Jet Zero

The Critical Role of Sustainable Aviation Fuel in Delivering Net Zero in the Aviation Sector by 2050

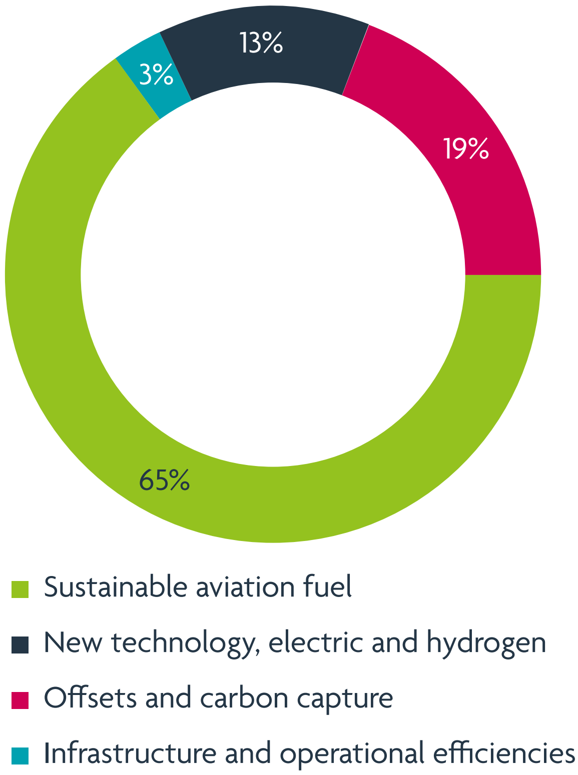
Introduction

The International Air Transport Association (IATA), which represents 300 airlines comprising 83% of global air traffic, approved a resolution in October 2021 for the global air transport industry to achieve net zero carbon emissions by 2050. In October 2022, the International Civil Aviation Organization (ICAO), a United Nations agency which helps 193 countries cooperate and share their skies, adopted a similar new global goal for international aviation of net zero CO2 emissions by 2050. These "jet zero" commitments align with the United Nations' Paris Agreement goal to limit global warming to well below 2 degrees Celsius, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.

IATA's strategy is to abate CO2 emissions using in-sector solutions such as sustainable aviation fuels (SAF), new aircraft technology, more efficient operations and infrastructure and the development of new zero-emissions energy sources such as electric and hydrogen power. In reality, the electrification of commercial aviation or the use of hydrogen fuel-cells to power aircraft are unlikely to be technically, practically or commercially viable any time soon (if ever), and therefore SAF is, and will be, the sector's principal path to decarbonization. This is creating complexity and opportunity across the industry.

Akin is currently advising clients on multiple SAF project development, financing, offtake and carbon offset mandates in the UK, the US and the Middle East, deploying a range of production pathways.

Impact of Measures to Reduce Carbon Emissions in Aviation



Source: IATA

Executive Summary/ Current Trends

Below we provide a comprehensive overview of the SAF sector, the current international regulatory framework and some of the key challenges being faced by developers, producers, fuel suppliers and airlines. In this section we highlight the key SAF trends which are currently shaping the industry:

1

Legislative Momentum

A significant amount of new legislation is emerging from the United Kingdom (UK), European Union (EU), United States (US), United Arab Emirates (UAE), Japan, Singapore and beyond (which we explore in more detail below). This is undoubtedly helpful and provides clarity as to what constitutes SAF, how production facilities need to be configured and the available supply-side and demand-side incentives. That said, the legislation is far from uniform and divergent sustainability and GHG emissions reduction criteria are creating some complexity.

2

Gaps in the Policy Framework

Whilst the existing mandates are undoubtedly a step in the right direction in driving demand, the focus on intra-EU and UK-domestic flights may not necessarily be the optimal path to net zero aviation emissions. Equally, the current absence of a book and claim system may prove to be a major barrier to SAF deployment.

3

Will the EU "Override" CORSIA?

There are questions arising within the EU as to whether the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) (which is discussed in further detail below) is sufficient to effect a meaningful change across the aviation industry. Against that backdrop, there is a prospect that the EU may seek to expand the scope of the EU Emissions Trading Scheme (ETS) flights, which means that new production facilities may have to pivot to ensure they can meet the EU's high watermark.

4

Change in Law Risk

Shifting regulatory climates are creating uncertainty for a variety of stakeholders. This is exacerbated in the context of a nascent industry where developers need to allocate risks under long-term contracts. Allocating change in law risk in offtake agreements is a hot topic among many of our clients.

5

Technology Risk

The technology risk associated with different SAF production pathways differs greatly (as we discuss in further detail below). Certain first and second generation technologies are mature and have been proven at scale while other emerging pathways contain first-of-a-kind technology which is new or has not been deployed at commercial scale. The contractual and financing approaches underpinning each will be vastly different. Where first generation technologies should secure a technology wrap from an EPC contractor, newer technologies are requiring far more creativity from stakeholders and advisors in order to appropriately allocate risks and secure non-recourse financing.

6

Competition for Feedstock

For HEFA and certain other pathways, volumes of feedstock are limited and accessing sufficient volumes over the long-term requires careful planning, particularly in markets where SAF production is competing with other use cases. In some locations, biogenic feedstock will always be insufficient and the focus is on synthetic fuel solutions which need to secure a reliable stream of CO_2 and benefit from a regulatory backdrop that allows use of such CO_2 (which is not always prevalent).

