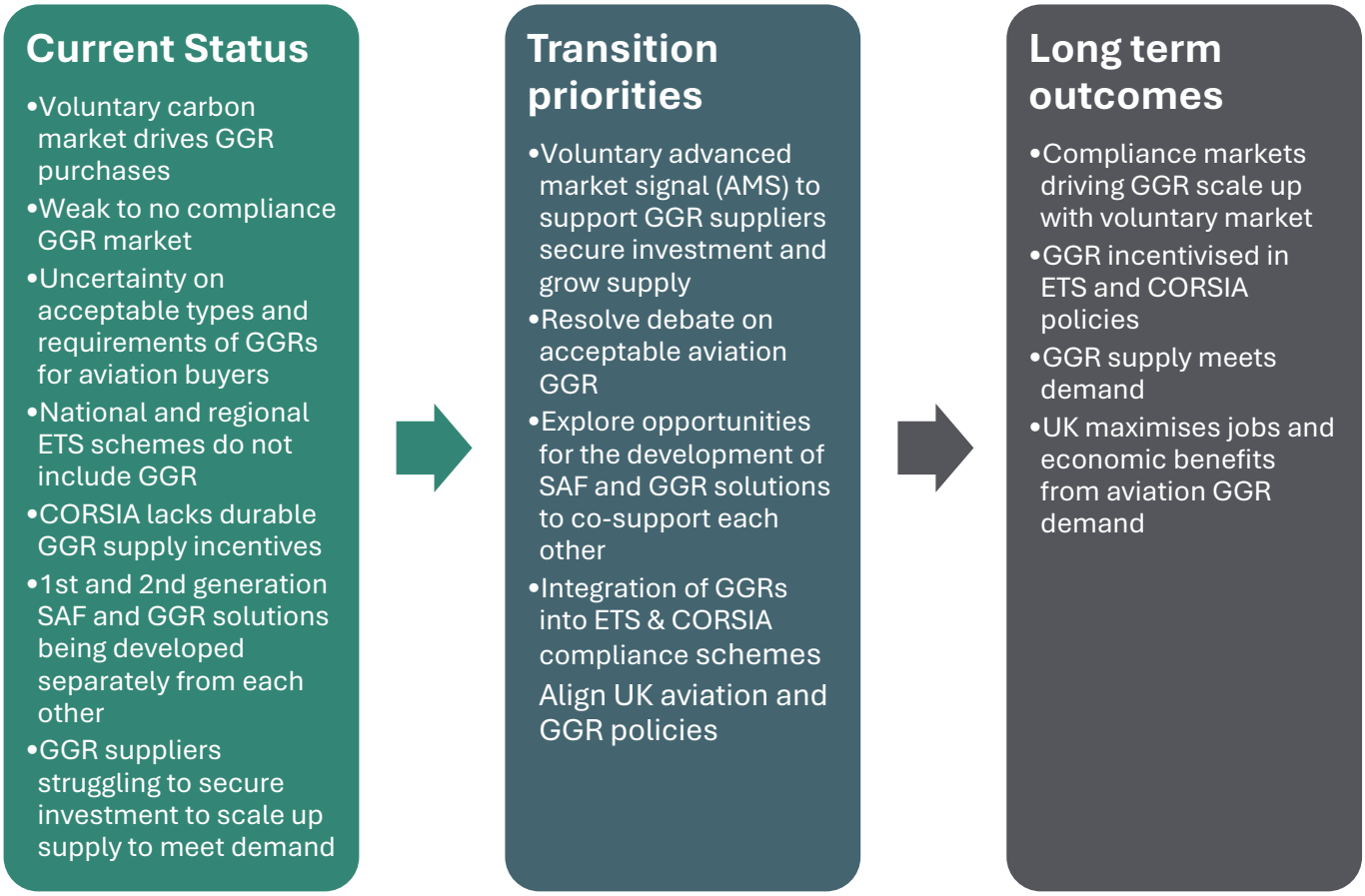
- National and international efforts on GGRs standards and methodology development are ongoing and there is a need for alignment across initiatives.
- Early investment is critical to reduce costs in the future and ensure availability of supply however the business justification for doing so today is very challenging and is suppressing demand and aviation industry action.
- Analysis to-date indicates significant economic opportunity from scaling UK GGRs, from exportable services along the value chains of both engineered and nature-based removals, providing up to 135,000 high skilled jobs and contributing £1 billion in taxation income[7] to the UK Government by 2035.
- Demand for GGR's by the aviation sector is expected to be significant over the next few decades. Current forecasts suggest aviation demand for removals could be one million tonnes by 2030 and three million by 2035. However, access to GGRs that are currently certified by emission trading and reduction schemes is constrained.

Advanced Markert Signal

- To address the supply-demand gap and rapidly scale GGRs production, increasing confidence in investment in GGRs is key to ensure the UK maximises the economic opportunity.
- An Advanced Market Signal can help to build this confidence, and the aviation sector is willing to play its role, recognising the importance of GGRs in achieving a credible net zero aviation transition.
- Members of Sustainable Aviation, some of which are members of this Task & Finish Group, have taken the opportunity to be part of a proof-of-concept signal that demonstrates intent and commitment to carbon removal.
- A total of seven SA Members have decided to participate in this AMS with the organisations representing a broad cross-section of the industry. The total expected value of the AMS is currently in excess of £2m.

[7] BeZero from risk to reward 2025 - Link

Aviation's GGRs transition journey



- This group presents five transitional, policy proposals to incentivise uptake of early sector investment in GGRs:
    - Allowing inclusion of purchased GGRs credits in a future UK ETS would de-risk early offtake.
    - Integration of GGRs within the UK SAF Mandate could support compliance during SAF bottlenecks whilst encouraging GGR investment from other aviation stakeholders beyond airlines.
    - Passenger-facing GGRs sales by airlines can support incremental demand if rigorously and transparently deployed.
    - Direct Government procurement can help endorse GGRs, further boost supply and improve economies of scale for buyers.
    - HMG and UK aviation industry to work together in exploring the critical role of durable GGRs in the international aviation sector's path to net zero and strengthening of CORSIA.

Further Government Considerations

- The UK Government should be active in informing standard development to ensure a high-integrity, low risk and investable GGRs market. Specifically, accelerate the BSI Flex

Standard development for removal types beyond BECCS and DACCS, giving buyers confidence to invest in a broader portfolio of removals. This work should be aligned with the ICVCM's CCPs so that there is regulatory convergence and confidence as the market grows.

- Near term Government support can amplify early demand signals; current aviation revenue streams could be utilised to fund new incentives that drive purchasing of UK GGRs:
- Government should work with industry to develop incentivising policy proposals by the end 2026 to ensure maximum impact in a pre-compliance phase.
- The Group notes the Independent GGR review has discussed incorporating GGRs into the SAF mandate. The Group recognises that both GGR and SAF are important elements in the aviation sector's decarbonisation pathway and believes it is important to explore synergies and potentially further integration of the policy frameworks. The Group also acknowledges the criticality of maintaining investor confidence in SAF. It is recommended that next year's JZTF could support Government by analysing what options may exist to support GGR demand through closer integration with the SAF mandate. Any options must not delay immediate SAF investment decisions or adversely impact longer term SAF investor confidence. This could comprise a broad group spanning finance, aviation, SAF and GGR representation.

The aviation sector welcomes the opportunity to work with Government to make this a success, recognising the importance of GGRs in achieving the sector's net zero pathway and the benefits to the UK economy.

Proposed next steps

- Further detailed review and analysis is recommended on the potential impacts of GGRs incorporation into the UK SAF Mandate, including on the Revenue Certainty Mechanism (RCM) and investments in 2G and 3G SAF plants. The Group recommends that the concept is taken forward by a task finish group in 2026, populated by representatives from the Aviation, GGRs and SAF communities.
- A detailed cost benefit analysis of each of the policy ideas included in this report, setting out the cost split between HMG, industry and the benefits to industry and society should be incorporated into the next task finish Terms of Reference. Economic analytical competence should be included in the group to ensure this can be performed.
- Deliver and review the Sustainable Aviation GGRs AMS "Proof of Concept" identifying learnings and assess potential to scale.
- Exploring opportunities for advancing support for GGRs and harmonizing policy approaches with the EU as part of ETS linkage negotiations.
- Review existing and recent work on information made available to customers at point of sale, including by the CAA and EU, to drive consistency for UK airlines and find opportunities for passenger engagement.
- Explore additional supply-side support policy ideas with relevant government departments and industry stakeholders.
- Explore cross-sector links and coalition efforts to accelerate the scaling of UK GGRs.

Contents

Glossary

AMS	Advanced Market Signal
APD	Air Passenger Duty
ATAG	Air Transport Action Group
BECCS	Bioenergy Carbon Capture and Storage
CCC	Climate Change Committee
CCS	Carbon Capture and Storage
CDR	Carbon Dioxide Removal
CI	Carbon Intensity
CNE	Coalition for Negative Emissions
CO_2	Carbon Dioxide
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CRCF	Carbon Removals and Carbon Farming
DAC	Direct Air Capture
DACCS	Direct Air Carbon Capture and Storage
DEFRA	Department for Environment, Food and Rural Affairs
DESNZ	Department of Energy Security and Net Zero
DOC	Direct Ocean Capture
DOE	Department of Energy (US)
ERW	Enhanced Rock Weathering
ETS	Emissions Trading Scheme
FID	Final Investment Decision
GGR	Greenhouse Gas Removals
GHG	Greenhouse Gas
HyNet	Hydrogen Network
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IEA WEO	International Energy Agency World Energy Outlook
ILO	International Labour Organisation
IPCC	Intergovernmental Panel on Climate Change
ICVCM	Integrity Council for the Voluntary Carbon Market
IUCN	International Union for Conservation of Nature
JZTF	Jet Zero Taskforce
LCFS	Low Carbon Fuel Standard (British Columbia)
LTAG	Long Term Aspirational Goal
MJ	Mega Joules
MRV	Monitoring, Reporting and Verification
NBS	Nature Based Solutions
OBR	Office of Budget Responsibility
PtL	Power to Liquid
SA	Sustainable Aviation (UK) Coalition
SAF	Sustainable Aviation Fuel
TNFD	Taskforce on Nature-related Financial Disclosures
TRL	Transport Research Laboratory
TWh	Terawatt-hour
UNEP	United Nations Environment Programme

Introduction

Aviation has a significant emissions profile with fossil-based CO_2 from jet fuel combustion representing around 2.5% of global emissions[8]. In the UK, emissions from aviation (all domestic and departing international flights) was 35.4 $MtCO_2e$ in 2023, accounting for 8% of total UK emissions[9]. Additional non-CO_2 effects like contrails and NO_x are also thought to contribute at least a doubling of aviation's climate impacts. Since 1990, the warming effect of non-CO_2 effects has tripled[10]. Whilst the past three decades has seen significant operational and technology efficiency gains, such as sustainable aviation fuels (SAF), even the most optimistic net zero pathways leave aviation with sizeable residual emissions to address by mid-century.

Greenhouse Gas Removals (GGRs) whilst not a substitute for reductions from operational efficiency and new aircraft technology; are necessary to complement a credible, science-aligned aviation net zero transition. Removals perform two roles in aviation's net zero pathway. First, they neutralise residual fossil-based CO_2 emissions that persist even after reductions from improved operational efficiency, introduction of new technology and switching to SAF. Second, they underpin the future growth of third generation (power to liquid) SAF by supplying atmospheric CO_2 as feedstock, as industrial point-source CO_2 becomes scarce or ineligible.

The supply of GGRs for all sectors, including aviation has not yet scaled to balance the residual emission requirements. A policy framework is developing to support domestic GGRs suppliers in the UK, but these quantities still fall below expected demand. There is an urgency here as the more CO_2 emitted from planes that is unabated in the short term, the harder we will need removals to work in the longer run, and the more deployment we will need to address all the current unabated emissions.

The lack of certainty in longer term GGRs supply is also hindered by the lack of short term demand signals from the aviation sector. This is occurring due to the lack of strong business cases to invest in GGRs purchases by aviation as any GGRs purchase made today are voluntary in nature and are not yet recognised in the emission trading schemes for aviation. New policy support in the short term to resolve these barriers is likely to be required.

Recognising this problem, the UK aviation sector is exploring options to support the development of a high integrity and durable global GGRs market through an early, unified demand signal – working with UK Government to establish support mechanisms such as an advanced market signal (AMS) – to encourage confidence and investment in a UK removals sector with quantifiable benefits to the UK economy and the Government's Growth Mission.

This report presents the recommendations and supporting evidence to Government by the Jet Zero GGRs task and finish group, a diverse group of aviation stakeholders, to ensure the sector can access durable GGRs and remain competitive in the global environment while progressing toward net zero in a credible, efficient and cost-effective way.

