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Policy Paper

# **Making Sustainable Aviation Fuels Sustainable**

*BritishAmerican Business Recommendations for  
Transatlantic Leadership on Sustainable Aviation Fuel*

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# Introduction

On November 28th, the first 100% sustainable aviation fuel (SAF) transatlantic commercial flight will take off from London Heathrow to New York JFK, through a joint venture led by Virgin Atlantic.

This historic flight - 'Flight100' - was initiated by the UK Department for Transport, in partnership with Innovate UK after Virgin Atlantic were selected to run the project. In early November 2023, the Civil Aviation Authority (CAA) granted approvals for the flight to go ahead, with agreement from the US Federal Aviation Administration (FAA), as well as Irish and Canadian aviation authorities. Though considered a test flight, the flight will carry selected passengers from aviation, press and political stakeholders.

SAF is considered the key solution available to accelerate global aviation's net zero transition.<sup>1</sup> SAF has received industry and political attention given the importance of decarbonizing the sector. With other difficult to abate sectors well underway with their net zero projects, the aviation industry has had to consider short- and long-term carbon reduction solutions to stop the emissions gap widening compared to other sectors.

Over 450,000 flights have already used a proportion of (up to the current cap of 50%) SAF across 50 different airlines and SAF is regularly distributed at 69 airports globally. Airlines, operators, and corporate partners currently have around \$45 billion in forward purchase agreements for SAF. However, Virgin's flight marks the maiden voyage of a 100% SAF transatlantic commercial flight.<sup>2</sup> It is a pivotal moment on the aviation industry's road to net zero, proving that deeply decarbonized aircraft operations are possible, subject to the necessary regulatory and policy frameworks.

Whilst industries from aviation to technology and finance continue to work hard to reduce wider adoption barriers of SAF, important steps have yet to be taken to make SAF a financially sustainable option in the future. Depending on the production pathway, the price of SAF can still be prohibitive in some instances, when compared to conventional jet fuel. Production costs are high, and purchasing costs are between two and eight times more than Jet A fuels. Today, government support and industry planning are already positively remedying cost barriers to help meet ambitious domestic SAF targets, and more collaboration is possible. Achieving these targets will depend on strengthening investor certainty in long-term commitments and whether there is a pipeline of SAF projects readily available.

It is no surprise that this 100% SAF flight is from London to New York. The US and UK share a strong trading partnership, largely supported by the aviation industry and transport hubs like Heathrow enabling a huge volume of passengers and cargo. North Atlantic routes continue to gain in importance, with the London to New York route ranked one of the most valuable flight corridors globally.

Choosing a transatlantic route also reinforces the role that both the US and the UK hold in the SAF conversation as business and government look to strengthen development, distribution, and funding routes for this vital technology. Actions by industry and government on both sides of the Atlantic will be a decisive factor in reaching a critical mass of affordable and accessible SAF supply by 2025.

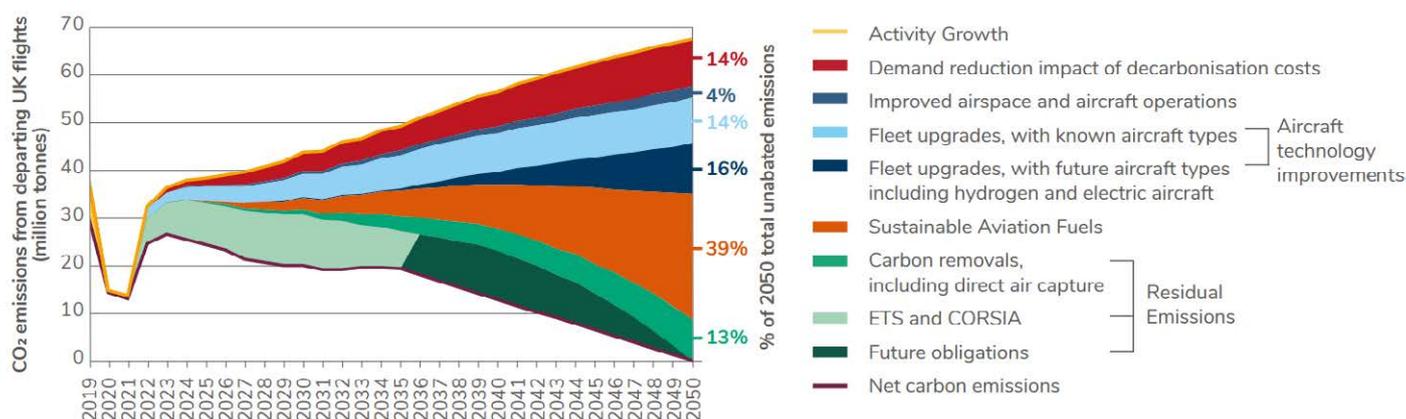
This paper highlights the prominent role that both the US and the UK play in the future of SAF. It takes the November 28th flight as a moment to assess the current state of play, approaches taken to SAF so far, and provides recommendations so that the US and UK can ensure they remain at the forefront in this fast-growing market.