7

Immature Feedstock Markets

Even in circumstances where there is commercial willingness to agree feedstock supply terms, the feedstock market may be immature. The expectations of suppliers, purchasers and financers rarely align (for example, regarding terms, tenor and support) and will need work to be reconciled. Balance sheet support is challenging, but surmountable.

8

Management of Scope 1 /Scope 3 Claims

Whilst a number of SAFc registries are emerging, there is no "official" or market-leading certification. This means that the allocation of environmental attributes (including scope 1 and scope 3 (end user) emissions) is being effected contractually. Significant thought is required as to how the attributes are allocated in a manner that achieves commercial aims and is not open to abuse.

9

Revenue Support Mechanisms Need to be Developed and Tailored

Whilst the US has rolled-out a series of meaningful production incentives, demand-side support mechanisms across the globe are somewhat lacking. In some instances, the prevalence of the 'stick over the carrot' may stifle development. In the EU measures such as H2 Global are designed to bridge the cost differential associated with e-SAF. However, at present there are challenges with the H2 Global model, which may need to be considered.

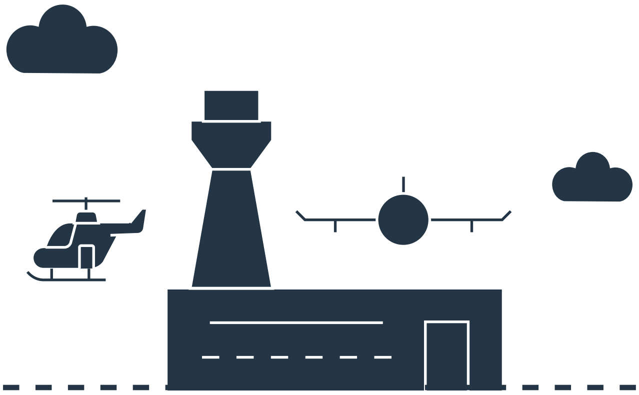
10

Project Finance Considerations

Project finance undoubtedly has a key role to play in facilitating the widespread development of new production facilities. However, certain of the risks presented by SAF projects (including feedstock supply risks and technology risks) may represent a deviation from core project finance risk allocation principles. SAF project sponsors will need to carefully manage these risks, including through tailored feedstock, construction and offtake strategies.

What is SAF and How Does it Help?

The magic of SAF is that it is a “drop-in” liquid hydrocarbon jet fuel produced from renewable or waste resources such as cooking oil, municipal waste and agricultural residues. SAF is blended with existing jet fuel to produce a mixture that is compatible with existing aircraft, engine models and pipeline and transportation infrastructure. SAF remains a hydrocarbon fuel and emits carbon dioxide when combusted in an aircraft engine. The challenge therefore is to maximize the extent to which SAF provides life-cycle greenhouse gas emissions reductions when compared to traditional jet fuel. These reductions are achieved through the lower carbon intensity of SAF as well as continuing efficiency advancements in methods of production, blending and distribution. Some types of SAF can also create indirect emissions benefits as they can reduce, for example, the formation of contrails, which contribute to climate change.



SAF remains a hydrocarbon fuel and emits carbon dioxide when combusted in an aircraft engine

Feedstocks Suitable for SAF Production

- Oil seed plants and energy grasses
- Algae
- Municipal solid waste
- Fats, oils and greases from cooking waste, and meat production
- Agricultural and forestry residue
- Industrial carbon monoxide waste gas

Source: IATA

How is SAF Produced?

There are multiple major feedstock sources capable of producing SAF: waste oils and fats, biofuels, municipal solid waste, agricultural and forestry residue and e-fuels or Power-to-Liquid (PtL) fuels. SAF produced from waste oils and fats using the HEFA process is often referred to as first generation SAF, SAF produced from biofuels such as ethanol using the Fischer-Tropsch process is often referred to as second generation SAF, and e-fuels generally constitute third generation SAF. Approximately 85% of SAF facilities that will start producing in the next five years will use HEFA production technology.

