ARUP

How can the UK capitalise on the huge demand for Sustainable Aviation Fuel?

Scaling up production and accelerating adoption to meet the UK's mandated commitment

Roundtable Summary | 2025

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What is Sustainable Aviation Fuel?

Sustainable Aviation Fuel (SAF) is an alternative to conventional jet kerosene which has lower whole-life carbon emissions. Early generations of SAF are made from waste or biogenic feedstocks such as used cooking oil, animal fats, agricultural residues and algae, rather than crude fossil oil. The newer generation e-SAF – also called electro-SAF, synthetic fuel, power-to-liquid and power-to-X fuel – is produced using clean hydrogen and captured CO_2. Different SAF pathways and feedstocks provide varying levels of carbon savings. e-SAF has the potential to achieve near-zero lifecycle emissions when powered by 100% renewable energy.

Cover image

Introduction

Sustainable aviation is crucial for the UK to retain the economic and social benefits of air travel – global trade, tourism, jobs and connectivity – while meeting its legally-binding decarbonisation target by 2050. As one of the hardest sectors to decarbonise, aviation contributes significantly to national emissions.

Sustainable Aviation Fuel (SAF) is currently the most credible pathway to deliver the UK's Jet Zero Strategy by 2050. With high barriers to zero-emission flight and delays to more efficient aircraft, accelerating and scaling up SAF development is urgent. It can be used in existing aircraft without modifications, but high costs and limited supply are restricting wider adoption.

Arup convened leaders from across the aviation value chain to explore the challenges and opportunities in enabling SAF development. Participants included fuel producers and suppliers, investors, airlines, airports, policymakers, feedstock developers and aviation fuel pipeline and terminal owners. In this report, we share their insights into how the UK can advance large-scale projects to final investment decision and open routes to market.

What is the UK already doing to advance sustainable aviation fuels?

The UK's SAF Mandate will require all departing flights to use an increasing amount of SAF in their fuel mix – starting at 2% in 2025, rising to 10% by 2030 and 22% by 2040. Within this, a sub-target for e-SAF begins at 0.2% of all jet fuel supply from 2028, increasing to 0.5% by 2030 and 3.5% by 2040. The mandate also encourages the use of the lowest-carbon fuels by issuing tradable certificates in proportion to the level of emission reductions they provide.

To stimulate domestic production, the UK Government has introduced the Revenue Certainty Mechanism (RCM) and Advanced Fuels Fund (AFF). The RCM guarantees a minimum price for producers – the strike price – while the AFF provides grant funding to first-of-a-kind and demonstration-scale projects. Together, these measures aim to de-risk investment and attract private capital to scale up UK production of SAF and e-SAF.

However, the UK still has a long way to travel – and fast. In 2022, it produced just 15,140 tonnes of SAF[1] – a tiny fraction of the 1.2–1.5 million tonnes required to meet the 10% target by 2030. Moreover, current output is limited to first generation SAF from Hydroprocessed Esters and Fatty Acids (HEFA), a pathway that will be subject to progressively tighter limits under the mandate.

The scale of the challenge

<0.2mt
of SAF produced in 2022

>1.2mt
of SAF needed by 2030

How can the UK capitalise on this opportunity?

Success will depend on ten essential ingredients:

1. Policy certainty, especially around the SAF mandate.
2. Revenue certainty, supported by the RCM.
3. Cost reduction, including via economies of scale, to de-risk offtake agreements.
4. Strengthened regulation, such as a fuel tankering ban.
5. Expansion of renewable power and CO_2 storage to make UK e-SAF globally competitive.
6. Collaboration across the value chain to secure feedstock streams.
7. Identifying the most viable technology pathways.
8. Addressing Engineering, Procurement and Construction (EPC) contract challenges.
9. Midstream and downstream connectivity – tanks, pipelines and blending facilities.
10. Robust certification system with full traceability.

1: 2022 Sustainable aviation fuel outlook - Bloomberg

How can the UK scale up production – progressing major projects to final investment decision?

The country cannot produce the more than 1.2 million tonnes of SAF needed by 2030 without significant change. New value chains are vital.