# State of Play

SAF is an alternative, non-conventional aviation fuel that is made from non-petroleum feedstocks. It is designed to reduce the environmental impact of aviation and can be blended with up to 50% of traditional jet fuel at present, depending on the SAF material.<sup>3</sup> The raw material comes from a variety of sources, including waste, animal fat unfit to be used as food or feed, vegetable oil, or used cooking oil, and has a similar chemical make-up as kerosene.<sup>4</sup> As such, it is considered a drop-in fuel, meaning the blended fuel can be used in existing aircraft, engines, and infrastructure without modification to existing technology that is already in use in commercial aircraft globally.<sup>5</sup> Therefore, scope 3 emissions associated with aircraft and infrastructure changes required for non 'drop-in' solutions are also reduced. Across its life cycle, SAFs can achieve carbon emissions savings of up to 70% compared with Jet fuel A.<sup>6</sup>

Achieving a lower carbon aviation industry is possible through a combination of policies, including SAF, airspace modernization, carbon removal technologies, innovation, and hydrogen and electric powered aircraft. With fast action, it is widely accepted that SAF will play the biggest role in reducing net aviation emissions in the short- to medium term. The ICAO Long Term Aspirational Goal for Aviation recognizes the capabilities of aviation emissions reductions globally and the part SAF will play.<sup>7</sup> Sustainable Aviation's Roadmap visualizes the important role that SAF will play in reaching 2050 carbon targets, providing sufficient supply is available in the UK.<sup>8</sup>

## Sustainable Aviation Net Zero Carbon Road-Map



Graph source: [www.sustainableaviation.co.uk](http://www.sustainableaviation.co.uk)

In 2022, 26 million liters (5.7 million gallons) of SAF were supplied in the UK,<sup>9</sup> and 15.8 million gallons (71.8 million liters) were produced in the US.<sup>10</sup> With an expected UK mandate of 1.5 billion liters and US goal of 3 billion gallons by 2030, expanding production capabilities is urgent. Aviation authorities currently cap SAF flights at 50%. Working with policy makers and industry will soon make lifting this cap to 100% operationally achievable.

The benefits of SAF make it a viable option for decarbonizing the aviation industry. Expanding domestic SAF production is also a new area of economic growth, with jobs being created and sustained across multiple industries, including feedstock production, construction, manufacturing, and aviation.<sup>11</sup> In the UK alone, a domestic SAF market has the potential to generate 60,000 jobs across all UK regions with the right policy framework.

The ability to use sustainable alternative fuels within much of the current aviation infrastructure at airports and in existing plane engines creates a viable delivery plan. However, its success in becoming a practical alternative depends on multiple factors, including policies to support the scale-up of available feedstock which will reduce the 'green premium' of the growing sector.

Businesses recognize SAF is the most realistic route to a lower carbon aviation industry. SAF is part of a cross-

sectoral effort to invest in green trade, and decarbonizing the aviation industry contributes to wider industry net-zero efforts as aviation logistics are factored into scope 1, 2 & 3 emissions reporting.

Solutions to questions surrounding feedstock supply and cost issues will have to be worked out both at a domestic level between government and business, and at an international multilateral government level. There are at least four main questions that must and can be resolved to take SAF to the next stage:

1. The first question to be addressed relates to domestic SAF production. The development of additional SAF production is key meeting SAF demand and targets. The US had three mass SAF production sites in operation in 2022, but a high number of planned facilities and projects.<sup>12</sup> In the UK, there is an amalgamation of small scale SAF supplies and imports in its supply network. Eight proposed larger scale SAF plants have early-stage support from the government, and general commitments to having five SAF plants under construction by 2025. Government funding programs support smaller, pilot SAF projects, but do not yet assist larger commercial sites, diverging from US funding policy. If construction on all supported sites announced begins soon, UK domestic SAF supply will generate only up to 50% of the UK mandate by 2030. Fourteen sites have been found across the UK as potential SAF production locations.<sup>13</sup> Rapid action and the scaling up of production sites is needed if the UK is to succeed in delivering its mandated 2030 targets via domestically produced SAF, rather than importing at a premium.
2. The second question concerns feedstock materials and addressing the current supply deficit. It is recognized that there is a hierarchy of fuels to consider in the creation of SAF. For example, protecting land crop diversity, ensuring no competition with food supply for humans and animals, and sharing fuel options used by other sectors are issues that need to be assessed. Ensuring enough supply from various sustainable feedstocks and prioritizing an appropriate SAF transition to more advanced fuel types by working with industry is essential for the continued scale-up of SAF. There has been much recent development in commercial scale technology that produces SAF from a range of feedstocks, so policy and funding need to be structured to enable implementation of such commercial technology. Simultaneously, sufficient supply will support keeping costs more stable for the aviation industry and other sectors reliant on the same raw materials.