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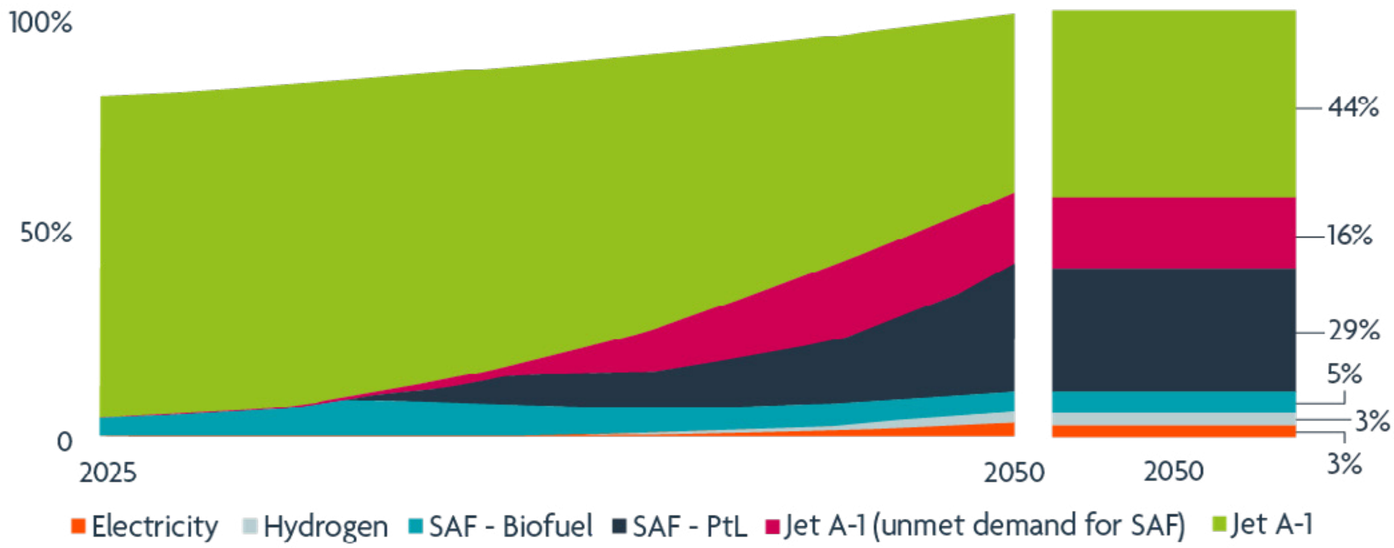
Biofuels can be produced from a wide range of renewable biomass and waste resources including corn grain, oil seeds, algae, other fats, oils, greases, agricultural residues, forestry residues, wood mill waste, municipal solid waste streams, wet wastes (manures, wastewater treatment sludge) and dedicated energy crops that do not compete with food or feed production.

PtL fuels are synthetically produced liquid hydrocarbons. PtL fuels are generally produced from the synthesis of clean hydrogen with CO2 derived carbon into syngas, which is then further refined and processed into SAF. Clean hydrogen is produced through electrolysis of water molecules powered by renewable electricity, low carbon electricity such as nuclear, biogas or natural gas fired power stations with carbon capture and storage. CO2 can be captured from fossil fuel power generation and industrial processes using carbon capture technologies or captured from the atmosphere using emerging direct air capture technologies. The means of production will determine sustainability credentials and the requirements in this regard may differ from one jurisdiction to the next, so a holistic and fully informed approach will need to be adopted by producers, given the international nature of air travel.

Projected Demand for Aviation Energy Types



Source: KPMG Sustainable Aviation Fuel Report

PtL is currently much more expensive than SAF produced from biofuels, but costs of production are expected to fall rapidly as the technology matures and depending on supply and demand dynamics, this may lead to a fall in end purchase costs. Additionally, there are significant concerns about the ability of SAF produced from biofuels alone to meet the scale of anticipated global SAF demand. The use of biofuels as feedstock to produce SAF also faces certain obstacles such as the high demand for such feedstock in non-aviation processes and industries, and the potential environmental impacts of large-scale biofuels production.

These obstacles limit the potential for biofuels to generate the entirety of SAF demand in the aviation industry. KPMG has forecast that SAF produced from biofuels will outpace SAF produced from PtL for the next decade but that only 5% of aviation energy demand will be met by SAF produced from biofuels in 2050, with 29% being met by SAF produced from PtL, suggesting that the PtL market will grow to be six times the size of the SAF biofuel market over the next 25+ years.

A Nascent Market

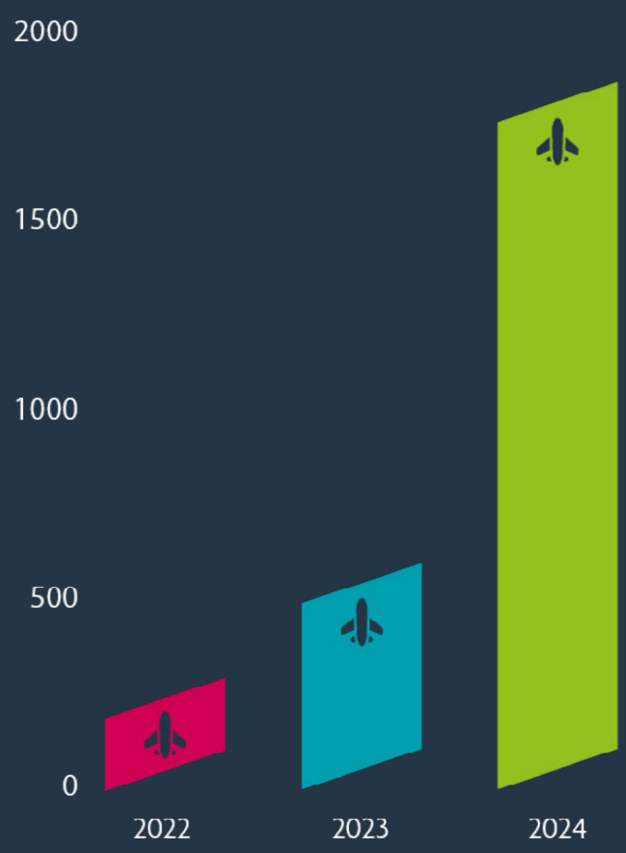
SAF is a nascent and emerging solution to delivering net zero in the aviation sector. Without an established marketplace for SAF offtake, there are limited pricing benchmarks and long-term pricing remains uncertain and potentially volatile.