[8] Our World in Data - Oxford University (2024). https://ourworldindata.org/global-aviation-emissions
[9] Committee on Climate Change 7th Carbon Budget (2025). https://www.theccc.org.uk/publication/the-seventh-carbon-budget/
[10] Committee on Climate Change 7th Carbon Budget (2025). https://www.theccc.org.uk/publication/the-seventh-carbon-budget/

Guiding Principles of this GGRs Task and Finish Group

- Desire to stimulate and grow GGRs supply for meeting aviation needs in the short (to 2030), medium (2030-20235) and longer term (2035 onwards)
- Consider both nature-based and engineered GGRs
- Clarify the current demand and supply status for aviation GGRs
- Recognise aviation demand for removals could reach 23 million tonnes per year by 2050, potentially 60% of UK total removal demand. (CCC 7th Carbon budget)
- Explore UK job and economic potential in meeting GGRs aviation demand
- Explore pragmatic short term actions and longer term policy solutions that scale up GGRs to deliver climate impact reductions from aviation activity

Structure of the report

Workstream 1 presents the evidence base – summarising the current state of UK GGRs demand and supply and demonstrates that early action to scale GGRs is important not only for UK aviation but delivers benefits for the UK economy.

Workstream 2 introduces the concept of an AMS and the scope for UK aviation voluntary action to stimulate the scale-up of UK GGRs through a demand signal.

Workstream 3 explores levers for Government to amplify this demand signal by incorporating GGRs into existing or new policy frameworks, followed by the Task and Finish Group's concluding remarks and potential for future work.

1. The Evidence Base

1.1. Defining Greenhouse-Gas Removals for Aviation

The Intergovernmental Panel on Climate Change (IPCC) defines greenhouse gas removals (GGRs) as human activities that directly capture CO_2 from the atmosphere and store it durably in geological, terrestrial or ocean reservoirs, or in long-lived products. UK, and wider international plans, to achieve net zero emission by aviation in 2050 all show a need to address residual emissions. Varying quantities of these residual emissions are expected to be met through existing compliance mechanisms such as trading carbon allowance credits in the UK and EU Emission Trading Schemes (ETS) or buying approved carbon reduction credits in the global Carbon Offset and Reduction Scheme for International Aviation (CORSIA). In the longer term there is a growing view across aviation stakeholders that these compliance schemes need to evolve to include a growing proportion of GGRs. While all GGRs solutions are expected to have a role in achieving net zero, their deployment may differ depending on the type of emissions they aim to abate. As aviation's atmospheric CO_2 emissions persist effectively permanently, long-term and durable storage on an equivalent timescale will be required to credibly deliver net-zero aligned removal of these emissions.

Removal methods can include the enhancement of natural removal processes (nature-based) and technology-based capture and storage processes (often termed "engineered" removals). There are various removals methods[11] at different levels of readiness, mitigation potential, storage method and duration, such as afforestation, direct air carbon capture and storage (DACCS) and bioenergy with carbon capture and storage (BECCS). Efforts such as the ICVCM's Core Carbon Principles (CCPs) to standardise the market and ensure consistent high quality should be encouraged.

Currently, the acceptable range of GGRs for use by the aviation sector has not been defined or agreed.

1.2. Standards and Definitions

Currently, despite many using the Oxford Principles for Net Zero Aligned Carbon Offsetting[12], global GGR standards and definitions are still being determined, with a complex picture now evolving at national and international level (see Figure 1).

[11] For a summary of removals methods see: The State of Carbon Dioxide Removal (2024) - Link

[12] https://www.smithschool.ox.ac.uk/sites/default/files/2024-02/Oxford-Principles-for-Net-Zero-Aligned-Carbon-Offsetting-revised-2024.pdf

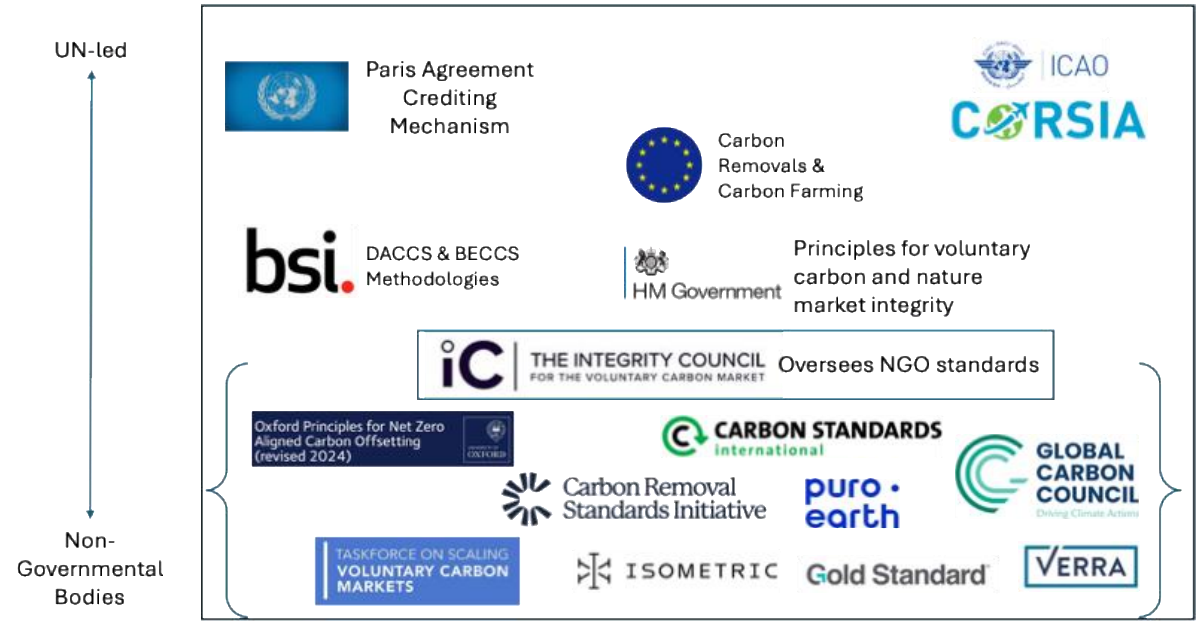


Figure 1: Landscape of Carbon Removal Standards and Methodologies (non-exhaustive)

In the UK, the Department for Energy Security and Net Zero (DESNZ) has commissioned the British Standards Institute (BSI) to develop methodologies for DACCS and BECCS for a UK GGR Standard. The government has the option to expand this to a broader set of removal types, subject to further approval, and this report recommends accelerating this process. Consultations are also ongoing regarding the practicalities of GGRs integration into the UK ETS[13] and raising integrity in voluntary carbon and nature markets[14].

Domestic alignment in standards and definition of GGRs would enable clarity between the Government's revenue support GGRs Business Model[15], and the UK ETS, for both producers and purchasers of GGRs. To further support the development of high-integrity GGRs, issues such as additionality, durability, measurability, storage and liability, and monitoring, reporting and verification (MRV) would benefit from standardised definitions and methodologies.

Further to this, international alignment across the developing landscape of definitions and standards will be critical to ensure consensus in the development of high-integrity GGRs, whilst reducing transactional costs, building market confidence and enabling international participation by all aviation stakeholders.

1.3. Supply of GGRs

Current UK GGRs Supply

UK GGRs possible supply covers the wide range of types as shown in figure 2.

[13] UK Gov DEFRA. Integrating Greenhouse Gas Removals in the UK ETS: Main Response (2025) – Link
[14] UK Gov DESNZ. Voluntary carbon and nature markets: raising integrity – consultation document (2025) – Link
[15] UK Gov. Greenhouse Gas Removals (GGR): business model (2025) - Link

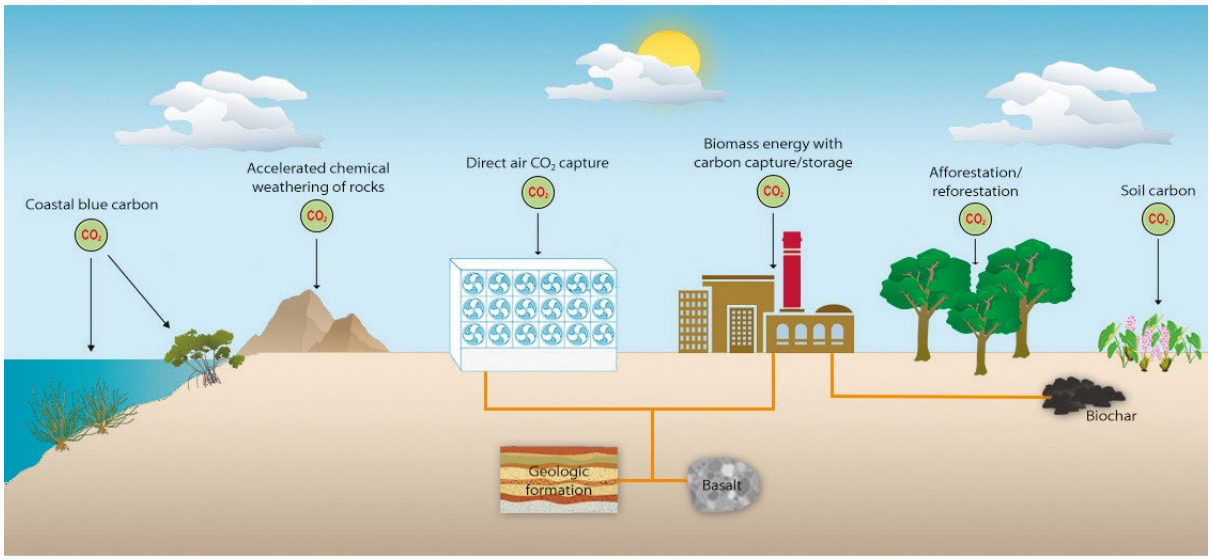


*Figure 2: Possible GGRs types (**Sourced from** https://climatehughes.org/ggr-briefing-paper/)*

The recent UK Carbon Budget Growth Delivery Plan[16] acknowledged the critical role of GGRs in balancing residual emissions from the hardest to decarbonise sectors such as aviation. This plan predicts that the total UK GGRs supply will be 0.7 $MtCO_2$ by 2030, rising to 21.8 $MtCO_2$/year by 2035, of which 17.4 $MtCO_2$ being delivered through engineered removals. This is based on current policies and proposals. However, despite notable recent growth in the number of GGRs companies across the UK (Figure 3), the CCC and CO2RE estimate UK removals deployment could be in the range of 2.6 MtCO2/year to 2.8 MtCO2/year, respectively.

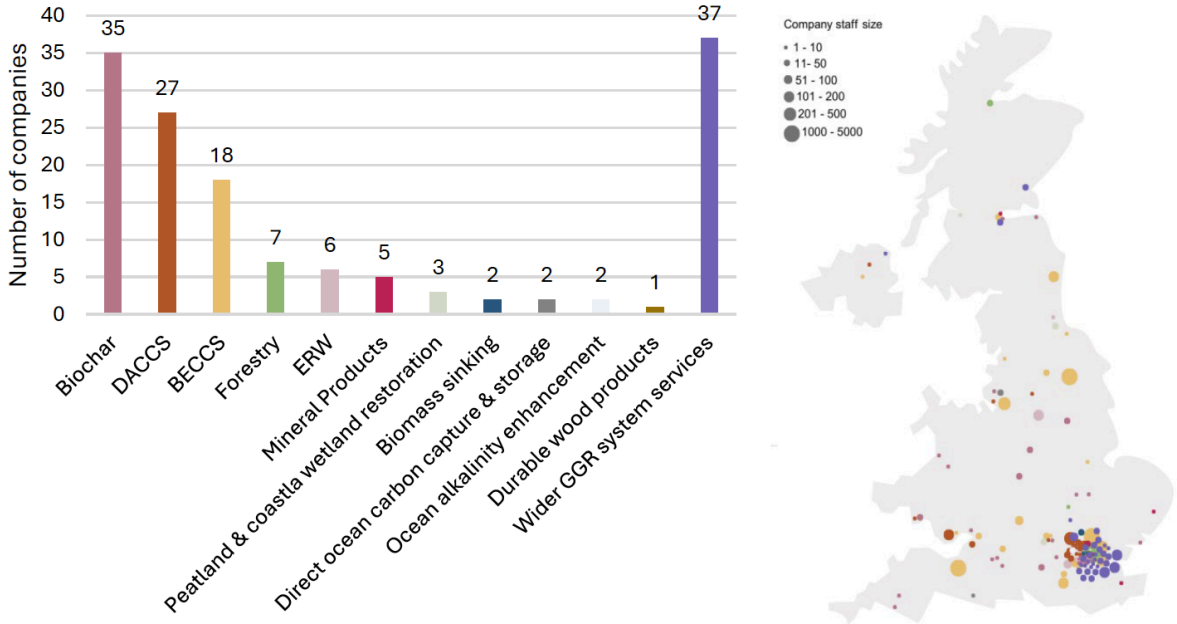


Figure 3: Number and location of GGR companies by removal method. Source: CO2RE - The UK State of CDR (2025)

Maximum technical potential UK GGRs supply by 2050

[16] UK Carbon Budget and Growth Delivery Plan - Link

In the recent independent review of GGRs for the UK government, each type of GGRs is considered including what the maximum technical potential supply levels could be in 2050. Combined, these solutions could generate around 270 $MtCO_2$[17]annually,with around 120 $MtCO_2$ coming from geologically permanent GGRs (90 $MtCO_2$ from BECCS and 30 Mt CO_2 from DACCS). Actual supply is expected to be lower than these figures for a range of reasons including market demand, investment requirements to deliver these volumes, especially from technologies that are currently in an earlier stage of development and how each solution competes in the market. Given the uncertainty of these factors a 'realistic' maximum supply of GGRs has not yet been defined.