3. The third question is on the recurring theme of financial capacity in SAF investments. As with many emerging green industries, this greener alternative carries a surplus 'green premium' between SAF and kerosene. Airlines themselves are unlikely to be able to carry these costs alone. A combination of airlines, governments, consumers, and other industry stakeholders will have to absorb the costs. Policies like a revenue certainty mechanism must be put in place to make SAF scale-up accessible and affordable to businesses. This must address the lack of financial support for commercial scale projects that would allow for a step change in the ability to produce significant quantities of SAF more cost effectively. The oversubscription of Heathrow's SAF incentive scheme provides a clear example that there is demand for SAF purchasing at a competitive price. Economies of scale can positively influence price disparities so encouraging large scale applications of SAF production is a key enabler of reducing the green premium.
4. A related fourth question is how governments can help act quickly to make SAF a viable option to decarbonize the aviation sector. The UK has approached the question through the creation of the **Jet Zero Strategy**, led by the Department for Transport, launched in July 2022.<sup>14</sup> Alongside it, the Jet Zero Council was formed as a partnership between industry and government with the aim of delivering at least 10% SAF in the UK fuel mix by 2030.<sup>15</sup> £180 million of funding has been committed to support UK industry development, including plans for five plants to be under construction by 2025 and having a SAF mandate of 10% in place by 2030.

The US has followed a different approach through the **Sustainable Aviation Fuel Grand Challenge**, an initiative between the Department for Energy, Department for Transportation, Department of Agriculture and other agencies in 2021 with the intention of developing a comprehensive strategy for scaling up new technologies to produce sustainable aviation fuels (SAF) on a commercial scale.<sup>16</sup> Within the **Inflation Reduction Act**, \$4.3 billion has been allocated to the development of SAFs, with focus on providing producers with tax credit eligibility of up to \$1.75 per gallon, open to all SAF investors. This is a transparent outcome approach mechanism, where meeting carbon intensity criteria sets qualification for financial assistance. There is no set mandate, however there is a goal.<sup>17</sup>

Both the US and UK have also taken a prominent role in encouraging international conversations on SAF. For example, the International Civil Aviation Organization and annual UN Climate Change Conferences (COP) have provided platforms for discussions about SAF at an intergovernmental level, and groups like Sustainable Aviation, the First Movers Coalition and the Sustainable Aviation Buyers Alliance are working to make SAF a cross-sector issue through purchasing power and financial promotion. Signed in June 2023, the Atlantic Declaration's prioritization of building a clean energy economy of the future as one of its five pillars has presented a solid framework for the continuation of SAF at a transatlantic level. The announcement of the US-UK partnership on Sustainable Aviation in May 2023 and its participation at the inaugural International Summit on Investment in SAF have complemented wider international conversations across the year and are expected to continue with their momentum in the lead up to 2030.

Meanwhile, the EU also made major investments spurred by its Fit for 55 package and ReFuelEU Aviation initiative. Its Emission Trading System, Renewable Energy Directive III, and wider research projects into the feasibility of working with foreign countries for SAF feedstock sourcing are fueling SAF investments into the industry.<sup>18</sup> The Nordic countries have equally heavily invested in SAF production, and ambitious targets have been set in Japan, Australia, Canada, and Turkey on SAF usage by 2050<sup>19</sup> with the first biofuel production site for SAF announced in Turkey in 2022.<sup>20</sup> China too has begun its journey into SAFs and possesses a theoretical full domestic supply of feedstock necessary to meet future demand.<sup>21</sup>

Virgin Atlantic's 100% SAF flight is an exciting development for the sector, and it is set to be monitored closely by many stakeholders. It is a great opportunity for both the UK and the US to showcase leadership in the SAF discussion, and for the global conversation to take a next step.