Whilst product of SAF is skyrocketing, it will only account for 0.53% of the aviation industry's fuel needs in 2024

Although approximately half a million fueled flights have taken place and 50+ airlines are currently using SAF in limited capacities, the first ever commercial test flight with 100% SAF in one engine only took place in December 2021 and with 100% SAF in both engines only in June 2022. Further, whilst production of SAF is skyrocketing, with production doubling from 2022 to 2023 (300 million liters in 2022; 600 million liters in 2023) and expected to triple in 2024 (to 1.875 billion liters), this volume will only account for 0.53% of the aviation's industry's fuel needs (up from 0.2% in 2023), and SAF as a proportion of all renewable fuel production will only grow to 6% (from 3% in 2023). With these figures in mind, there is still a long way to go, with IATA reporting that the aviation industry needs between 25% to 30% of renewable fuel production capacity for SAF in order for aviation to reach net zero carbon emissions by 2050, describing the current production levels as "missing huge opportunities to advance aviation's decarbonization". As outlined below, the demand-side drivers are all relatively new and there are limited pricing signals available and, as a result, there is considerable flux in the offtake market.

SAF Production 2022-2024

(Million Litres)



Source: IATA

International/ Supra-national Policy and Regulatory Frameworks

The evolution of the global SAF market is being shaped by international aviation emissions based regulatory mechanisms that attach a compliance cost of carbon / Green House Gas (GHG) emissions to defined flights and allow flights fueled with eligible SAF to secure favorable emissions treatment. These mechanisms include:

CORSIA

Established in 2015 and applicable to international flights between the 126 participating states. It requires airline operators to purchase and cancel eligible carbon credits to offset their emissions from in-scope flights against a baseline, which from 2024 until the end of the scheme in 2035, is 85% of international aviation emissions in 2019. The compliance obligation has been narrow to date and the cost of compliance low, but the compliance obligation is expected to be significantly strengthened, including in respect of the integrity of qualifying offsets in the coming years, with compliance costs and the incentive to avoid those costs via eligible SAF flights increasing accordingly.

EU ETS

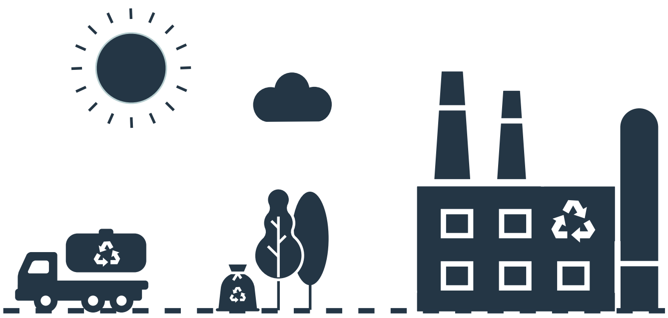
A “cap and trade” mandatory emissions trading scheme that applies to multiple economic sectors (power, heat, manufacturing industries, aviation) and incentivizes CO2 reduction or the trading of allowances with other operators with lower emission reduction costs to secure compliance. EU ETS applies to flights that depart and arrive within the European Economic Area (40% of total EU aviation fuel use), but aircraft operators have received very significant free allocations of allowances reducing their compliance costs to date and these free allowances are being completely phased out by 2026. Eligible SAF flights which are biomass-based are treated as zero emission for the biofuel fraction of the SAF physically supplied and allocated to those flights. The penalties for non-compliance are significant (and much greater than the costs of CORSIA compliance) and this is likely to drive allocation of eligible SAF to short-haul intra-EEA flights rather than long-haul CORSIA or other international flights.

UK Emissions Trading Scheme (UK ETS)

Similar to the EU ETS and established in 2021 post Brexit, but applying different sustainability criteria for SAF to be eligible for a zero emissions factor, creating a compliance headache for fuel producers, suppliers and aircraft operators.

Carbon Border Adjustment Mechanism (CBAM)

An EU climate measure, which is being phased in from 2026, following a transitional period, to prevent the risk of carbon leakage by requiring EU importers to buy carbon certificates corresponding to the carbon price that would have been paid had the relevant goods been produced under the EU’s carbon pricing rules, applicable to cement, aluminum, iron, steel, fertilizers, hydrogen and electricity, but which may be extended to aviation and other EU ETS sectors before 2030.



Domestic Policy and Regulatory Frameworks

In order to spur investment in SAF production and use and to develop a robust marketplace for SAF, domestic governments have also developed SAF mandates and economic incentives in the form of tax credits and environmental attributes that can be monetized by parties to SAF production and offtake transactions. These mandates and incentives have yielded significant success in generating interest and attracting capital and demand for SAF offtake.

The advancement of SAF is being supported by major government policy initiatives such as:

US

Several US federal, state and local government-led initiatives including:

- The United States 2021 Aviation Climate Action Plan, which lays out the US government's strategy to foster innovation and drive change across the entire US aviation ecosystem and meet a goal of net zero GHG emissions from US aviation by 2050.

- The launch by the Department of Energy (DOE), Department of Transportation (DOT) and US Department of Agriculture (USDA) of a government-wide SAF Grand Challenge in September 2021 which aims to expand US domestic SAF production to achieve 3 billion gallons per year with a minimum of a 50% reduction in life-cycle GHG emissions compared to conventional fuel by 2030 and 100% of projected aviation jet fuel use, or 35 billion gallons of annual production, by 2050.