Global Supply of GGRs

Aviation has and always will be predominantly international in its outlook and procurement. Internationally, around 80 $MtCO_2$/year[18] of engineered removals capacity is in development across DACCS (12 Mt) and BECCS (68 Mt), but only about 5% of these projects have reached final investment decision (FID), implying roughly 4 $MtCO_2$/year online by 2030 without further intervention[19]. This points to the need for credible demand signals, clear standards and investable CO_2 transport and storage to unlock capital at pace.

Further studies indicate that by 2050 the global GGRs supply market could be in the range of 4.5 to 10 GtCO2[20].

1.4. Demand for GGRs

1.4.1. UK wide

There are several UK projections for the volume of GGRs required to achieve net zero. The Climate Change Committee (CCC)[21] indicates a growing demand requirement from 2.6 $MtCO_2$ in 2030, to 35.8 $MtCO_2$ of engineered removals by 2050. It is suggested that BECCS will be responsible for nearly 25 $MtCO_2$ in 2050 and DACCS responsible for 8 $MtCO_2$. The CCC Seventh Carbon Budget report (figure 3.5) also highlights the potential abatement from Nature Based Solutions (NBS) contributing 25 $MtCO_2$ to UK decarbonisation in 2050 (16 $MtCO_2$ abatement from afforestation, 8 $MtCO_2$ from peatland restoration and the remaining 1 $MtCO_2$ from other sources of NBS.)

1.4.2. UK aviation

The CCC 7th Carbon Budget balanced pathway scenario anticipates aviation will need roughly 60% of total GGRs supply in 2050 - around 23 $MtCO_2$[22].

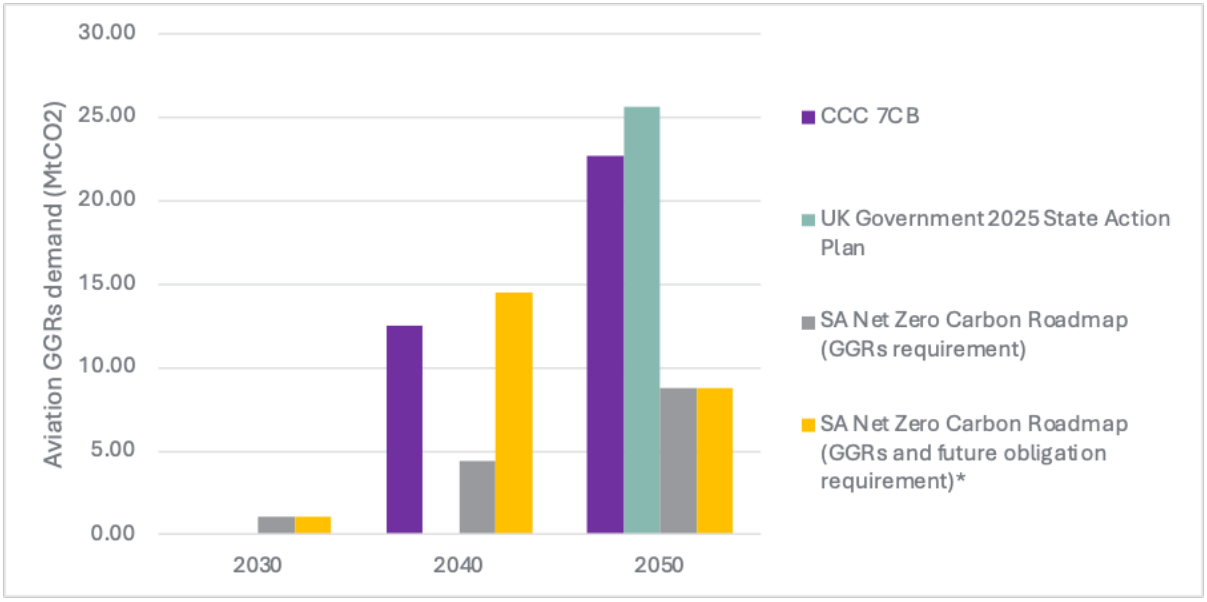
The UK Government 2025 State Action Plan provides a more granular assessment for aviation indicating a need for about 26 $MtCO_2$ to address residual emissions to get aviation to net-zero in 2050.[23]

Other sources of demand requirement are the UK Jet Zero Strategy (2022) and the Sustainable Aviation (SA) 2023 Net Zero Carbon Road-Map. Additionally, by summing the annual GGRs

[17] Calculated from data presented in chapter 2 of The Independent Review of GGR - Link
[18] IEA – CCUS projects around the world are reaching new milestones (2025) - Link
[19] IEA – CCUS projects around the world are reaching new milestones (2025) - Link
[20] McKinsey – Insights 2023 - Link
[21] Climate Change Committee Seventh Carbon Budget - Link
[22] CCC 7th Carbon Budget section 7.6, table 7.6.1 (assumes solely domestic deployment of BECCS and DACCS.) Link
[23] UK State Action Plan on International Aviation CO2 Reductions – 2025 – Link

demand in the SA roadmap between 2024 to 2050, a cumulative total of 101 $MtCO_2$ is required[24]. The variations in these demand expectations are summarised in figure 4. Further information is provided in appendix 1.

Figure 4: Range of UK Aviation GGRs demand requirements to address residual emissions (excludes any PtL SAF GGRs demand)



** Derived using the roadmap wedge CO_2 data in Appendix 5 of the SA technical report. It is not entirely clear if SA intended for all the future obligation to be met by using GGRs or not, but in this example, we have assumed they did.*

In addition to the direct use of GGRs within the Aviation sector, forms of GGRs that generate a CO_2 stream will also be required in the production of Power-to-Liquid (PtL) synthetic fuels to meet SAF demand. The UK SAF mandate has set a PtL sub mandate that comes into effect in 2028. This requires 0.2% of obligated fuel to be supplied by PtL SAF in 2028 and rises to 4.5% by 2040[25]. The actual amount of CO_2 capture required to make this PtL SAF is not fixed because it depends on the total amount of fossil jet fuel used by Aviation in each of these years.

The CCC[21] (figure 7.12.3) forecast that the direct air capture capacity in their Balanced Pathway scenario for aviation and shipping synthetic fuel has a feedstock requirement of around 3 $MtCO_2$ in 2040 (of which 1.5 $MtCO_2$ for is for aviation). By 2050 aviation's feedstock requirement is forecast to rise to 4.1 $MtCO_2$.

Investments in engineered removals today delivers not only the removal of atmospheric CO_2 for storage but for use as the future feedstock base for Third Generation SAF, strengthening energy security and sector resilience (Figure 5).

[24] See section 1.6 of Sustainable Aviation Net Zero Carbon Road-Map Technical Report - Link
[25] UK SAF mandate: An essential guide - Link

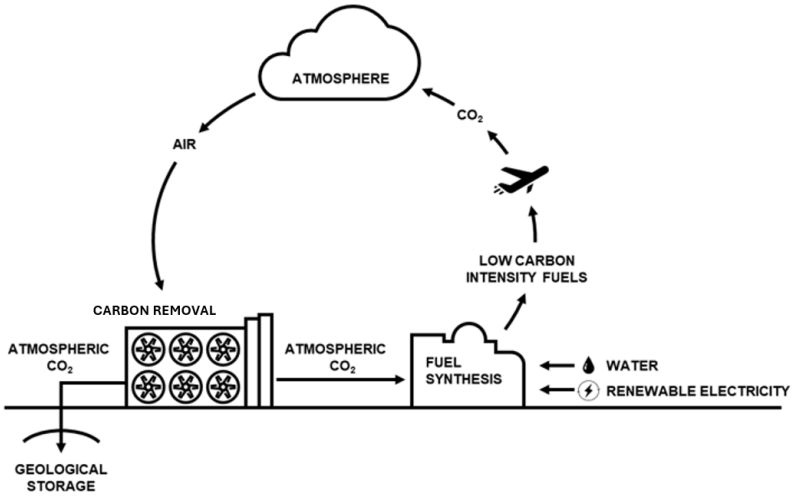


Figure 5: Schematic of atmospheric CO_2 as a feedstock to supply PtL plants.

This section has defined a range of potential UK aviation GGRs demand due to the range of assumptions about demand growth and emission reductions achieved by other solutions in each forecast. Any changes to these assumptions, such as SAF uptake being slower than mandated, or costs remaining higher than expected, is likely to increase residual emission requirements.

1.4.3. Global Aviation Demand for GGRs

Global projections differ by scenario and policy ambition, generating significant levels of uncertainty (Figure 6). The International Civil Aviation Organisation (ICAO) Long Term Aspirational Goal (LTAG) suggests aviation residuals of between 203 and 954 $MtCO_2$ in 2050. Even the lower bounds of these projections imply a substantial requirement for durable removals for international aviation by mid-century. See Appendix 1 for further information.

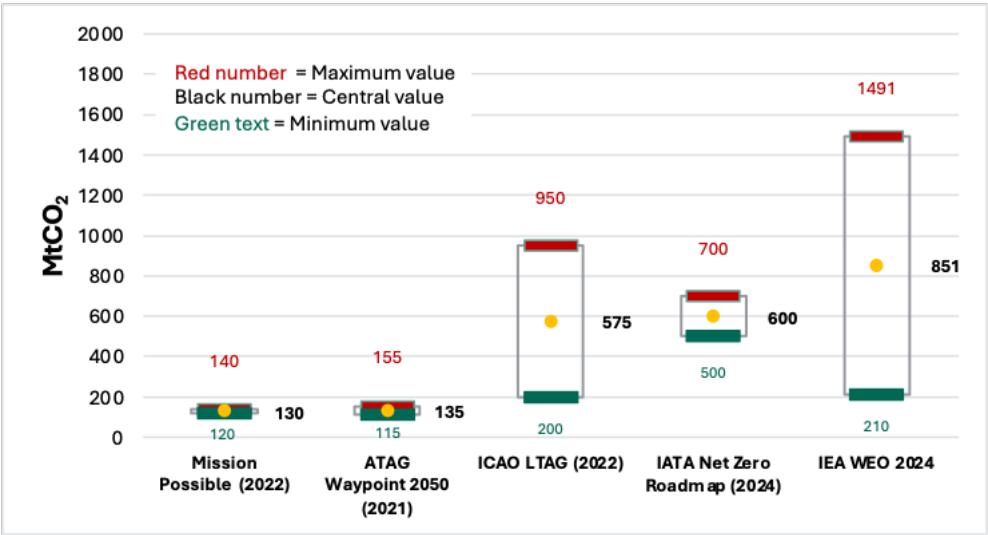


Figure 6: Estimates of international aviation's residual emissions in 2050 from Mission Possible[26], ICAO[27], ATAG[28], IATA[29] and IEA[30]. Note: ICAO LTAG accounts for international aviation emissions only (no domestic).

[26] Mission Possible. Making net zero aviation possible - Link
[27] ICAO Long Term Aspirational Goal (LTAG) - Link
[28] ATAG Waypoint 2050 - Link
[29] IATA Net Zero Roadmap - Link
[30] IEA World Energy Outlook - Link

In September 2025 the International Air Transport Association (IATA) published their latest projections in the Global Feedstock Assessment for SAF Production Outlook to 2050[31]. Figure 7 suggests 176Mt PtL SAF supply is achievable in 2050 which will require GGRs at least the same volume of CO_2 capture.

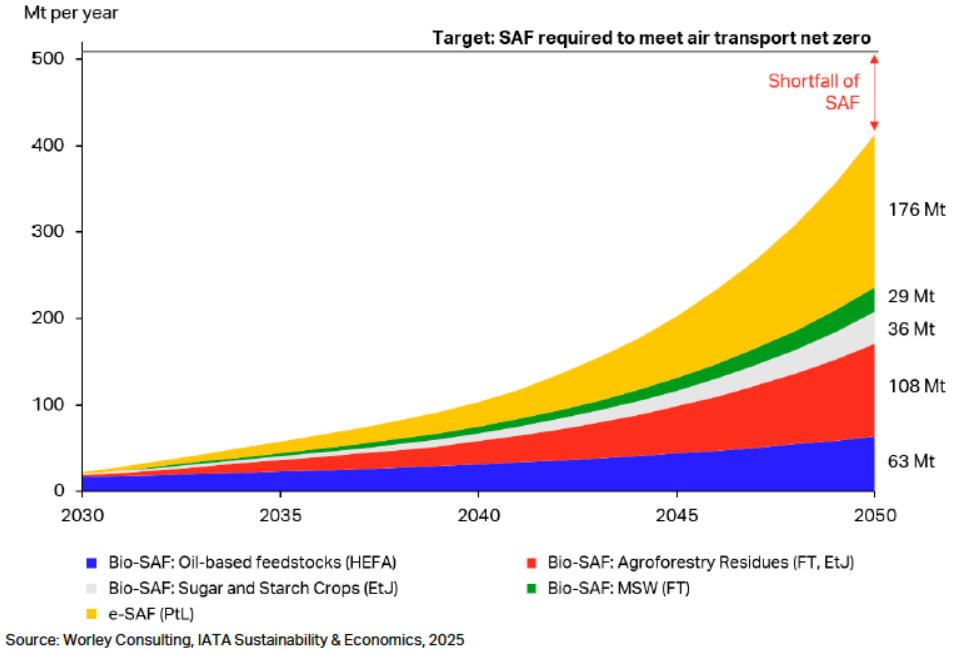


Figure 7: IATA Estimate of Global SAF production potential (core forecast)

An earlier study suggested PtL adoption could require well over 250 $MtCO_2$ per year[32] above the quantities shown in figure 6.