The SAF mandate will stimulate national demand, but questions remain over supply – whether the UK will rely on imports, be forced to dilute policy or, ideally, rapidly scale up domestic production.

The nation needs more large-scale projects to reach final investment decision, at pace. Otherwise, airlines may need to seek alternative fuel sources, while unaffordable fuel and limited supply could reduce air traffic to the UK and weaken its transfer market.

Why is policy certainty so important for SAF production?

Concerns about policy rollbacks – especially the SAF mandate – are deterring investment in production, as market uptake currently relies on regulatory forces rather than inherent commercial benefit. Moreover, any dilution of the SAF mandate by the UK – or other countries with similar mandates – will cause demand to drop and undermine aviation's decarbonisation pathway.

With only a few countries worldwide adopting SAF mandates, the UK must ensure sufficient supply to meet demand and avoid policy reversals that could leave producers with costly fuel and no buyers. The EU has already scaled back its mandate due to insufficient supply.

Given the long lead times for developing and financing projects, sufficient buffer must be allowed between policy announcement and implementation for developers to prepare projects and secure funding.

How could the RCM de-risk investment?

The SAF market currently offers no revenue certainty, undermining investor confidence. Many projects seeking investment have stalled due to low projected returns. The RCM aims to de-risk investment by providing a guaranteed strike price, reducing revenue uncertainty for emerging producers and investors, insulating them from volatility in the offtake and feedstock markets. It also aims to improve SAF price certainty for airlines. However, the mechanics and detail of the RCM are not expected to be confirmed until the end of 2026, which coincides with the time-point producers are targeting final investment decision to ensure production by 2030.

The RCM will be industry-funded through a levy on aviation fuel suppliers, though the source of this funding is not yet confirmed. If it does not draw on the UK Emissions Trading System (ETS) – a levy to support low-carbon innovation and R&D – to finance SAF allowances for airlines and offset fuel costs, airlines (and ultimately passengers) could face a double burden of carbon costs.

In the long-term, UK SAF production must become commercially viable with or without incentives. While the RCM will play a key role in reducing early risks for producers and investors, real success will depend on domestically produced SAF being competitive globally, with costs fairly balanced across producers, airlines and consumers.

What are the barriers to binding offtake agreements?

Binding offtake agreements remain difficult to secure due to high SAF prices. Airlines are reluctant to sign UK offtake agreements, as cheaper SAF is expected from regions with advantaged feedstocks and tax incentives, such as the EU Clean Industrial Deal. Moreover, prices are expected to decline over time.

Airlines are also concerned about paying twice for carbon reductions – through both ETS costs and SAF's price premium over conventional jet fuel. This sense of first mover disadvantage leaves producers struggling to secure the long-term agreements they need to fund production, evidenced by the UK's lack of offtake contracts.

With fuel costs typically comprising 25-35% of airfares[2], airlines and fuel suppliers are highly sensitive to them. In a global market, they can choose where to buy SAF. Uncompetitive UK SAF production would drive investors away, leaving assets and supplies stranded. This could, in turn, reduce the appeal of flying to or via UK airports, with knock-on impacts for the wider economy, to which aviation is a significant contributor.

Why is a fuel tankering ban essential?

Unlike the EU, the UK currently permits tankering, where aircraft carry fuel for their return flight. Given aviation's global nature, without a tankering ban, UK airlines will be at a disadvantage. The SAF mandate will raise their operating costs through higher fuel prices and new infrastructure requirements – costs which overseas carriers could avoid by tankering fuel into the UK from their home bases. This risks opening the domestic market to cheaper, less sustainable imports, undermining the emissions benefit of the SAF mandate.

Some imported fuels may meet or even exceed the UK's SAF principles, benefiting from low-cost renewable energy or labour. However, others may be far less ethical or sustainable. SAF from countries that allow first generation feedstocks carries significant environmental and social risks, including deforestation, pressure on food supplies, biodiversity loss and higher water use.

By contrast, the UK and EU require all SAF to be produced from at least second-generation feedstocks, which avoids competition with food sources but results in higher prices, at least initially.