- The US Inflation Reduction Act of 2022, which includes a production tax credit for those who blend and sell or use SAF before 2025; a subsequent three-year tax credit for those who produce and sell SAF beginning in 2025 and before 2028; and a grant program of $290 million over four years to carry out projects that produce, transport, blend or store SAF, or develop, demonstrate or apply low-emission aviation technologies. To be eligible for the tax credits, the SAF must achieve approximately a 50% improvement in GHG emissions performance on a life-cycle basis as compared with conventional jet fuel. Before 2025, the production tax credit starts at $1.25/gallon of neat SAF and increases with every percentage point of improvement in life-cycle emissions performance up to $1.75/gallon. Between 2025 and 2027, the production tax credit generally starts at $1.75/gallon and increases or decreases depending on the SAF's emissions rate. An increase above $1.75 requires a negative emissions rate. However, the credit generally starts at $0.35/gallon unless producers pay prevailing local wages and employ a threshold number of apprentices when constructing, altering or repairing their production facilities.

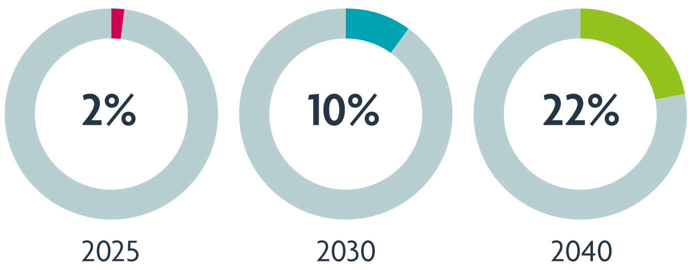
- The US Renewable Fuel Standard (RFS), created by the Energy Policy Act of 2005 and administered by the Environmental Protection Agency, requires the mixing of renewable fuel with traditional fuel for ground transportation, requiring a minimum amount of renewable fuel annually with a ramp-up period.
- California's Low Carbon Fuel Standard, a market-based program that focuses on reducing the carbon intensity (CI) of transportation fuels used within California. The program provides credit generation opportunities for producers and importers of transportation fuels into California that produce or import fuel with CI levels below the benchmark set by the State. Subject entities that produce or import fuels with a CI level above the benchmark will accrue deficits and are required to purchase credits from those entities that have excess credits.

UK

The UK's Jet Zero Strategy, published in July 2022 and updated in April 2024, establishes the UK's SAF Mandate (which will come into force on 1 January 2025).

- The SAF Mandate introduces specific targets for the proportion of SAF in the aviation fuel mix (ranging from 2% in 2025, to 10% in 2030 and 22% in 2040), which suppliers need to comply with. The mandate introduces tradeable certificates awarded at the duty point for the supply of SAF that will need to be surrendered (or a buy-out price paid) to ensure mandate compliance, with additional certificates awarded for fuels with higher GHG emissions savings. The buy-out mechanism will set an initial buy-out price of £4.70 per liter (£5.00 for PtL fuels) creating a marketplace, and setting an effective price cap, for these tradeable SAF certificates. The UK mandate sets a cap on the volume of HEFA certificates that can be used to discharge the mandate obligations (making up 100% of SAF in 2025 and 2026, decreasing to 71% in 2030 and 35% in 2040) and creates a separate PtL obligation from 2028 set at 0.2% of total jet fuel demand and reaching 3.5% of total jet fuel demand in 2040. It allows for the carry forward of a proportion of SAF certificates, with 25% of the obligation capable of being met by certificates awarded in the previous obligation year. SAF must achieve minimum GHG emissions reductions of 40% to be eligible and cannot be produced from food, feed or energy crops.

UK SAF Mandate Targets



Source: UK Government

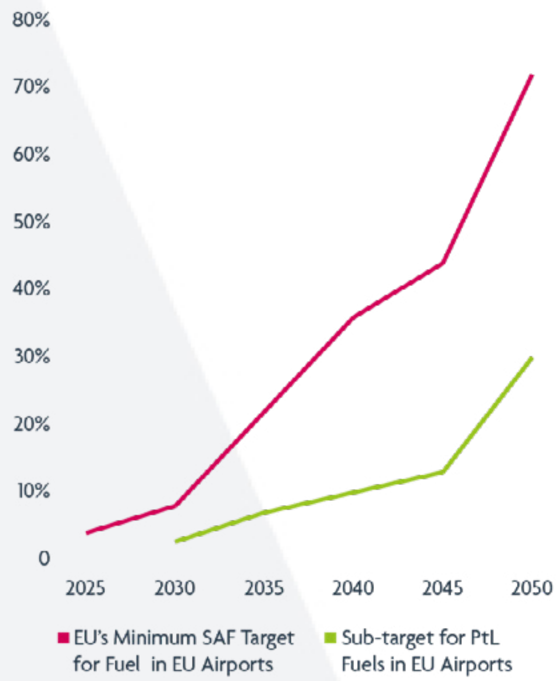
- The UK government is separately consulting on the introduction of a revenue certainty mechanism for non HEFA, commercial-scale, domestic SAF plants. This will most likely take the form of a guaranteed strike price (GSP), modeled on the UK contract for difference, guaranteeing an agreed price per liter of fuel, but other options being considered include a buyer of last resort mechanism for SAF certificates guaranteeing an agreed minimum price when the market price falls below an agreed level, a mandate auto-ratchet mechanism adjusting the SAF Mandate targets (and the HEFA cap) when there is an oversupply of SAF, or a mandate floor price, creating a universal minimum price for SAF certificates.