1.4.4. Immediate demand challenges

While there is broad recognition of the aviation sector's anticipated long-term demand for durable greenhouse gas removals (GGRs), both domestically and internationally, current uptake remains minimal. This is primarily due to a range of market, regulatory, and operational barriers that constrain short-term purchasing activity.

According to CDR.fyi[33], an independent tracker of durable GGRs credit transactions, over 39 million tonnes of GGRs have been sold globally to date. Aviation companies account for only 1.4% of these purchases. Even when excluding Microsoft, the largest single buyer with 31 million tonnes, aviation's share rises only to 7.1% of remaining transactions. This indicates a significant disconnect between projected future demand and present-day market engagement, particularly when compared to other sectors.

Moreover, emissions reductions attributed to GGRs currently lag behind other aviation mitigation strategies, such as improvements in fuel efficiency, fleet modernisation, and the deployment of sustainable aviation fuels (SAF).

[31] IATA Global Feedstock Assessment for SAF Production Outlook to 2050 - Link
[32] McKinsey Clean Skies for Tomorrow. Delivering on the Global Power-to-Liquid Ambition. Insight Report (2022) – Link
[33] CDR.fyi - Link

Key Barriers to Immediate Demand include but are not limited to:

1. Cost Constraints

- Durable GGRs credits are currently priced between £150 and £1,000 per tonne, rendering them financially prohibitive for many aviation operators.
- Alternative mitigation measures often deliver greater cost-effectiveness, with added benefits such as fuel savings, reduced compliance costs, and access to financial incentives.

2. Limited Utility in Compliance Frameworks and Certifications

- GGRs do not offer the same clarity of emissions reductions as direct measures like SAF or operational efficiencies in compliance schemes such as ETS.
- GGRs are not yet eligible for use within compliance schemes such as the UK / EU Emissions Trading System (ETS) however plans to integrate GGRs have been recently announced.
- Under CORSIA, airlines derive no clear advantage from purchasing GGRs over lower-cost avoidance credits.
- GGRs are not currently recognised as valid carbon reduction instruments under frameworks such as the Science Based Targets initiative (SBTi).

3. Reputational and Legal Risk

- Historical scrutiny of voluntary carbon offsetting by NGOs, media, and the public has led to heightened sensitivity around perceived "greenwashing."
- Aviation companies face potential litigation risks if carbon credit use is deemed misleading or excessive.

4. Timing of Net Zero Commitments

- Many aviation firms have set Net Zero targets for 2050, which may reduce the urgency for near-term action.
- In contrast, companies in other sectors - such as Microsoft, which has committed to net negative emissions by 2030 - are driving earlier market engagement.

5. Market Maturity and Awareness

- The GGRs sector remains nascent, with limited standardisation and a lack of government-endorsed protocols.
- Aviation stakeholders often lack the technical expertise and confidence required to engage with emerging GGRs technologies and developers.

Overcoming these current barriers to GGRs adoption within the aviation sector is essential to unlocking the long-term potential of these technologies and ensuring the UK remains at the forefront of climate innovation. Without targeted interventions to address cost, utility, reputational risk, and market maturity, the sector risks falling behind in its decarbonisation roadmaps and missing critical opportunities to drive investment in durable removals.

Stimulating early demand from aviation can play a pivotal role in accelerating the development, scale-up, and cost reduction of GGRs technologies. This, in turn, will help build a robust and credible supply base capable of meeting future climate commitments, both nationally and globally.

1.5. Addressing the Supply-Demand Gap

Despite the growing number of GGRs projects in development in the UK and globally, a significant gap persists between the anticipated demand for durable removals and supply. Using the Oxford Offsetting Principles[34], the following sections discuss how this gap can be addressed.

1.5.1. Role for Nature Based Solutions (NBS)

UK opportunities for NBS include but are not limited to: afforestation; reforestation; forest management; agroforestry; farming of macroalgae; and restoration of wetland, peatland and coastal habitats.

Afforestation is already commercially deployed in the UK and there is some potential to grow existing capacity with afforestation targets that could be effective in around 20 years' time and there are constraints to available land. Carbon capture through reforestation has been successfully deployed in the UK by organisations such as *Forest Carbon*, who since 2006, have initiated the planting of approximately 13 million new trees in 220 new woodlands, removing over 3.3 $MtCO_2e$ from the atmosphere[35]. Further information on other NBS potential is provided in the recent Independent Review of GGRs[36] and UK Government Carbon Budget and Growth Delivery Plan[37].

1.5.2. Role for Engineered Solutions

UK opportunities for engineered solutions include but are not limited to: biochar; enhanced rock weathering (ERW); marine carbon dioxide removal techniques; direct air capture (DAC) and direct air carbon capture and storage (DACCS); bioenergy with carbon capture and storage (BECCS); and carbon negative building material. Some technologies within this portfolio remain novel, with scientific uncertainties that must be addressed before responsible commercial deployment can be considered.

Initial engineered GGRs developments are concentrated around industrial clusters – such as HyNet in Northwest England, and Teesside – where the colocation of CO_2 transport and storage infrastructure can improve securing investment[38]. However, there are also lots of sites around the UK which could offer removals outside the clusters (e.g. biomethane projects, and biochar which does not need to be situated near a cluster necessarily). Further information on other engineered solutions potential is provided in the recent Independent Review of GGRs[39] and UK Government Carbon Budget and Growth Delivery Plan[40].

[34] Oxford Offsetting Principles - Link
[35] Forest Carbon - Link
[36] Independent Review of GGRs - Link
[37] UK Government Carbon Budget and Growth Delivery Plan - Link
[38] Preliminary Assessment of Investment Readiness of CDR in the UK - Link
[39] Independent Review of GGRs - Link
[40] UK Government Carbon Budget and Growth Delivery Plan - Link

1.5.3. The Need to catalyse UK economic development of Removals Today

Clarifying the role of Nature Based Solutions (NBS) alongside Engineered Solutions

There is currently much debate about the acceptability of using NBS as part of addressing aviation's residual emissions, with the focus on the immediacy, durability, measurability, verifiability and the investment impacts of NBS on engineered solutions. The debate is effectively constraining current investment in GGRs whilst policy led certainty in standards and definitions for aviation GGRs is achieved.

However, UK industry coalition Sustainable Aviation in their 2023 Net Zero Carbon Road-Map set out a progressive transition pathway from NBS to engineered removals that could be used as a template[41].

Reducing Costs

The many GGRs pathways available in UK have varying costs and scalability potentials (Table 1). Catalytic investment will deliver significant cost reductions in GGRs – particularly DACCS and to a lesser extent BECCS. Only early action will deliver the accelerated learning to compress costs materially before 2040.

Table 1:Cost and scalability of UK GGRs methods. Source: Element Energy, 2021[42] and Independent Review of GGRs, 2025[43]

GGR option	TRL (a)	Cost (£/tCO2 gross)		Scale Considered (MtCO2 gross / year)		UK Technical potential (MtCO2 gross / year)
		2030	2050	2030	2050	2050
Anaerobic Digestion	9	145-157		30		30.0
Afforestation	9	2-173		3 – 5	16 – 24	26.5
BECCS EfW	7	221-347	173-298	0.5 – 1.2	2.5 – 7.5	12.0
BECCS Hydrogen and Other	5-7	50 – 120	30 – 100	0 – 2	10 – 35	
BECCS Industry	7	50 – 270	40 – 300	0 - 1	3 – 6.5	
BECCS Power	5-7	223-334	223-334	0 – 8	4 – 29	90.0
Biochar	5	20-1,171	5-1,210	0 – 1.1	3 - 15	20.0
DACCS Liquid	6	325-578	169-405	8-48		50.0
DACCS Solid	7	636-842	259-489			
Enhanced Rock Weathering	4	350-864	262-670	0 – 1.2	0 – 18	18.7
Habitat Restoration - Peat	9	26 – 48	26 – 48	0 – 1.5	0 – 4.6	4.7
Habitat Restoration – Saltmarsh	7	17 – 35	17 – 35	0 – 0.3	0 – 1	1.0
Marine Carbon Dioxide Removal	1-2	2-350		Currently Uncertain		
Soil Carbon Sequestration	8	4 – 20	4 – 20	0 – 12	0 – 15	15.7
Wood in Construction	9	Negligible	Negligible	0.2 – 0.6	0.4 – 2.8	3.3

[41] Figure 11 https://www.sustainableaviation.co.uk/wp-content/uploads/2024/06/FullTechnicalRoadmap-Jun24.pdf
[42] Element Energy. Greenhouse Gas Removal Methods and their potential UK deployment (2021) – Link
[43] Independent Review of GGRs - Link

Capital and operating costs for engineered removals like DACCS are currently higher in the UK than in some other countries (notably the United States and the UAE) due to energy costs, labour costs and differing policy incentives. If these costs differentials are not resolved, early UK volumes will be modest. Consequently, access to NBS or international removals will be required while UK engineered GGRs capacity scales.

Learnings from the SAF Industry

The scale up of UK GGRs can draw lessons from the SAF market, adopting a similar strategy, specifically a firm policy framework with a robust mandate and reliable support mechanisms. By mirroring the dual focus on policy clarity and market incentives, the UK can ensure the timely scale-up of GGRs, positioning itself at the forefront of the global GGRs market.

1.6. Benefits for the UK Economy

Analysis to-date indicates significant economic opportunity from scaling UK GGRs, from exportable services along the value chains of both engineered and nature-based removals, providing jobs and contributing to the UK Government's Growth Mission.

The UK Carbon Budget and Growth Delivery Plan indicates that by 2035 engineered GGRs has the potential to generate 5,000 jobs directly and across the supply chain[44]. According to the plan, investment in the deployment of engineered GGRs has the potential to attract £2billion (public and private) annual average investment over UK Government Carbon Budget 6 (2033 to 2037).

By 2050 the jobs potential is expected to rise further as summarised in Figure 8.

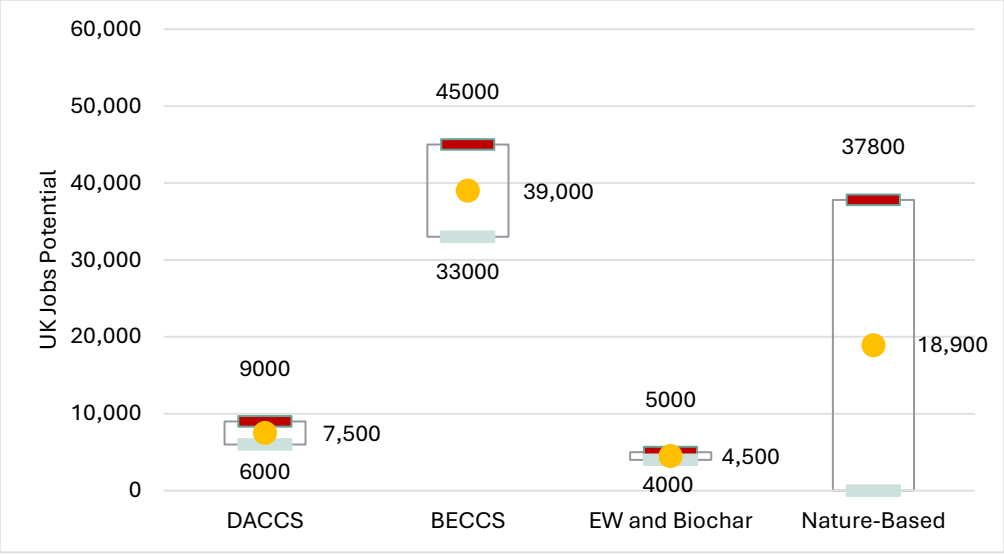


Figure 8: Indicative UK jobs potential by 2050.

Note: DACCS, BECCS, EW and Biochar based on Carbon Gap 2050 estimates[45]. Nature-based based on current estimate UK employment, uplifted by 80% based on findings of UNEP report (2030 figures).

[44] Page 233, UK GOV Carbon Budget and Growth Delivery Plan (Oct 2025) - Link
[45] Carbon Gap. Growth through removals: Making Greenhouse Gas Removals a vibrant part of the UK economy (June 2025) – Link

Further Studies:

Developing GGRs is also expected to support the service sector. This is a critical area of strength and opportunity for the UK.