A tankering ban is therefore essential to protect UK airlines, achieve decarbonisation goals and prevent capital and air traffic from shifting abroad.

How could renewable power and CO_2 storage play a vital role?

Nordic countries and Canada are currently better positioned for SAF production than the UK due to their lower electricity and biogenic CO_2 costs and greater feedstock supply certainty. These conditions make them more attractive to investors. However, the UK has strong potential to be competitive in e-SAF production.

The government's ambition to build surplus renewable energy capacity could offer a key advantage by lowering one of the largest cost components of e-SAF. The UK is also well positioned for carbon capture, usage and storage, supported by favourable geology and ambitious government targets. When applied to SAF, this could reduce carbon intensity by around 200% compared with the current 80% reduction.

It is important to note that these advantages are countered by significant challenges. e-SAF is the most technologically demanding pathway, as it relies on access to renewable electricity, clean hydrogen and biogenic CO_2. The mandated strike price is also too low to cover e-SAF production. In addition – like many other sectors – Engineering, Procurement and Construction (EPC) contractors are reluctant to provide fixed prices and guarantees, leaving the risks with developers and investors. At the same time, technology risks sit with licensors rather than EPC contractors. It is therefore crucial to determine who is best positioned to control and manage this risk early in the project.

2: Analysis: 5 Key Factors That Influence Airline Ticket Prices – CanSky Aviation


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Why must the country secure feedstock streams?

Second and third generation SAF rely on multiple feedstock streams – including electricity, biomass and biogenic CO_2 – that are higher in value and more price volatile than those for first generation SAF. As a result, their operating margins are typically lower and more unpredictable.

To deliver the SAF mandate and e-SAF sub-target in full, producers will need to source biogenic CO_2 from numerous technologies and feedstock. The sustainability of these feedstocks is key. Frameworks such as the Renewable Energy Directive (RED) and certifications like ISCC can verify the sustainability of UK-derived crops for biogas.

The UK must also remain open to other innovative ways to produce fuel. These include biomass-derived hydrogen – currently prohibited – which could enable much cheaper production methods.

What are the biggest planning and construction risks to tackle?

Additional chemical plants will be essential for large-scale SAF production. Yet, only a few UK regions support the development of greenfield chemical plants, with stringent planning requirements discouraging developers and investors.

The UK has several Tier 1 contractors, who could share construction risks. However, risk-averse lenders often require lump-sum turnkey EPC contracts, where a single contractor delivers a ready-to-use facility at a fixed price. Such contracts are rarely cost-competitive in the UK, as risks – such as weather variability, labour costs, borrowing costs and management complexities – are priced-in. By contrast, many other countries offer cheaper EPCs with fewer uncertainties and reduced labour constraints.