# Recommendations

- We welcome the leadership role the US and the UK have taken in support of making SAF a viable option to de-carbonize the aviation industry, as well as making SAF an important part of their economies. Given its importance to the sector and stage of development, this is a crucial time in taking next steps in SAF production, distribution, and use. The momentum created by Flight100 should be used to further the discussion.
- We welcome the proactive business engagement across industries on this important topic, including in the work for this paper, and support efforts to reach close coordination and alignment, including in the work with the ICAO to reach net zero goals.
- We welcome the various initiatives both the US and the UK have already taken in scaling up SAF production in their respective economies. We emphasize that further urgent steps need to be taken for both the US and the UK to reach the SAF goals set by governments; to use government action to help de-risk and unlock investment in SAF and provide more certainty for the aviation industry, and to take advantage of the economic opportunity for their respective markets.
- We recommend the UK lead in introducing a revenue certainty mechanism to further incentivize the scale up of SAF. This step is needed due to the lack of price certainty for SAF. It will help reduce risk and incentivize investment in domestic commercial scale SAF production facilities and would help mitigate the 'green premium' of SAF against traditional jet fuel.
- We also welcome the funding attributed to supporting further industry development, including plans for five plants to be under construction by 2025 and having a SAF mandate of 10% in place by 2030. This has been an important first step. We recommend that the UK government and industry work together to develop support mechanisms that are better aligned with supporting true commercial scale applications and to start construction of such commercial scale local SAF production plants as a priority. There are several proven commercial scale technologies readily available that can be leveraged to make a step change in the UK. With a legislative commitment to 10% SAF mandate by 2030, if domestic production is not rapidly scaled up, SAF will have to be imported to meet policy requirements. This serves only to shift carbon emissions into other transport sectors, particularly maritime transport, and not support the UK's 2050 net zero targets. It would also hinder the potential for tens of thousands of SAF related jobs to be created in the US and UK.
- We welcome the US' support of the industry through the measures introduced by the Inflation Reduction Act. We also welcome plans to establish more SAF producing facilities over the coming years. However, we also take note of reports that current production may not meet the demand. We therefore call on the US government to regularly review whether domestic SAF production can meet government goals and rising demand from the industry.
- We welcome the establishment of the US-UK partnership on Sustainable Aviation, and we look forward to partners meeting again soon. We agree that the UK and the US should closely coordinate their approaches to SAF, utilizing the framework of the Atlantic Declaration. Especially because geographic and economic context is different, both the UK and the US can productively feed into each other's thinking on how best to scale up production facilities and financial support. Transatlantic alignment will also provide a stable basis for UK and US participation in multilateral discussions.
- We fully support that all relevant industries with a stake in the SAF conversation are part of government-led efforts. Engagement with technology, defense, financial services, energy, and food producers, among others, must be included in future discussions to understand further how they will support the drive to reduce the SAF green premium, as well as engage on innovative supply solutions in the shorter-term. For example,

we recognize the ongoing conversations on financial assistance systems, including the book and claims system,<sup>22</sup> and welcome the UK government's consideration on the matter.<sup>23</sup> We support the avoidance of any fragmentation in continuing discussions and welcome an aligned approach of government working with stakeholders to find a workable global system where the reduction of carbon intensity is the main priority.

- We recommend government policies that incentivize R&D, and the scaling up of power-to-liquid feedstocks.<sup>24</sup> Technology readiness level of Power-to-liquid is lower than other SAF feedstocks including gasification, alcohol-to-jet, and HEFA. Expanding PTL supplies is critical for long-term supplies. Work is underway across universities and organizations on SAF and the intersection of the emerging green hydrogen economy, with notable developments at the University of Sheffield, Aerospace Technology Institute and NASA,<sup>25</sup> and continued R&D incentives can increase feedstock options, and therefore supply. On that note, we welcome the agreement signed by Boeing and Zero Petroleum at the Dubai Airshow to work together to advance SAF, including by establishing a testing program at the University of Sheffield's Energy Innovation Centre (EIC) and its SAG research facility in the UK.<sup>26</sup> In parallel to the development and scale up of novel technologies, there are higher maturity commercial solutions that must also be leveraged to reach and exceed production targets.
- The important work on SAF needs to be accompanied by other carbon emission-reducing initiatives, such as better airspace routing, the development of new propulsions and airframe technology and contrail avoidance, among others.

## Conclusion

As Flight100 takes off, momentum behind SAF is strong. The flight has shown the potential of government and industry working in collaboration. Industries across the Atlantic begin to heavily invest across the supply chain to scale up domestic SAF in their journey to net zero by 2050. This paper sets out some overarching transatlantic business recommendations for what needs to happen to make SAF commercially sustainable.

The paper establishes that targeted and comprehensive government support is needed to build up the industry, and to eventually meet SAF and net zero commitments set by both governments and industry.