- Carbon Gap estimates around 60,000 UK jobs from removals by 2050: 33,000 to 45,000 in BECCS, 6,000 to 9,000 in DACCS, and 4,000 to 5,000 in enhanced weathering and biochar. They estimate median pay associated with these jobs of £48,800 – roughly 30% higher than the national average.
- BeZero[46] suggest a wider potential of 135,000 new jobs by 2035, including 30,000 for engineered and 80,000 for nature-based removals projects, accompanying 25,000 market infrastructure and professional services (analysts, brokers, scientists, insurers, lawyers, auditors). They estimate these roles would deliver £1 billion in tax revenue every year.
- Coalition for Negative Emissions[47] (CNE) estimate that by 2050 industry revenues could reach around £18 billion per annum from UK sales alone (engineered and nature based).
- BloombergNEF and TNFD[48] recently estimated the value from broader nature-related services (mitigation, MRV, restoration and other activities) to the UK economy, recognising it as a growing, major contributor to the UK economy – worth over £2.2 billion in 2024, with 21,000 workers in 900 UK organisations.
- Beyond the above direct services, the sequestration value alone of UK woodland is estimated to be worth £5.1 Billion[49]. In addition, the sequestration, resilience and climate mitigation related value of isolated trees that make up hedgerows and line streets (those outside woodland) have been valued at £3.8 Billion to the UK economy[50].
- A report by the ILO, UNEP and IUCN[51] estimates that nature-based solutions in service of net zero could unlock an additional 32 million jobs globally by 2030, with potential growth of 80% across European countries. Most of the growth is predicted across Latin America, Asia Pacific and Africa.

Task and Finish Group member industry experience indicates that a 0.5 $MtCO_2$ per year DACCS facility could support around 1,200 construction jobs during build and approximately 340 operational roles thereafter.

In summary, early corporate and government leadership in developing the UK removals market will help anchor supply chains and exportable services in engineering, fabrication, MRV and finance, supporting regional growth in industrial clusters.

1.7. Seizing the Opportunity in a Global Market

Aviation is inherently international, because of this the solutions it adopts are also likely to be international. UK strengths and capabilities in offshore CO_2 storage capacity, engineering, MRV, insurance, project finance, legal services and registry and data infrastructure, are exportable now, allowing UK firms to capture value even as the global GGRs market develops (Figure 9).

[46] BeZero. From risk to reward: Making the UK the carbon markets capital of the world (May 2025) – Link
[47] CNE. The Growth Potential of the UK Greenhouse Gas Removals Industry - Link
[48] BloombergNEF. The Growing role of Nature-related Business in the UK Economy – Link
[49] Office of National Statistics (ONS) Woodland Natural Capital Accounts - Link
[50] DEFRA Economic value of the UK's individual trees revealed - Link
[51] ILO, UNEP and IUCN. Decent Work in Nature-based Solutions 2024 – Link

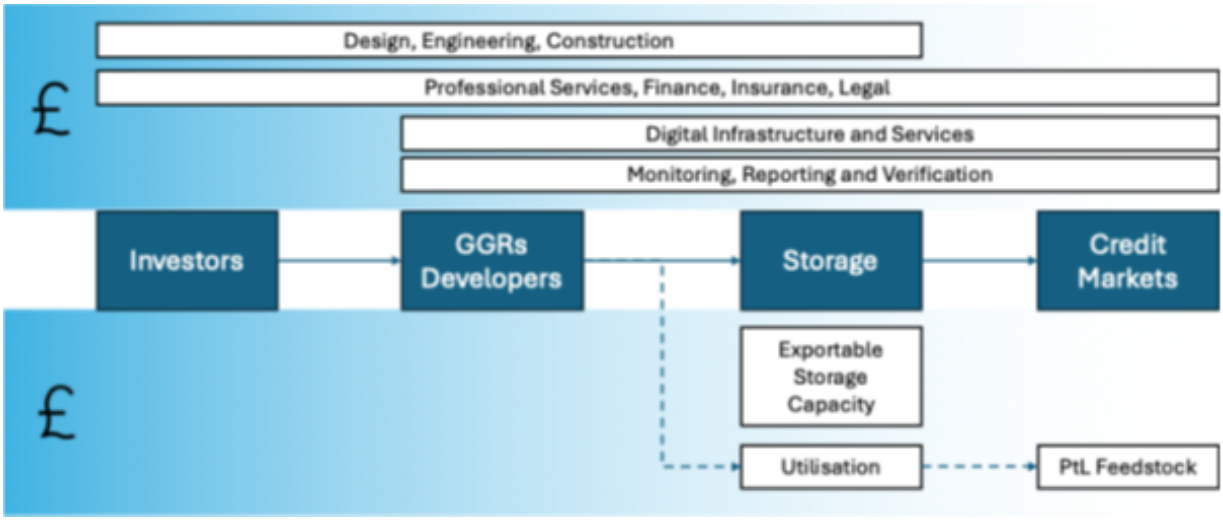


Figure 9: Exportable UK services along the GGRs value chain.

UK aviation's access to international durable removals in the voluntary carbon market is expected to reduce their costs by providing access to competitive projects, diversifying GGRs supply risk, and preventing delay from domestic bottlenecks whilst UK supply capacity is being developed. To maximise this potential however, international accounting systems urgently need to be developed to allow the possible integration of international units in compliance schemes.

In parallel, Government can further accelerate UK supply by developing GGRs standards beyond BECCS and DACCS, ensuring investable CO_2 transport and storage, and considering time-bound support measures to improve buyer affordability. This could evolve into the development of globally recognised frameworks, with UK taking a strong lead in shaping robust criteria for GGRs, helping protect against the introduction of low-quality removals and the various risks associated with weak methodologies. UK involvement in this process will reinforce trust in markets that airlines and investors depend on. Working closely with the ICVCM, a UK based entity, will be key to achieving international alignment.

1.7.1 CORSIA

The ICAO Carbon Offset and Reduction Scheme for International Aviation (CORSIA) creates a further opportunity. While GGRs are now progressing towards full eligibility into the scheme, the limit of approved methodologies, the lack of corresponding adjustments and the lack of supply means that no high durability GGRs are yet available. Recent developments, including the approval of UK-based GGRs registry Isometric within CORSIA and the acceptance of GGRs specific methodologies within other approved registries are very welcome and should support further supply of GGRs credits into the market. Opportunities for further UK Government and UK industry to work together in exploring the scaling of GGRs in CORSIA is outlined in section 3.4.5

2. An Advanced Market Signal concept for aviation

2.1. Why consider an Advanced Market Signal (AMS)

From the evidence base in chapter 1 we have identified that the aviation sector has:

- A high demand for high integrity GGRs
- A need for GGRs to scale up rapidly
- A need for GGRs supply to evolve to include a significant proportion of engineered removals
- Not yet collectively indicated a strong signal to the GGRs market

In 2023, members of the UK industry coalition *Sustainable Aviation (SA)* recognised the need to support the development and scale-up of removals and set out the case for an AMS[52]. Building on this and the context stated above, a number of companies across the spectrum of SA's membership have taken the opportunity to be part of a proof-of-concept signal that demonstrates their intent and commitment to carbon removals.

Other Advance Market Signals exist today.

- In 2021 the NextGen CDR facility was founded by Mitsubishi Corporation & South Pole and committed plans to purchase over one million tonnes of verified carbon dioxide removals (CDRs) from projects generated from a range of technologies by 2025. Buyers include BCG and UBS[53].
- In 2022 Frontier (a coalition of Stripe, Meta, McKinsey and others) committed to purchase $1bn of permanent removals between 2022 and 2030[54].
- In 2022, Airbus partnered with 1PointFive to bring carbon removals from direct air capture technology to the aviation industry by pre-purchasing 100,000 tonnes of carbon removals per year over four years as part of an initial offtake[55]. Many airlines have written letters of intent to Airbus with easyJet[56] being the first airline to sign a contract.

In 2023 a first-of-a-kind pilot for financing carbon removals was launched in partnership between CUR8, UNDO, British Airways and Standard Chartered[57]. This was followed in 2024 with British Airways signing a deal to purchase more than £9 million worth of innovative carbon removals credits in the United Kingdom and overseas as part of a six-year agreement[58].

2.2. The Benefits of an AMS

In exploring the concept of an aviation sector AMS, the benefits of doing so have become more compelling. To fully establish the most effective AMS format the sector has come together to carry out an initial "proof of concept". This will be a small, time-bound activity to inform the industry and Government, with the results considered for further use or scaling over time.

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[52] Sustainable Aviation Decarbonisation Roadmap 2023 – Chapter 8 – Link
[53] See https://www.nextgencdr.com
[54] See https://frontierclimate.com
[55] See https://www.airbus.com/en/newsroom/stories/2022-07-direct-air-carbon-capture-and-storage-for-aviation-explained
[56] See https://carboncredits.com/easyjet-airbus-strike-a-deal-zero-carbon-flying-with-carbon-removal-credits/
[57] See https://mediacentre.britishairways.com/pressrelease/details/18528
[58] See https://mediacentre.britishairways.com/pressrelease/details/20828

The initial 2026 “proof of concept” AMS aims to support:

- **Quality**: Set clear expectations about GGRs quality. The AMS signals the minimum guardrails buyers expect by requiring independent MRV, public registries, additionality and long-lived storage. Reinforce existing quality initiatives such as the ICVCM’s CCPs.
- **Learning**: Provide a controlled environment for learning. Industry and government can discuss, in a transparent way, how measures such as tax treatment, ETS allowance issuance or links to the SAF mandate and CORSIA, as well as other instruments might work in practice, without pre-judging future compliance rules. Individual organisations can also learn more about approaches to contracting and procurement.
- :
- **Investment**: Improve the early investment in high integrity UK removals, by giving developers greater confidence in future removal demand.
- **Synergies**: The signal reinforces that removals are an important part of the UK aviation decarbonisation pathway and where appropriate, for decarbonising inputs such as SAF and hydrogen production.

2.3. Creating an Advanced Market Signal (AMS)

The JZTF GGR task finish group recognises the potential of the SA initiative that would involve the advanced purchase of future-dated removal credits to support the development and scaling of GGRs methods today, driving down costs faster.

The participating companies in the “proof of concept” will make an initial purchase commitment (with flexibility to scale up) for future-dated removal credits that meet high-integrity principles and emerging best practice standards. Organisations will buy individually or through carbon removal brokers (trusted intermediaries) (Figure 10).

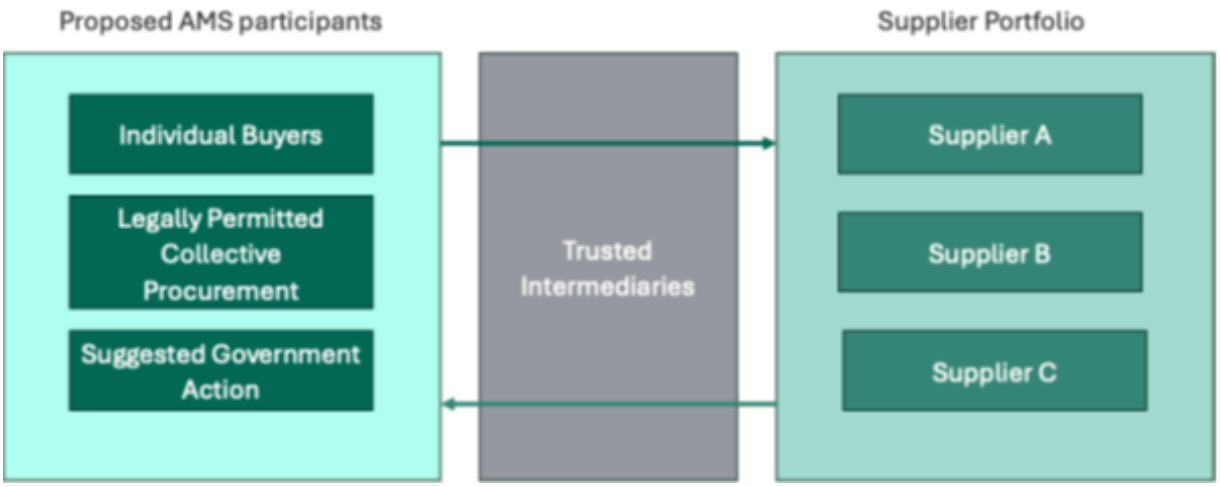

Figure 10: AMS concept diagram

As noted in section 1 of this report, the focus is on high integrity and durable removals, verified by accredited third parties, and recorded on transparent registries. The AMS will be set up to align with emerging and future compliance rules (UK ETS, ICVCM Core Carbon Principles, and - subject to alignment - CORSIA), so what is purchased voluntarily through the AMS is compatible with the future regulatory market. Consequently, it is intended to mimic a future state in the

decarbonisation of UK aviation, rather than solely represent a best practice voluntary exercise in carbon removal in the present.

At the time of writing, seven members of this group and SA are willing to proceed with the proof of concept in the first half of 2026 to purchase future-dated, high integrity removals credits aligned with UK/EU/ICAO standards. The participants represent a broad cross-section of the industry, and the total expected value of the AMS is currently in excess of £2m.

The overall portfolio is guided by a set of core principles which will ensure alignment to the prevailing view of best practice in the voluntary carbon market, based on the ICVCM Core Carbon Principles:

Transparency in measurement, reporting and issuance: Credits should be robustly quantified, monitored, validated, reported and verified by an accredited and independent third party. Information on credits should be publicly available in electronic format and accessible to non-specialised audiences. Credits should be issued via a registry to ensure they can be identified securely and unambiguously.

Use of established and credible projects: SA will recognise all registries with a likely route to CORSIA and ICROA endorsement but note that registries continue to be reviewed and evolve over time for both voluntary and compliance market schemes.