EU

- The EU's ReFuelEU Aviation initiative, presented in July 2021 and bolstered by a regulation passed by EU lawmakers in October 2023 is part of a wider package of proposals to make the EU's climate, energy, land use, transport and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared with 1990 levels: the "Fit for 55" package. The ReFuelEU Aviation initiative aims to ensure a level playing field for sustainable air transport by imposing obligations on aviation fuel suppliers. Whilst there is currently no correlating obligation on airlines to purchase and use SAF, in practice the uptake will be driven by EU ETS obligations and internal emissions reductions targets. Under the package, aviation fuel suppliers are required to supply a minimum share of SAF at EU airports, starting at 2% of overall fuel supplied by 2025 and reaching 70% by 2050 (with sub-targets for PtL fuels from 0.7% to 35% over the same period); aircraft operators departing from EU airports will be required to ensure that the yearly quantity of aviation fuel uplifted at a given EU airport is at least 90% of the yearly aviation fuel required, to avoid emissions related to extra weight or carbon leakage caused by 'tankering' practices (deliberately carrying excess fuel to avoid refueling with SAF) and airports will be required to ensure that their fueling infrastructure is available and fit for SAF distribution. The EU's proposals also create a Union labelling scheme about environmental performance for aircraft operators using SAF which is aimed to help consumers make informed choices and promote greener flights.

- From 2025, the EU's minimum SAF target for fuel in EU airports is 2% which increases every five years, to 6% in 2030, 20% in 2035, 34% in 2040, 42% in 2045 and 70% in 2050. A sub-target for synthetic aviation fuels is also included from 1.2% average (minimum of 0.7% per annum) in 2030 and 2031, to 2% average (minimum of 1.2% per annum) in 2032, 2033 and 2034 to 5% in 2035, 10% in 2040, 15% in 2045, and 35% in 2050.

EU's Minimum SAF Target for Fuel and Sub-target for PtL Fuels in EU Airports

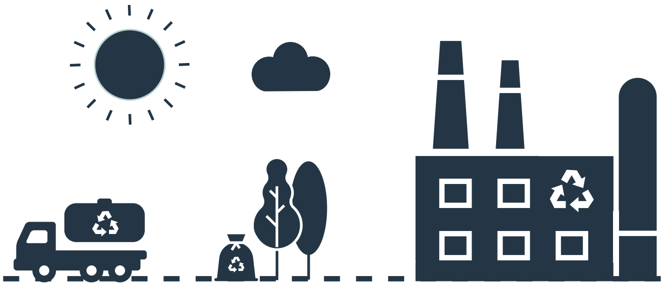


Source: European Council

UEA

In the UAE, the General Policy for Sustainable Aviation Fuel aims to position the UAE as a regional hub for low-carbon aviation fuel by establishing a national regulatory framework for SAF, investing $7 billion to $9 billion to produce 700 million liters of SAF annually at up to five SAF facilities by 2030 and creating a voluntary target, aiming to supply 1% of fuel to national airlines at the UAE airports, using locally produced SAF by 2031. Some of this production could be exported to make use of more mature policy regimes, such as those in the EU and the UK, further diversifying the UAE's economy.

The UAE is investing between $7 billion and $9 billion to produce 700 million litres of SAF annually at up to five SAF facilities by 2030



Japan

In Japan, binding regulations are expected to be introduced in 2030 making wholesale fuel suppliers responsible for ensuring that 10% of aviation fuel for international flights using Japanese airports is sustainable, alongside obligations on Japanese airlines that fly internationally to use 10% SAF for those flights. We are already seeing this stimulate interest in solutions aimed at supplying Japanese airlines.

Regulatory Divergence

The regulations outlined above are not uniform and do not apply to all stakeholders in the same manner. In addition:

(i) there are questions arising as to whether CORSIA is sufficient to effect a meaningful change across the aviation industry; and

(ii) most airlines have adopted their own voluntary decarbonization targets, which go well beyond their CORSIA obligations. Against this backdrop, it is possible that the EU may seek to expand the scope of the ETS to better achieve its climate goals. This creates risk and opportunity.

Key Risks Faced by SAF Producers

SAF producers and investors face a number of specific risks when developing and scaling their SAF production facilities, including:

Feedstock Risk

This is a particular challenge for projects dependent on waste products or biofuels to produce SAF. SAF producers will need to be able to control feedstock price and volume risks whilst ensuring that their chosen feedstock satisfies prevailing sustainability criteria in their chosen markets; these criteria may change over time creating political and change in law risk for producers.

First of a Kind Technology Risk

In relation to existing and new SAF production processes and their certification for use in commercial aviation in either increased blends alongside existing jet fuel or using 100% SAF Production of synthetic SAF to meet the demand for fuel in the aviation industry may lead to an initial increase in the price of SAF as new production methodologies come online.

Demand Underpins

Whilst global demand for SAF remains uncertain, it will continue to be challenging for SAF producers to find offtakers willing to commit to take defined SAF volumes for fixed or floored pricing over a medium to long term horizon: these offtake commitments may be needed to underpin the economics of the SAF production facilities in order to achieve a final investment decision or to raise financing for development.

Price Volatility

It remains uncertain how big a premium will apply to SAF over traditional kerosene jet fuel; a SAF producer will need to determine how it should best manage the price volatility and price risk associated with its offtake — in the UK this has led to the debate about whether the UK government should insulate early SAF producers from price quantum and price volatility risk via a contract for difference (CfD), pursuant to which the SAF offtaker would receive a fixed offtake price with price and price volatility risk transferred to a government owned counterparty and potentially redistributed across the industry.