The paper concludes that both the US and UK are well positioned to be leaders in the growing SAF market as businesses push ahead with developing and expanding the industry, helping to protect future connectivity, trade, tourism, and transatlantic competitiveness.

## Acknowledgements

This paper has been produced as part of the BAB Sustainability Policy Sub-Committee Workstream. BAB gives particular thanks to those who specifically contributed to BAB's work on the topic of SAF, and to the engagement of the *BAB SAF Coalition*.

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# Appendix

Fig. 1

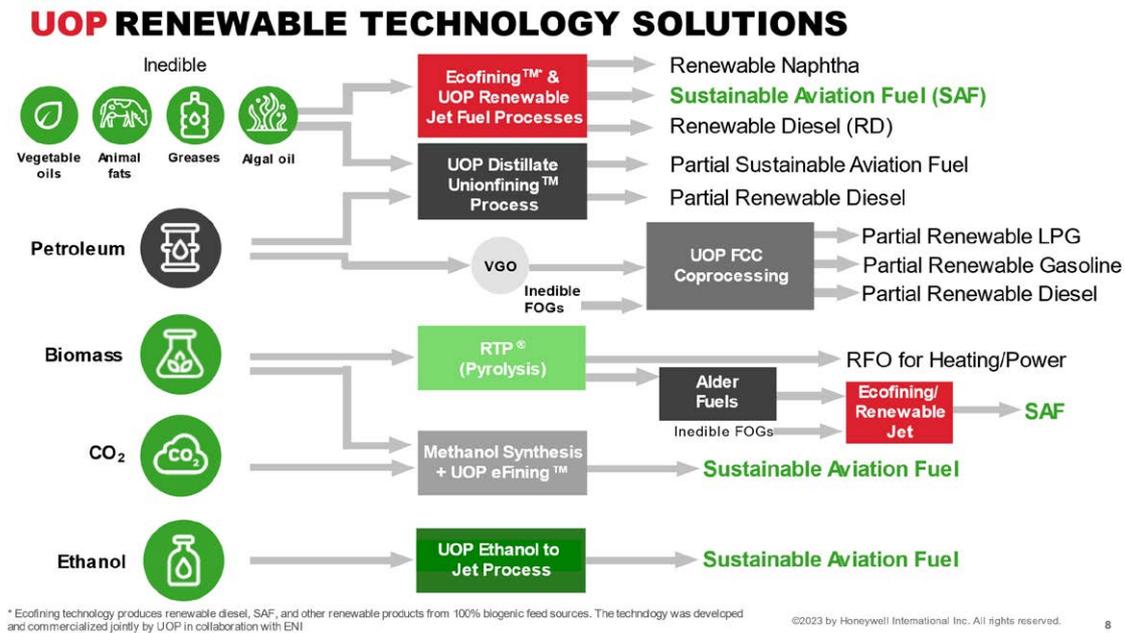
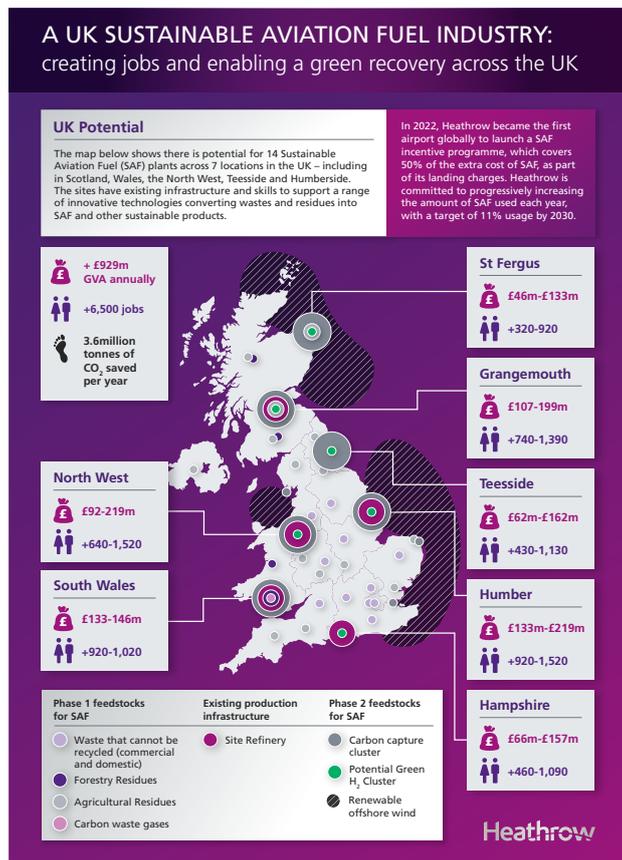


Fig. 2



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**November 2023**  
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