Additionality: The carbon removals from the mitigation activity shall be additional, i.e., they would not have occurred in the absence of the incentive created by carbon credit revenues.

Durability: There is a preference for GGRs from the mitigation activity to be of high durability. In line with this, the AMS will focus primarily on removals classified under Type V in the Oxford Principles for Net Zero Aligned Carbon Offsetting, with carbon removal to the geosphere. The AMS will also prioritise high integrity UK-based Type IV removals (carbon removal to the biosphere) to support the scaling of the UK market. *Removal credits will aim to align with UK ETS requirements, including a potential minimum durability of 100 years with an aspiration to move towards 200+ years over time.*.

Only counted once towards a mitigation obligation: The GGRs from the mitigation activity shall not be double counted, i.e., they shall only be counted once towards achieving mitigation targets or goals. Double counting covers double issuance, double claiming, and double use.

No net harm: Removals should conform with or go beyond widely established industry best practices on social and environmental safeguards while delivering positive sustainable development impacts.

Measures must be in place to assess and mitigate incidences of material leakage. Removal credits should be generated from projects that do not cause emissions to materially increase elsewhere (this concept is also known as leakage) in line with ICVCM guidance.

Origin of credits: SA should outline the need for both domestic and international credits as part of its transition as an international sector – provided that credits are of similar high quality and integrity. For the purposes of the AMS and scaling the domestic GGRs market, preference should be shown to credits of a domestic origin, but international credits will be eligible as part of the AMS.

Subject to alignment to these principles, individual SA member organisations will make their own decisions regarding the overall composition of the portfolio. SA is facilitating the exercise by

selecting a GGRs provider to offer its members an optional portfolio. This optional portfolio will ensure there is a wide variety of carbon removal types included in the activity, including very high durability engineered removals, and removals drawn from both within the UK and the international voluntary carbon markets.

The exercise, and the portfolio to be selected, is intended to support a set of learning objectives for industry (and other stakeholders) and help SA in formulating its approach to industry best practice and "policy asks" to enable market scaling.

2.4. Maximising the Impact of an AMS

There is an expectation that the outcomes and learnings from this trial will require further analysis and consideration of policy mechanisms to ensure the UK maximises the job and economic potential of aviation's investment in high integrity GGRs. The trial will see companies representing all parts of the UK aviation ecosystem procuring a wide portfolio of carbon removals, spanning engineered and nature-based, both in the UK and internationally, in order to support its learning objectives.

This GGRs Task and Finish working group and members of SA believe that this initial proof of concept can lead to significantly increased impact as more members join, including those in the wider aviation value chain and beyond the aviation sector, subject to the right incentives being put in place.

The government could further incentivise participation by considering additional intervention. It is understood that the success of this collective action, beyond the proof-of-concept, would be significantly boosted if government provided support, with potential policy ideas set out in section 3.

3. Incorporating GGRs into existing or new policy frameworks

3.1. Current UK GGRs policy framework

The UK Government's current GGRs policy framework includes the following elements:

GGRs Business Model to incentivise private investment in commercial GGRs projects through a contractual revenue support mechanism (based on Contract for Difference style principles). The latest GGR Business Model publication summarises the key design aspects of the proposed GGR Business Model for projects in the HyNet Track-1 expansion Project Negotiation List[59]. HMG may seek to evolve the GGR Business Model in the future for any further allocation rounds.

GGRs Deployment in the CCUS HyNet and East Coast Clusters (ECC). The Track-1 expansion (T1x) HyNet Process allowed GGR and Power BECCS projects to apply for access to the HyNet cluster in the North West. The HyNet Track-1 expansion Project Negotiation List (PNL), which includes two GGR projects, was published on the 5th of August. These projects will now proceed to the negotiations phase of the selection process[60].

GGRs Standards: The Government is currently working with the British Standards Institution to develop a GGRs Standard and methodologies that projects supported under the business models will be required to use. A robust GGRs Standard, including monitoring, reporting and verification (MRV), will be crucial to preserve the integrity of any market for negative GHG emissions and instil public and investor confidence that removals are genuine and verifiable. The standards are currently limited to BECCS and DACCS. It would be extremely beneficial to accelerate the development of the BSI GGRs standards and methodologies to include a broader range of GGRs types, e.g. biochar, Enhanced Rock Weathering, NBS removals (in addition to WCC), well ahead of GGR integration in the UK ETS.

Integration of GGRs in the UK ETS: The UK ETS Authority is committed to integrating engineered Greenhouse Gas Removals (GGRs) into the UK ETS, aiming for the system to be operational in 2029, with legislation in 2028. The Authority response to its consultation on GGR integration was published on the 21st July 2025 and sets out a balanced approach to integrating GGRs alongside the ambitious emissions reduction that are essential to meeting legally binding carbon budgets[61].

Voluntary Carbon Markets: Government published six principles for Voluntary Carbon and Nature Market Integrity and has consulted to clarify, and test proposed policy to boost market confidence. In this consultation, Government encourages more companies to engage with the purchasing of high-integrity removals credits in ways that align with the Government's VCNM principles[62].

GGRs Innovation programme: Government has invested £100 million in research and innovation including through the Net Zero Innovation Portfolio Direct Air Capture (DAC) and GGR

[59] Greenhouse Gas Removal Business Model: summary (August 2025)
[60] HyNet expansion: project negotiation list - GOV.UK
[61] Integrating greenhouse gas removals in the UK Emissions Trading Scheme - GOV.UK
[62] Voluntary carbon and nature markets: raising integrity - GOV.UK

Programme. The Innovation Programme is now coming to a close, and final reports will be published[63].

3.2. Gaps in policy and the need for urgency in a "pre-compliance" phase

The UK Governments current policy framework is primarily focused on support to the supply side. The aviation sector welcomes the eventual planned integration of GGRs into the UK's Emission Trading Scheme in 2029, which will provide a necessary price signal and business case. The years prior to integration represent a "pre-compliance phase", during which the lack of corporate demand and government signals are creating market uncertainty. To scale the removals market, it is essential to provide clear guidance and demand-side policy support in the near term. This will ensure that companies can already begin now to confidently purchase GGRs and include them in their transition plans and compliance obligations. The policy ideas introduced in this document are designed to address gaps in current support to the demand side and target a different set of beneficiaries than existing support mechanisms, such as the GGRs Business Model[15]. To achieve their maximum impact in the pre-compliance phase, the demand side policy support ideas should be considered and implemented as soon as possible.

Even after GGRs are integrated into the ETS, demand will remain limited, since availability of GGRs in the ETS will be controlled, GGRs will be more costly than allowances, and purchase of GGRs will not be mandatory. To further stimulate uptake, additional demand-side measures can be layered onto the ETS. One such measure is the GGRs integration into the SAF Mandate, described in Section 3.4.4, which offers targeted incentives for airlines and SAF producers. This policy concept could serve as a longer-term complement to the ETS, supporting sustained market development and reinforcing long-term climate objectives.

A number of additional supply side policy ideas were raised by group members and wider industry stakeholders during discussions. There is a recommendation for any future work to consider these for further exploration. Ideas include:

- BSI Flex Standard expansion to methodologies further than BECCS and DAC, including (but not limited to) biochar, enhanced rock weathering and ocean or river alkalinity improvements
- Pursuing BSI Standard alignment, wherever possible, with EU draft standards as set out in the EU CRCF (Carbon Removals and Carbon Farming) and permanent carbon removal delegated act
- New funding streams for FOAK projects, extending Innovation Programme like investment opportunities. Ensuring a wider focus of methodologies previously not within scope.
- Additional opportunities for connection to pipeline storage infrastructure and providing / acknowledging non-pipeline storage for smaller developers / plants
- Acknowledgement of UK GGR technology and infrastructure deployed overseas (e.g. inclusion of relevant credits in ETS)
- Assessment of quality criteria required for transportation of CO_2 for geological storage to reduce barriers and cost
- Clarify import/export rules and tax treatment for international GGR credits

[63] Net Zero Innovation Portfolio Direct Air Capture (DAC) and GGR Programme- Link

- Supporting MRV development of wider removal techniques, including biochar and enhanced rock weathering, and research into agronomic co-benefits

3.3. Funding New Incentives

This Task and Finish Group recognises that the Government has funding constraints when considering additional policy levers in support of near term GGR purchases. Whilst we also recognise that UK Government does not hypothecate funds as a matter of principle, we propose that there are three viable sources of revenue from the aviation sector that could indirectly and temporarily provide funds to incentivise pre-compliance purchase of UK GGRs: ETS Allowances, Air Passenger Duty (APD), and SAF Mandate. All are increasing revenue sources but currently with no direct route to financing aviation decarbonisation. For example:

- **ETS Revenue:** Free ETS allowances to all operators totalled 4,086,868 in 2025 according to published Government data. From 1st of January 2026, the Government are removing free allowances to airline operators and so at a UKA price of £45 this is equivalent **to £183,909,097** increased revenue**.**
- **Air Passenger Duty:** The Office for Budget Responsibility (OBR)[64] estimates that in 2025 to 2026 the APD will raise to **£4.7 billion, and up to £6.5 billion by 2029-2030** due to both volume increase and increases in the APD on domestic journeys.

International approaches such as the EU's use of ETS revenues for decarbonisation offer workable precedents for the UK to consider. Future linkage of the EU and UK ETS could create an opportunity for alignment of approach on hypothecation. Analysis of the potential value of funds available, should UK Government adopt such an approach, are included in Appendix 2 – Financing GGRs incentives.

3.4. Policy Ideas

The following policy ideas have been developed to address some of the near-term challenges described in section 1, notably they seek to address:

Quality – Providing buyers with confidence that GGR credits purchased are of sufficient quality and in-line with emerging Government policy and regulations

Business case – Providing buyers with a business case to buy in the "pre-compliance" phase. Value can come from reducing compliance costs or penalties and or increasing use cases for credits.

Supply – Increasing supply of GGR credits, especially for those projects not currently within scope of Government support

The policy ideas are compared in the table 2 and explained in more detail afterwards.

[64] Office for Budget Responsibility – Air Passenger Duty - Link

Table 2: Summary of policy ideas

Policy idea	Quality	Business case for aviation	Supply
Grandfathering GGR purchases into UK ETS	Provides Government support for credit types purchased	Supports unit cost reduction in long-term	Supports projects to be scaled
Enabling passenger facing GGRs offers	Provides Government support for credit types purchased	Cost coverage from passengers for some GGRs	Uptake uncertain
Multiplying the AMS – Direct Government Procurement	Provides Government support for credit types purchased	May offer short term cost reduction / improve scale.	Supports projects to be scaled.
Expanding integration of GGRs into SAF mandate	Provides Government support for credit types purchased	Supports unit cost reduction in long-term. Avoid penalties.	Supports some projects to be scaled.
Scaling the use of GGRs in CORSIA	Growing volume of durable GGRs in CORSIA	Widens market for GGR and scale up to bring costs down	Strengthens global market demand for GGR

Key:

- **Green = Action has a clear outcome**
- **Yellow = Action has an outcome that is partially uncertain**

3.4.1. Grandfathering GGRs Purchases into the UK ETS

Concept: Government defines a pathway for Grandfathering purchases of GGR (from projects that are not recipients of the GGRs Business Models) to be included within a future UK ETS scheme ahead of full integration. This would require Government to accelerate BSI Flex Standard development for removal types beyond BECCS and DACCS.

Benefits: This approach would improve the investment business case in the near term by signalling a future compliance value to the credits. It would also support the decarbonisation potential of the ETS by allowing for a greater number of projects and approaches to be eligible. This would support the initial success of GGRs integration into the ETS and adoption by participants, increasing the available supply of eligible credits and reducing costs of procurement. It would also be catalytic in nature, driving investment into nascent technologies earlier and supporting jobs, growth and removal production. This approach appears to be aligned with the UK ETS Authority's intention to enable forward offtake agreements for UK ETS GGRs allowances as part of the integration policy that will be explored in the next phase of policy development.

Additional technology types could include but are not limited to:

- Biochar
- Enhanced Rock Weathering (ERW)
- Direct Ocean Capture (DOC)
- Ocean or River alkalinity improvements
- CO_2 building materials and mineralisation

Drawbacks: BSI Flex Standards currently only cover DACCS and BECCS so work to endorse standards for more credit types will need to be accelerated. Certain projects, purchased in

advance, may not achieve BSI Flex Standard requirements, however this could be mitigated by offtake terms.

A further risk for AMS participants may be uncertainty over eligibility of GGRs procured from projects outside the UK. Currently, UK Government only anticipates UK credits to be considered for initial integration in the UK ETS.

Impact: This would improve the business case for near-term GGRs procurement for parties subject to ETS and therefore could boost AMS participation and levels of procurement. It would also support the long-term supply of ETS eligible credits into the market, boosting the likelihood success of this policy and its adoption.

3.4.2. Enabling Passenger-facing GGRs offers

Concept: Airlines can open a direct route to market for GGRs by offering them to passengers at point of airline ticket sale. To enable this, UK Government would need to clarify the CMA and Green Claims Code to ensure that it does not penalise airlines for offering this product as an option for customers. The ability to channel GGRs credits directly to passengers could further incentivise airline participation in the AMS and increase levels of procurement.