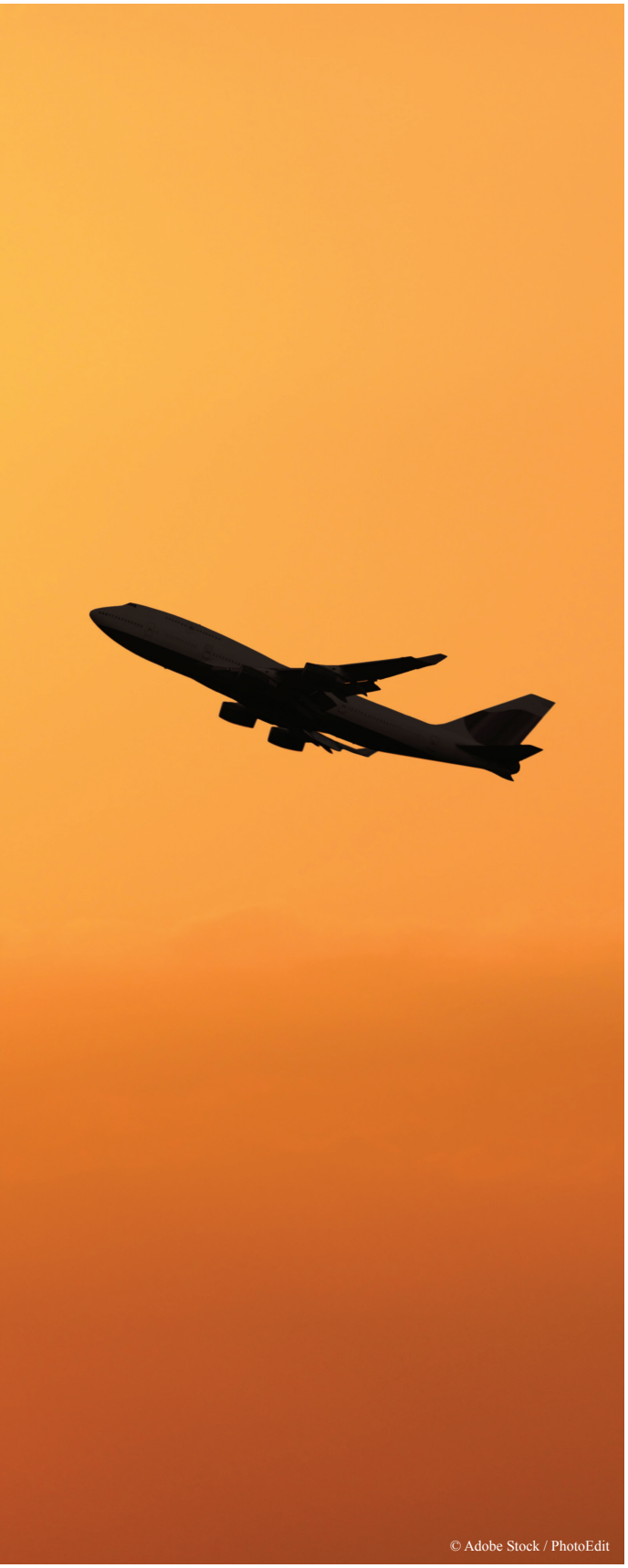
> EPC issues are common in the UK for first-of-a-kind investments across all industries. Net Zero Teesside stands out as a rare case in the chemical sector where these investment barriers have been overcome.

Why is midstream and downstream connectivity a challenge?

Producers are reluctant to build their own midstream and downstream assets, such as tanks, pipelines and blending facilities. Without strong contractor networks, this could lead to issues in distributing and storing SAF and feedstocks, and increase carbon intensity if road transit becomes the default.

End users often prefer to blend SAF at different points along the pipeline. An interface is needed to coordinate SAF transportation, which is an inherently complex process, supported by robust legal frameworks to protect all parties.

> Producers cannot scale SAF production until technologies are proven to deliver fuel at competitive costs. Many technologies remain in the early stages of the production chain. The UK must identify and advance its most viable technology pathways.



How can the UK accelerate adoption – opening routes to market?

The country has an opportunity to leverage progressive policy support, public and private collaboration and its existing value chain to accelerate the deployment of SAF.

SAF producers are in the middle of two volatile markets – feedstock and trading prices. The RCM should protect investment so capital flows into first-of-a-kind production plants, providing long-term certainty and shortening the period between final investment decision and consumer offtake.

Second-of-a-kind plants should build on earlier lessons and existing infrastructure and networks, entering the market with fewer barriers and without RCM support, with any uncovered costs passed to consumers.

The industry welcomes the UK Department for Transport's recognition of the policy barriers to domestic e-SAF production. Urgent action is needed across industry and government to develop and implement solutions, enabling projects to progress towards final investment decision.

> Promoted by Tees Valley Combined Authority as a hub for decarbonised industry, Teesside has become a popular location for planned SAF production. It offers existing infrastructure and available land from former chemical and steel works. It also has freeport status, with deep water access to the North Sea, though it is poorly connected to airports by pipeline. By engaging early with local logistics providers, producers could leverage their supply chains and ensure sufficient infrastructure is optimised in time for production.

Strengthening midstream and downstream connectivity

Existing logistics and fuel infrastructure could be leveraged, not only for fuel distribution but also for feedstock storage and use of assets such as jetties and rail heads. Upgrades might be needed since, although SAF handling technology is similar to existing infrastructure, neat SAF is slightly more corrosive than conventional jet kerosene. Early engagement with logistics providers will help identify infrastructure gaps, reduce project risk and limit upfront investment.