Cost Reduction and Availability of Government Support

The speed of cost reduction across the sector will affect SAF uptake; this applies to all SAF production, but also specifically to cost competition within and between different SAF production pathways and, in particular, between SAF produced from biofuels and SAF produced using PtL. It is currently much more expensive to produce and use SAF than to achieve the equivalent GHG reductions through carbon credit offsetting and government support mechanisms will be needed to help increase the competitiveness of SAF in the short to medium term and to support cost reduction.

Supply Chain Maturity and Interface Risk

The processing and refining facilities needed to produce SAF from biomass or renewable electricity and CO2 feedstocks at the anticipated scale do not currently exist — this means that the robustness of key supply chain dependencies and interfaces will be critical in early projects, particularly for those SAF producers not developing full-chain integrated solutions.

Regulatory Divergence

If different regulatory and technical standards for SAF (e.g., in relation to acceptable source feedstocks) emerge in different markets, such as the US and the EU, this will create market friction and slow the pace of global SAF adoption.

Political Risk

The risk that political commitments to SAF change or wane over time, that SAF mandate deadlines are extended (as we have seen with the transition to electric vehicles) or that government views of what amounts to "sustainable" SAF production, e.g., in relation to biomass feedstocks, harden or shift as the market matures.

Change in Law/Regulation Risk

The risk that evolving SAF legal and regulatory standards require expensive retrofitting or upgrading to SAF production facilities or render them obsolete.

Demand Uncertainty

The scale and growth curve of global demand for SAF remains uncertain and will be affected by:

- The speed with which airlines voluntarily embrace the transition to SAF as part of their own net zero and broader environmental, social and governance (ESG) targets
- The pace of introduction of mandatory national or international SAF mandates such as those being proposed in the EU from 2025 onwards
- The cost and availability of SAF certified for use in commercial aviation

Technology Obsolescence

There are currently multiple certified methods of producing SAF; over time, one or more dominant solutions are likely to emerge offering optimum cost, efficiency, availability and scalability and this may render other SAF production solutions obsolete or uneconomic.

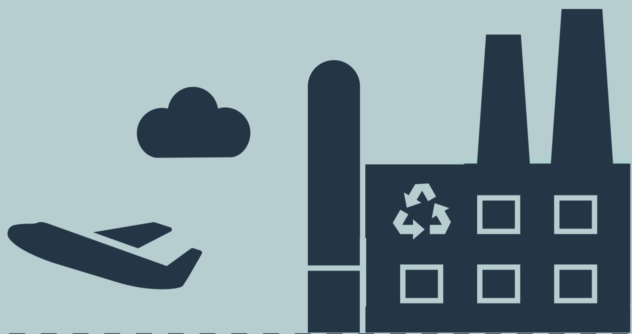
GHG and Macros-economic Externalities

- GHG emission reduction gains made elsewhere in the global energy economy (for example, in the heavy industry and maritime sectors) may reduce incentives to accelerate the transition to SAF and feed into the political risk described above
- Macro-economic factors such as prolonged high wholesale energy prices may soften political momentum to transition to SAF; the current political desire for energy independence is also likely to shape where and how SAF is produced for individual aviation markets

Competing Commercial Use Cases

There is likely to be competition for biomass and renewable electricity and clean hydrogen and carbon as a feedstock from other offtakers, which may increase the costs of SAF production or divert feedstocks away from SAF production — this may result from, for example:

- Biomass being used as a fuel for electricity generation or to produce biomethane (green natural gas) that is injected into the gas grid
- Renewable electricity being used for electricity generation, for clean hydrogen production that is then used as a road or maritime fuel, for non-SAF hydrogen flight or to decarbonize heavy industry such as steel, aluminum, cement or ammonia production



Divergent Sustainability and GHG Emissions Reduction Criteria

This is an issue across the US, EU, UK and other major global SAF markets making compliance and subsidy stacking for international projects looking to produce SAF in markets with favorable SAF production support measures (e.g., North America) and export it for sale to markets with favorable SAF supply/demand side measures (e.g., the EU and the UK).

Broader Government Policies and Inter-dependencies

In addition to government policy measures that directly affect SAF, the cost and availability of SAF production will be indirectly affected by the status and evolution of government policies and support measures in a significant number of other related areas that are relevant to the SAF value chain, such as government policies in respect of:

- Biomass, biogas and biomethane production and use
- Renewable and low carbon (e.g., nuclear) electricity generation
- Clean hydrogen production
- Direct air carbon capture
- Industrial and power generation carbon capture, utilization & storage policies, (e.g., those in the UK which are not currently set up to allow the use of CO2 in SAF e-fuel production in place of permanent sub-sea sequestration and storage)
- The decarbonization of other "hard to abate" sectors such as heavy industry, domestic gas-fired heating, long distance road transport and the maritime sector
- Carbon pricing (within individual countries or cross-border) and whether or not this is set to reflect the true costs of carbon and other GHGs
- Aviation fuel taxes (and any related SAF exemptions or reductions)
- Mandatory and voluntary carbon markets, with mandatory carbon markets setting requirements for the surrender of emissions allowances by airlines, which may be reduced to reflect SAF use and voluntary carbon markets helping to establish a market price for carbon (and other GHG emissions) and capable of providing a route for airlines, corporates and individuals to offset their residual GHG emissions

SAF Project Finance

Project finance offers a significant potential source of liquidity for SAF project developers that need to raise capital to develop their SAF production facilities, but for deals to be "bankable", they will need to be structured to achieve a robust and acceptable risk profile that supports limited recourse, highly leveraged debt finance. We have set out above our views on a number of key project risks that SAF producers will face, in particular those that create material revenue and cost risks or that could result in significant project delays or project failure. Novel solutions are likely to be needed for a number of these risks so that the base case economics of the borrower SPV can be maintained in a range of credible downside sensitivity scenarios. At this early stage in the market's development, this will require detailed engagement with governments and policy makers to optimize the effect of government support measures for the industry, as well as engagement with supply chain, investors and lenders to better understand and allocate key risks.