Benefits: This approach creates an additional demand driver for airlines to procure GGRs through an AMS. Unlike the support measures above, it connects the use and cost of GGRs directly with aviation's end users – the passengers.

- **Drawbacks:** Current Green Claims code has been interpreted by some stakeholders as precluding this use case. This idea would benefit from development of BSI Flex Standards to a broader range of credit types. Standards currently only cover DACCS and BECCS.
- Could become an ETS linkage topic requiring harmonisation with the EU Green Claims directive. Ultimately, as a voluntary initiative, success with this relies on customer perception of the credibility of removals, which will be influenced by Government and reporting standards as well as customers willingness to pay.

International Precedent: A similar approach is currently offered by Lufthansa through their green fare initiative[65].

Impact: The direct cost coverage of GGRs credits that airlines can sell to passengers. This would potentially increase short-term procurement of GGRs by airlines and further promote their use-case with customers.

3.4.3. Multiplying the AMS – Direct Government Procurement

Concept: Government participate in the AMS and purchase GGRs credits along with airlines and aviation companies

Benefits: This would enable government to support developers and credit types that have not benefitted from the UK GGRs Business Model[66] and provide build confidence for AMS and other market participants on use case and acceptable quality standards.

- Point of alignment with EU ahead of linkage with EU ETS

[65] Green Fares Initiative - Link
[66] UK Government Greenhouse Gas Removals Business Model (2025) - Link

- Creates a sustainable long-term market for developers, increase early-stage capital to projects, help private actors facilitate longer term offtake solutions and drive more projects to FID
- HMG benefits from UK deployed GGRs for carbon budgets. A shared benefit of any policy which supports additional UK GGR deployment.
- Crown commercial services could undertake procurement which would benefit AMS participants with procurement compliance obligations

Drawbacks: Places a direct budget request on HMG. Limited availability of UK GGRs supply. Details of the specific mechanism need to be further defined

International Precedent: Several public removal credit procurement schemes are planned or underway including:

- EU
    - Direct procurement of small volumes of high-quality, permanent CDR from a diverse set of methods (e.g., DACCS, biochar, Bio-CCS).
    - Launch planned for 2025, with an initial 3-year duration.
    - Portfolio approach: The programme will support a range of technologies and suppliers to encourage innovation and market diversity.
    - Funding mix: Public funding from the EU budget, potentially matched by private investment.
    - Certification: Procured removals must meet incoming standards under the Carbon Removal and Carbon Farming (CRCF) framework.
- British Columbia LCFS
    - Based on decreasing annual carbon intensity targets
    - It was recently modified to create eligibility avenues and targets for reducing the carbon intensity of aviation fuel along with enabling credits for certain permanent GGRs.
- Canada Clean Fuel Regulation credits
- US Department of Energy (DoE) established a CDR pilot purchase prize program of 35 million USD to deliver credits directly to the US DoE.

Impact: It would help to scale the overall AMS, reduce unit-costs (in the near-term and long-term) and improve project funding. Such a joint procurement approach would need to be governed by an agreement setting out eligible credit types such as UK projects with BSI Flex Standards in place.

3.4.4. Expanding integration of GGRs into the SAF Mandate

Concept: While similar to a concept outlined in the recent Independent GGRs Review, this proposal is distinct. It aims to leverage the potential synergies between GGRs and SAF policy frameworks and if designed carefully, should protect and boost UK SAF investment. The UK's SAF Mandate features an innovative GHG-based mechanism incentivising producers to develop sustainable fuels at lower carbon intensities by providing additional certificates for compliance. This mechanism is essential to promote greater carbon efficiency of SAF projects and to boost UK investment in SAF. The Mandate could be further enhanced by the inclusion of a limited volume GGRs from outside the project value chain, to further reduce the carbon intensity (CI) of

eligible UK-produced SAF units to reach net zero. In such a mechanism, the obligated parties can procure GGRs credits to reduce the carbon intensity of SAF (with a lower CI limit of 0 gCO_2e/MJ).

Benefits: This approach recognises the relationship between GGRs and SAF and creates a near term pathway to incentivise GGRs demand for future advanced SAF development. Allowing a GGRs to be paired with an uncoupled volume of SAF (2G or 3G), rather than requiring the GGRs be generated directly within the fuel production pathway, will allow more policy resilience to achieve the desired outcomes without compromising the environmental ambition of the SAF Mandate. As this is limited to net zero, it should not damage the incentive for SAF projects to pursue fully integrated GGRs within the project value chain as these would be able to go beyond zero – to effectively generate truly carbon negative fuels.

- **Supports third generation SAF**: It is envisaged that new technologies capturing CO_2 for use as the feedstock necessary for PtL SAF would be eligible for inclusion in the SAF Mandate, helping address both near-term compliance and long-term PtL SAF needs. This helps to scale and reduce cost.
- **Flexibility during SAF bottlenecks**: GGRs could be used to ease pressure during SAF bottlenecks. Further consideration of the precise mechanisms to be used would be required.
- **Reduced Cost to consumers and taxpayers**: With GGRs technologies that produce a stream of CO_2 having a lower carbon abatement cost per tonne than some advanced SAF pathways, integration of these will enable lower cost of compliance and less cost passed through to airline customers. Additionally, by integrating GGRs into the existing policy, it reduces the taxpayer spend for GGRs subsidies.
- **Benefit for UK SAF Producers**: GGRs integration could be made eligible to support only domestic SAF producers, enabling potentially greater environmental benefit at no additional cost to HMG or taxpayers. Pairing GGRs with a lower carbon abatement cost per tonne would lower the carbon abatement cost for UK SAF, economically advantaging domestic SAF over imports. UK producers would be able to generate more certificates as a result of their investment, providing an additional incentive for a domestic SAF industry. Additionally, allowing UK SAF project developers to opt-in to access to some GGRs-based emission savings would be advantageous where the project cannot immediately connect to a relevant CCS capture network when the infrastructure is still under development. This supports development and investment case for UK SAF projects.
- **GGRs Demand signal**: Including removals into the SAF Mandate creates a demand signal for GGRs and incentivises a broader range of buyers from the aviation sector beyond airlines, e.g. SAF producers.

Drawbacks:

- The principal risk to mitigate is to ensure balance between SAF production volume and reliance on removals and to ensure the incentive to combine SAF with GGRs is not curtailed. The SAF Mandate recently came into force in 2025 and looks to support a wide range of SAF projects. It is important that any rule changes are limited and hence don't damage investment in the SAF sector and affect the deployment of the first wave of SAF plants.
- In the context of the broader use of GGRs by the aviation sector, there is a risk that applying a narrower standard for inclusion in the SAF mandate could lead to

inconsistency across different policies, e.g. the ETS. It is important that this does not unintentionally undermine the credibility of other GGRs types when used in different contexts.

- Aviation stakeholders who do not pay for SAF may not find this approach relevant – ideally support measures would benefit broader aviation and not just airlines.
- Monitoring, reporting and verification mechanisms would need to be enhanced to avoid any risks of double counting and to ensure it promotes high integrity, durable GGRs.

Further analysis is required to ensure that the policy does not unintentionally prolong fossil fuel reliance or create competition for resources between GGRs and SAF projects. Priority for UK GGRs credits in such a scheme could also be considered.

Further detailed review and analysis is recommended on the potential impacts of GGRs incorporation on the SAF Mandate, Revenue Certainty Mechanism (RCM) and investments in 2G and 3G SAF plants. This task finish group recommends that the concept is taken forward by a task finish group in 2026, populated by representatives from the Aviation, GGRs, NGO and SAF communities.

International Precedent: This would be a new, innovative approach not deployed elsewhere, that other national SAF mandates could benefit from. UK Government could further showcase this innovation and propose wider adoption globally including within upcoming negotiations with EU.

Impact: This policy may have a limited impact on the initial AMS, given its specific scope, however it is believed to have a significant impact in scaling GGRs adoption by the aviation industry if implemented and likely the highest impact policy lever presented in this paper.

3.4.5. Scaling the use of GGRs in CORSIA

Concept: Section 1.7.1. defined the current constraints of CORSIA in scaling GGRs. The Group believe that there are opportunities for UK Government and UK industry to work together in exploring the scaling of GGRs in CORSIA.

Benefits: CORSIA can provide both an integrity standard and a source of demand for GGRs, whether originating from the UK or elsewhere. According to recent projections, the cumulative offsetting requirements of CORSIA globally could range from ~950 to ~1500 $MtCO_2$ from 2024-2035[67]. Based on an assumption of UK airlines contributing 5% of this[68], the respective UK demand could range between ~47.5 to ~ 75 $MtCO_2$. If GGRs comprised 10% of the supply and demand of the CORSIA market, then it could represent ~4.75 to ~7.5 $MtCO_2$ for UK airlines alone for the period.

Currently there is a major new workstream on removals beginning at ICAO, to assess what's needed and the role ICAO and CORSIA could play. It will be important for both the UK Government and aviation industry to play an active part in this work to ensure a positive outcome is secured for GGRs and the strengthening of the CORSIA scheme.

Drawbacks: Two initial risks have been identified:

[67] Draft Assembly Working Paper – Consolidated statement of continuing ICAO Policies and Practices related to Environmental Protection – Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) - Link
[68] UK State Action Plan 2025 - Link

- There may be an increased cost risk for airlines compared to non GGRs credit options within the scheme. However, in the end this is an inevitable part of achieving net zero and these increased costs may be better than an alternative where the quality of CORSIA credits do not to improve and even greater costs are incurred to meet net zero by 2050.
- The CORSIA has a route-based approach requiring both departure and arrival member states to adopt a principle before it can be affectively applied. Should both members states not implement CORSIA consistently there would be a risk of competitive distortion for airlines operating the same route from participating and non-participating states.

Impact: There is an opportunity for UK Government and UK industry to show leadership by working together in exploring the options to accelerate the use of durable GGRs by the international aviation sector.

Report Summary

- High-integrity, durable GGRs are indispensable for a credible net-zero pathway for aviation.
- There is an urgent need to close the emerging gap between GGRs demand and supply to reduce the future burden of emissions mitigation of short to medium term unabated aviation emissions.
- National and international efforts on GGRs standards and definitions are ongoing and there is a need for alignment across initiatives.
- Early investment is critical to reduce future costs of GGRs and ensure availability of supply.
- Analysis to-date indicates significant economic opportunity from scaling UK GGRs, from exportable services along the value chains of both engineered and nature-based removals: providing 96,000-135,000 jobs and contributing to the UK Government's Growth Mission.
- Increasing confidence in investment in UK GGRs is key to address the supply-demand gap and rapidly scale production. An AMS is needed to achieve this, with the aviation sector willing to play its role, recognising the importance of GGRs in achieving a credible net zero aviation transition.
- A cross-sectoral group, as part of SA and this task finish group, will participate in a proof-of-concept AMS in 2026, committing over £2m to the purchase of high quality, durable GGRs.
- This group presents five transitional, policy proposals to incentivise uptake of early sector investment in GGRs:
    - Allowing inclusion of purchased GGRs credits in a future UK ETS would de-risk early offtake.
    - Integration of GGRs within the UK SAF Mandate could support compliance during SAF bottlenecks whilst encouraging GGR investment from other aviation stakeholders beyond airlines.
    - Passenger-facing GGRs sales by airlines can support incremental demand if rigorously and transparently deployed.
    - Direct Government procurement can help endorse GGRs, further boost supply and improve economies of scale for buyers.
    - HMG and UK aviation industry to work together in exploring the critical role of durable GGRs in the international aviation sector's path to net zero and strengthening of CORSIA.

Ideas for Government to consider:

- The UK Government should be active in informing standard development to ensure a high-integrity, low risk and investable GGRs market. Specifically, accelerate the BSI Flex Standard development for removal types beyond BECCS and DACCS, giving buyers confidence to invest in a broader portfolio of removals. This work should be aligned with the ICVCM's CCPs so that there is regulatory convergence and confidence as the market grows.

- Near term Government support can amplify early demand signals; current aviation revenue streams could be utilised to fund new incentives that drive purchasing of UK GGRs:
- Government should work with industry to develop incentivising policy proposals by the end 2026 to ensure maximum impact in a pre-compliance phase.
- The Group notes the Independent GGR review has discussed incorporating GGRs into the SAF mandate. The Group recognises that both GGR and SAF are important elements in the aviation sector's decarbonisation pathway and believes it is important to explore synergies and potentially further integration of the policy frameworks. The Group also acknowledges the criticality of maintaining investor confidence in SAF. It is recommended that next year's JZTF could support Government by analysing what options may exist to support GGR demand through closer integration with the SAF mandate. Any options must not delay immediate SAF investment decisions or adversely impact longer term SAF investor confidence. This could comprise a broad group spanning finance, aviation, SAF and GGR representation.

The aviation sector welcomes the opportunity to work with Government to make this a success, recognising the importance of GGRs in achieving the sector's net zero pathway and the benefits to the UK economy.