Potential production sites without pipeline connections, such as Teesside, will need more jetty space to move SAF via smaller vessels. Airports without pipeline connections may be disadvantaged in securing supply, facing higher SAF costs. This will impact airlines and could reduce air traffic and thus revenue. Early engagement is therefore essential – not only with logistics providers and producers, but also with airports and airlines.

The midstream and downstream industry could partner with producers to build smaller, distributed storage tanks, improving resilience and capturing economies of scale. Midstream players could also help de-risk SAF supply chains, as they have lower capital requirements than producers do. The proximity of storage to production plants and airports will impact SAF carbon intensity.

Airlines often require suppliers to handle blending, even if the SAF is not procured through them. SAF blending is more complex than other fuels, as different SAF types have varying technical requirements and blend limits. A clear framework may be needed to ensure products are handled correctly, along with SAF certificates for full and accurate traceability. Suppliers and end users will need to jointly determine the location of blending facilities.

Not all SAF is the same – carbon intensity and traceability

Traceability is a key consideration: tracking SAF sources back to origin and accounting for the carbon intensity from cradle to grave. Developers, producers and suppliers must consider the carbon intensity of transportation and feedstocks from the outset. These factors influence SAF qualification and the value of tradable certificates, even if transport emissions do not directly impact SAF market prices.

Opening routes to market

There is currently no spot market for second or third generation SAF, leaving producers exposed to high volume and price risks. Producers should continue to prioritise forward selling SAF to reduce the risk of increased costs for the RCM. Transparency between buyers and sellers is also needed to avoid hitting the RCM floor price. Even with the RCM, SAF supply should meet mandated demand, so airlines are not compelled to pay the buyout price.

The UK market will interact strongly with the EU, which has a more competitive environment for SAF production, especially for third generation fuels. Imports from the EU cannot be ruled out. If domestically produced second and third generation SAF costs remain higher than global competitors, airlines may shift both investment and traffic offshore.

It is also worth noting that airlines depend on suppliers to produce SAF but, if they move upstream, they become both customer and competitor, complicating market dynamics.

Competitive challenges facing UK airlines

The absolute cost of SAF remains very high, particularly impacting low-cost carriers. Even with the RCM, producers must remain focused on minimising production costs to ensure a competitive market for airlines.

Long-term offtake contracts could expose airlines to future cost risks. If SAF prices fall with economies of scale, airlines locked into higher prices will be at a competitive disadvantage. Low-cost carriers in this position could struggle to compete on ticket prices and ultimately be driven out of business or have to redeploy capital.

While SAF is more expensive by volume, its lower carbon intensity may save airlines on carbon levies and emissions trading schemes. Within the UK, second generation SAF could prove more competitive than first generation on this basis.

Third generation SAF

High electricity prices and plant capex make third generation SAF production in the UK expensive. Plants also need to run 24/7 to make best use of equipment and meet chemical process requirements, which is difficult in the UK, given variability in renewable electricity supply. Nuclear small modulator reactors could solve this problem but involve high upfront costs, remain unproven at scale and are decades away. The long-term goal for third generation SAF is to facilitate grid balancing, but producers will need to break even without running plant 24/7.

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Conclusion

Securing the supply of SAF to fulfil the UK mandate is not the only challenge. We have drawn out a few themes impacting these projects, such as the need for the RCM and offtake agreements to be globally competitively priced and issued quickly to provide certainty for projects and airlines. Regardless of the agreed solution, it is crucial that air fares remain affordable.

Aviation drives significant socioeconomic benefits and using the ETS to fund the RCM will help drive affordability. Early collaboration across the value chain will help optimise SAF production and connectivity.

There remain many aspects to explore, such as establishing secure and cost-competitive feedstock supply chains, identifying the most viable technology pathways, de-risking offtake agreements, optimising logistics infrastructure and managing SAF impacts on airport fuel supplies.

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Arup has extensive experience in SAF projects, focusing on pathways which have the most impact on decarbonisation. Contact our experts.

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