We have seen a footrace from project developers to secure the structural anchor of a long-term offtake agreement with a creditworthy counterparty, typically an airline. This has led to a number of deals in the market being signed on potentially unbankable terms that are likely to need to be revisited once project lenders are actively engaged in negotiations. This approach reflects a degree of pragmatism from airlines keen to signal their commitment to SAF and project developers who are weighing up the difficulties of locking down all aspects of fully bankable terms at a very early stage of their project's development and with the supporting regulatory and policy environments for the sector still in flux against the immediate brand boost and advantages of being able to announce the involvement of a key strategic partner and a route to market.

Novel technology risk may well require bespoke solutions and you can read our detailed thoughts on Securing Bankable Construction Delivery Solutions for Energy Transition Projects here.

SAF Transportation, Blending, Storage and Delivery

There is significant complexity in the journey from SAF producer to delivery of blended SAF to the door of an aircraft. First, there is the logistics challenge of securing the required rail car, vehicle or vessel capacity to transport neat SAF from the point of SAF production to SAF blending facilities, in the absence of dedicated SAF pipeline infrastructure.

This is made more complex in the early years where the commercial operations date of the SAF production facility or early SAF volumes may be uncertain. The offtaker may also need to secure the required levels of blending and storage capacity at its own or third party blending facilities, where the capacity needed may vary depending on whether actual volumes produced and blended meet forecast expectations. Fuel delivery may be committed to one or more airports or airlines from the outset, but an offtaker may want to allow itself flexibility to pivot to servicing new markets or accessing new economic incentives or environmental attributes over the life of the deal, complicating the structuring of the logistics solution. Finally, delivery of the blended SAF will need to be integrated into airport and airline fuel purchasing and delivery arrangements at individual airports without undermining the essential green nexus between the blended SAF and the ultimate airline customer. Failing to properly structure these arrangements may result in an increased risk of an offtaker "failing to take" neat SAF at the point of production.

It should be noted that not all market participants are seeking to bundle SAF with its green attributes for sale into markets with the most attractive government support measures. Some market participants unbundle the sale of SAF fuel from the sale of the GHG reduction benefits associated with SAF, allowing the SAF fuel to be delivered into a local aviation market rather than seeking to transport it over long distances or internationally (with an increased carbon footprint) to a target destination market and with SAF certificates (SAFc) representing the GHG reduction benefits associated with the fuel separately sold to, for example, large corporate users of air travel on a book and claim basis to monetize the environmental benefits of the SAF. The long-term integrity of these SAFcs, the nature of the environmental claims that the holder of a SAFc is entitled to make, the risk of double claims or double counting in relation to the GHG reduction benefits of the SAF and the green nexus between the purchaser of the SAFcs and the SAF will continue to be important issues, as they are in the broader voluntary carbon markets.

Conclusion

The SAF market will be initially reliant on government-imposed mandatory SAF targets and on government economic and risk incentives and support to scale. This is already proving critical to the development of early SAF production facilities and to kick-starting the cost reduction pathway for the sector. Over time, costs are expected to decline quickly and the costs of alternative high-quality carbon offsets are expected to increase to reflect the true cost of carbon. This, combined with broader government and airline ESG and net zero commitments will further catalyse the market.

SAF Fuel’s Price Premium

($ Cents per Gallon)

Source: Reuters, Argus Media

Ultimately, the goal is to reach cost parity between SAF and conventional jet fuel to allow SAF to compete on an equal (or better) economic footing. This is likely to result both from a reduction in the costs of producing SAF, but also from the introduction of more stringent carbon pricing or taxation to increase the price of traditional aviation fuels.

The ability to navigate “first of a kind” technology risk and “safe to fly” certification will be critical alongside the need for SAF producers to secure medium to long-term feedstock and offtake commitments for fixed or stable prices from airlines or other market participants, such as energy trading majors that underpin demand for and the economics of, their facilities.

Given SAF’s dependency on biomass, renewable electricity, clean hydrogen and carbon capture as a feedstock, continued government policy support for these areas will be important to producing and reducing the cost of SAF, as will the impact of competing demand for these feedstocks for other use cases such as the decarbonization of electricity, road transport, the maritime sector, non-SAF aviation and heavy industry (such as steel and cement production), which may either reduce the availability of these feedstocks or increase their cost. SAF producers and buyers will therefore need to be mindful of these potential competitor use cases in structuring their business models.

Akin attorneys have led significant representations on industry changing mandates representing major investors in, and producers of, SAF and major airline carriers in various transactions involving the development and financing of greenfield SAF projects, SAF offtake, logistics and blending, the sale and monetization of associated environmental attributes and in SAF carbon offset solutions.

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