Proposed next steps:

- Further detailed review and analysis is recommended on the potential impacts of GGRs incorporation on the SAF Mandate, Revenue Certainty Mechanism (RCM) and investments in 2G and 3G SAF plants. This task finish group recommends that the concept is taken forward by a task finish group in 2026, populated by representatives from the Aviation, GGRs and SAF communities.
- A detailed cost benefit analysis of each of the policy proposals setting out the cost split between HMG, industry and the benefits to industry and society should be incorporated into the next task finish Terms of Reference. Economic analytical competence should be included in the group to ensure this can be performed.
- Trial and review AMS pilot learnings and assess potential to scale
- Exploring opportunities for advancing support for GGRs and harmonizing policy approaches with the EU as part of ETS linkage negotiations
- Review existing and recent work on information made available to customers at point of sale, including by the CAA and EU, to drive consistency for UK airlines and find opportunities for passenger engagement.
- Explore additional supply-side support policy ideas with relevant government departments and industry stakeholders.
- Explore cross-sector links to accelerate the scaling of UK GGRs.

Appendix 1: Comparison of different forecasts of UK and Global aviation residual emissions

UK Aviation residual emission forecasts (Demand)				
Data forecast	**2030**	**2040**	**2050**	**Notes**
	MtCO2	**MtCO2**	**MtCO2**	
CCC 7CB		12.49	22.67	Derived from the difference between the CCC 7th Carbon Budget advice to UK GOV - balance pathway scenario with and without the removals share from figure 7.6.2
UK Government 2025 State Action Plan *			25.6	Taken from table 12. No net emission pathway is stated in the report other than 2050
UK Jet Zero Strategy (lower net emission trajectory) *	12.12	16.78	19.29	Derived by subtracting the lower illustrative net emission trajectories form the residual emissions using the High Ambition Scenario (using data from Figure 4 and 10 in the accompanying analytical document to the Jet Zero Strategy)
UK Jet Zero Strategy (upper net emission trajectory) *	6.55	10.78	19.29	Derived by subtracting the higher illustrative net emission trajectories form the residual emissions using the High Ambition Scenario (using data from Figure 4 and 10 in the accompanying analytical document to the Jet Zero Strategy)
SA Net Zero Carbon Roadmap (GGRs requirement)	1.06	4.39	8.80	Derived by subtracting the GGR emission point from the SAF point using the roadmap wedge CO2 data in Appendix 5 of the technical report
SA Net Zero Carbon Roadmap (GGRs and future obligation requirement) **	1.06	14.49	8.80	Derived by adding the differences between the GGR data from the SAF data, plus the GGR data from the future obligation data using the roadmap wedge CO2 data in Appendix 5 of the technical report. It is not entirely clear if SA intended for all the future obligation to be met by using GGR or not, but in this example, we have assumed they did.
* Forecasts do not clearly state an expectation that GGRs will be the only method to address these residual emissions				
** SA implies but does not clearly set an expectation that all future obligation requirements will be met by GGRs				

Global Aviation residual emission forecasts (Demand)*				
Data forecast	**2030**	**2040**	**2050**	**Notes**
	MtCO2	**MtCO2**	**MtCO2**	
ICAO LTAG Integrated Scenario 1	670	850	950	https://www.icao.int/sites/default/files/sp-files/environmental-protection/LTAG/Documents/ICAO_LTAG_Report_AppendixR2.pdf
ICAO LTAG Integrated Scenario 2	610	620	500	https://www.icao.int/sites/default/files/sp-files/environmental-protection/LTAG/Documents/ICAO_LTAG_Report_AppendixR2.pdf
ICAO LTAG Integrated Scenario 3	550	390	200	https://www.icao.int/sites/default/files/sp-files/environmental-protection/LTAG/Documents/ICAO_LTAG_Report_AppendixR2.pdf
ICAO LTAG averaged outcome	610	620	550	Derived data using ICAO LTAG IS 1, 2 and 3 results
Mission Possible (2022) **	n/a	n/a	130	Page 22 of report - https://3stepsolutions.s3-accelerate.amazonaws.com/assets/custom/010856/downloads/Making-Net-Zero-Aviation-possible.pdf
ATAG Waypoint (2021)**	n/a	n/a	135	2021 report data on out of sector carbon reduction market mechanisms - this work is currently being reviewed and updated. https://aviationbenefits.org/media/167417/w2050_v2021_27sept_full.pdf
IATA Net Zero Roadmap (2024)**	n/a	n/a	600	Sept 2024 Report 'carbon removals including MBM' requires between 500-700 Mt captured CO2 by 2050 - https://www.iata.org/contentassets/8d19e716636a47c184e7221c77563c93/energy-and-new-fuels-infrastructure-net-zero-roadmap.pdf
IEA World Energy Outlook (WEO) Stated policies (2024)	1,158	1,363	1,491	See pg. 300 Table A.4a: World CO2 emissions - https://iea.blob.core.windows.net/assets/140a0470-5b90-4922-a0e9-838b3ac6918c/WorldEnergyOutlook2024.pdf
IEA WEO Amended Pledges (2024)	1,090	1,083	971	See pg. 306 Table A.4b: World CO2 emissions - https://iea.blob.core.windows.net/assets/140a0470-5b90-4922-a0e9-838b3ac6918c/WorldEnergyOutlook2024.pdf
IEA WEO Net Emissions (2024)	922	561	210	See pg. 312 Table A.4c: World CO2 emissions - https://iea.blob.core.windows.net/assets/140a0470-5b90-4922-a0e9-838b3ac6918c/WorldEnergyOutlook2024.pdf
IATA PtL SAF feedstock report (2025)	n/a	n/a	176	Quantity of CO2 capture required for SAF PtL forecast, taken from table 3 of IATA SAF feedstock report 2025 - https://www.iata.org/globalassets/iata/publications/sustainability/global-feedstock-assessment-for-saf-production-outlook-to-2050.pdf

*Global forecasts show residual emissions outcomes but do not confirm how these are met - terms such as market based measures, carbon offsetting and carbon removal are all used but not separately quantified. It is also not clear how much of the residual emissions prior to 2050 will be mitigated. ** Averaged 2050 result

Appendix 2 - Financing GGRs incentives

Long Term Financing Mechanisms: ETS Revenue & APD

In 2025, the CCC[69] stated "*the cost of decarbonising aviation and addressing non-CO_2 effects should be reflected in the cost to fly. This will help… generate the revenues needed to pay for…. engineered removals*" [R2025-72].

The 'cost to fly' is made up of several different components, including Passenger Service Duty (or APD) as well as other mandatory fees that airlines are subject to including compliance regimes, such as CORSIA and ETS. Government sets the fees and airlines choose the extent to which they absorb them or pass them onto consumers, this presents options to structure a long term GGRs mechanism.

Potential to support a long-term financing option

ETS Revenue: 2025 Free allowances to all operators from UK Government published data were 4,086,868[70]. At the current UKA price (£45) this is equivalent to = **£183,909,097.** Using the Government Traded carbon values used for modelling purposes, 2024[71] this value could rise to £318,775,770 by 2030 and £506,771,737 by 2050.

Air Passenger Duty: The Office for Budget Responsibility (OBR)[72] estimates that in 2025 to 2026 the APD will raise to **£4.7 billion, up to £6.5 billion by 2029-2030** due to both volume increase and increases in the APD on domestic journeys.

A proportion of the increase in APD revenue could be used to co-finance a long-term GGR mechanism with the aviation industry

Table 3: Air passenger duty increase (percentage increase)

	Reduced Rate	Standard Rate	Higher Rate
Domestic	£7 >£8 (14%)	£14>£16 (14%)	£84>£142 (69%)
Band A (0 to 2,000 miles)	£13>£15 (15%)	£28>£32 (14%)	£84>£142 (69%)
Band B (2,001 - 5,500 miles)	£90>£102 (13%)	£216>£244 (13%)	£647>£1097 (69%)
Band C (over 5,500 miles)	£94>£106 (13%)	£224>£253 (12%)	£673>£1141(69%)

[69] CCC Progress report to Parliament (2025) - Link

[70] See https://www.gov.uk/government/publications/uk-ets-allocation-table-for-operators-of-installations

[71] See https://www.gov.uk/government/publications/traded-carbon-values-used-for-modelling-purposes-2024/traded-carbon-values-used-for-modelling-purposes-2024

[72] Office for Budget Responsibility – Air Passenger Duty - Link

Table 4: Potential revenue generation from the increase in APD (based on 24/25 Receipts in 000s). Total passenger numbers totalled 122,749,000, minimum total projected revenue from the increase is £603,002,000.

	Reduced Rate	Standard Rate	Higher Rate
Domestic	£1*12914= 12914	£2*393= 786	£58* (ND)
Band A (0 to 2,000 miles)	£2*80978 = 161956	£4*2145=8580	£58*24=1392
Band B (2,001 - 5,500 miles)	£12*16695=200340	£28*4768 =133504	£450*13=5850
Band C (over 5,500 miles)	£12*3641=43692	£29*1172=33988	£468* (ND)

Appendix 3 – Relevant international policies

Canada

- Federal low-carbon fuel procurement program
    - $134.9 million in funding over eight years (fiscal years 2023–24 to 2030–31) to support the purchase of low-carbon-intensity liquid fuels for federal air and marine fleet operations and in 2024, the program was expanded to include the procurement of CDR services.
- British Columbia Low Carbon Fuel Standard (Provincial-level policy)
    - Sets requirements that encourage the use of renewable and low carbon fuels and offers incentives to organizations that supply them.
    - Based on decreasing annual carbon intensity targets
    - It was recently modified to create eligibility avenues and targets for reducing the carbon intensity of aviation fuel along with enabling credits for certain permanent GGRs.
- Canada's CCUS Investment Tax Credit (ITC) is a refundable tax credit that applies to eligible expenditures incurred for a qualified CCUS project though only applies to those projects that enable permanent CO_2 storage rather than utilization.

United States

- 45Q tax credit
    - Provides a performance-based tax credit for carbon management projects that capture carbon oxides (carbon dioxide (CO_2) and carbon monoxide (CO)) from eligible industry and power facilities and directly from the atmosphere. The tax credit can be claimed for eligible projects that provide secure storage of captured carbon dioxide (CO_2) in appropriate geologic formations or reuse the captured CO2 or carbon monoxide (CO) as a feedstock to produce low– and zero-embodied carbon products including fuels.
- Federal pilot procurement program
    - US Department of Energy (DOE) established a CDR purchase pilot prize program[73] that allows companies to compete for the opportunity to deliver carbon dioxide removal credits directly to DOE. Carbon removal credits can be purchased by any individual or entity that is interested in responsibly managing their past and/or future carbon dioxide emissions. This program is intended to help catalyse the development of carbon dioxide removal markets, demonstrate rigorous monitoring, measurement, reporting, and verification practices through third-party scientific validation, and provide a model for workforce and community benefits for high-quality credits.

[73] https://www.energy.gov/fecm/funding-notice-carbon-dioxide-removal-purchase-pilot-prize

- California Low Carbon Fuel Standard (State-level policy)

Sets goal to reduce carbon intensity of transportation fuel pool by at least 20% by 2030 from a 2010 baseline. The LCFS sets annual carbon intensity standards that decrease over time. Project-based crediting system including projects based on carbon capture and sequestration using direct air capture. Jet fuel is credited as opt-in and there is eligibility of DACCS from anywhere in the world.

Germany

- The German government's 2026 draft budget includes over €111 million for carbon dioxide removal (CDR) – with €98 million for project funding, €11.5 million for purchasing removal credits, and €2 million for administrative costs. An additional €320 million in multi-year commitments are planned through 2033. The budget also allocates €44.6 million to support soils as carbon sinks.

Japan

- Green Transformation (GX) and Emissions Trading Scheme (GX-ETS)
    - Combine voluntary actions with phased introduction of regulatory efforts. The GX-ETS is currently a voluntary carbon market for trading emissions allowances. The Japanese government pledged 1 trillion USD over 10 years, including for CDR projects in Japan and abroad. DACCS credits are allowed from anywhere in the world, conditional on 20% Japanese ownership.

Appendix 4 - JZTF GGR Group Membership and Contributors

Abby Cooper	Decarbonisation Graduate	MAG
Adam Freeman	Decarbonisation and ESG Director	MAG
Andy Jefferson	Group Secretariat	A&G Jefferson Ltd
Carrie Harris	Group Chair & Director of Sustainability	British Airways
Celeste Hicks	Policy Manager	AEF
Chris Leeds	Head, Carbon Markets Development	Standard Chartered Bank
Duncan Wallman	Sustainability Manager	Virgin Atlantic
Gabrielle Walker	Co-Founder and Chief Scientist	CUR8
Gillian Jefferson	Group Secretariat	A&G Jefferson Ltd
Ian Collier	Business Development Manager	1PointFive
Injy Johnstone	Research Fellow	Oxford University
Margaret Mistry	VP Carbon Markets	Equinor UK Ltd
Matt Prescott	Head of Carbon Strategy	Heathrow Airport
Myles Frempong Quacoe	Government Policy Analyst	easyJet
Sally Hargreaves	Group Secretariat	British Airways
Simon Owens	Environment and Technical Director	Alfanar
Solange Baena	UK Lead, Environmental Roadmap	Airbus
Tom Byrne	Group Secretariat & Head of Net Zero	British Airways
	Department for Transport Officials	
	Department for Energy, Security and Net Zero Officials	