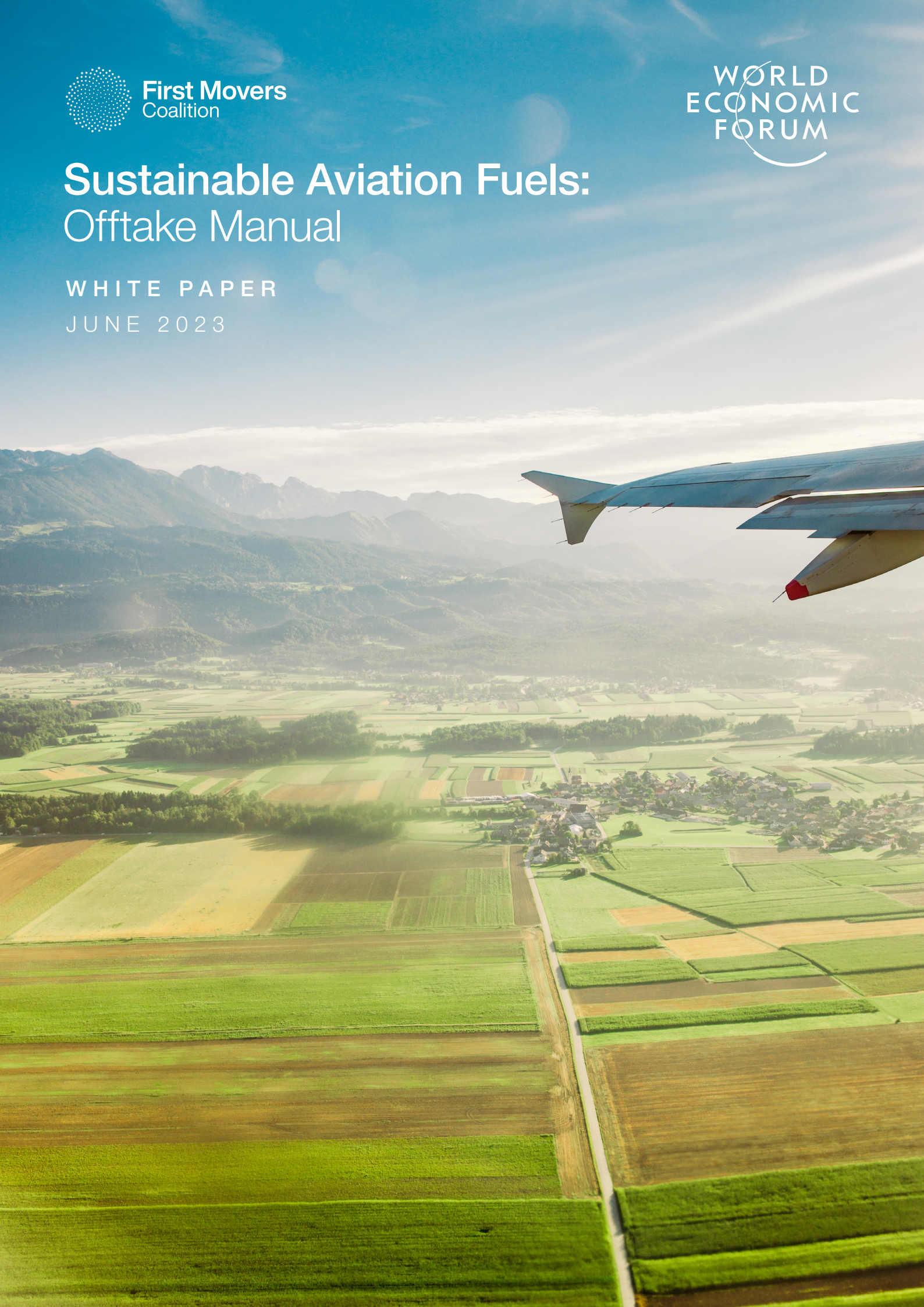
First Movers Coalition

WORLD ECONOMIC FORUM

# Sustainable Aviation Fuels: Offtake Manual

WHITE PAPER

JUNE 2023



**Images:** Getty Images

# Contents

# Executive summary

## FMC aviation's guide illuminates the path towards a 65% emissions reduction by 2050 via effective, streamlined sustainable aviation fuel procurement.

First Movers Coalition (FMC) aviation members have committed to adopting emissions reduction technologies, including sustainable aviation fuels (SAF). It is estimated that SAF have the potential to contribute to 65% of aviation emissions reduction to achieve net zero by 2050.[1] With the aim of accelerating decarbonization efforts in the lead-up to 2030, the FMC aviation community have produced this guide for purchasing SAF and SAF certificates (SAFc). It highlights key considerations and resources for fuel producers, airlines and corporate buyers of SAF and serves as a manual illustrating how to procure SAF. The intended audience is non-procurement specialists or novice SAF buyers seeking insight into what SAF offtake discussions entail.

**Making sense of SAF**

SAF offtake can be a complex venture. Although there is a lot of information available and relevant to SAF procurement and contracting, it is quite a fragmented knowledge landscape, and the process itself involves multiple players. The document contains a compilation of key resources and serves as a one-stop-shop for readers seeking information on SAF technology, SAF feedstock and sustainability, SAF economics and SAF policy and regulation. FMC aviation community members also feature practical experiences to call attention to gaps and address key questions.

**How to use this document**

For suppliers, the report lends a better understanding of the fuel purchaser's needs and also allows them to consider interests of corporate customers.

For airlines, the report explains technical, feedstock, economic and policy related aspects of SAF to raise awareness and enable successful offtake agreements.

Finally, for corporate buyers who have had varied experience in securing SAF scope 3 credits, the report shares best practices for procuring scope 3 credits by detailing key stakeholders, watchouts and accounting methods to make SAF offtakes more accessible especially for companies outside of the aviation space.

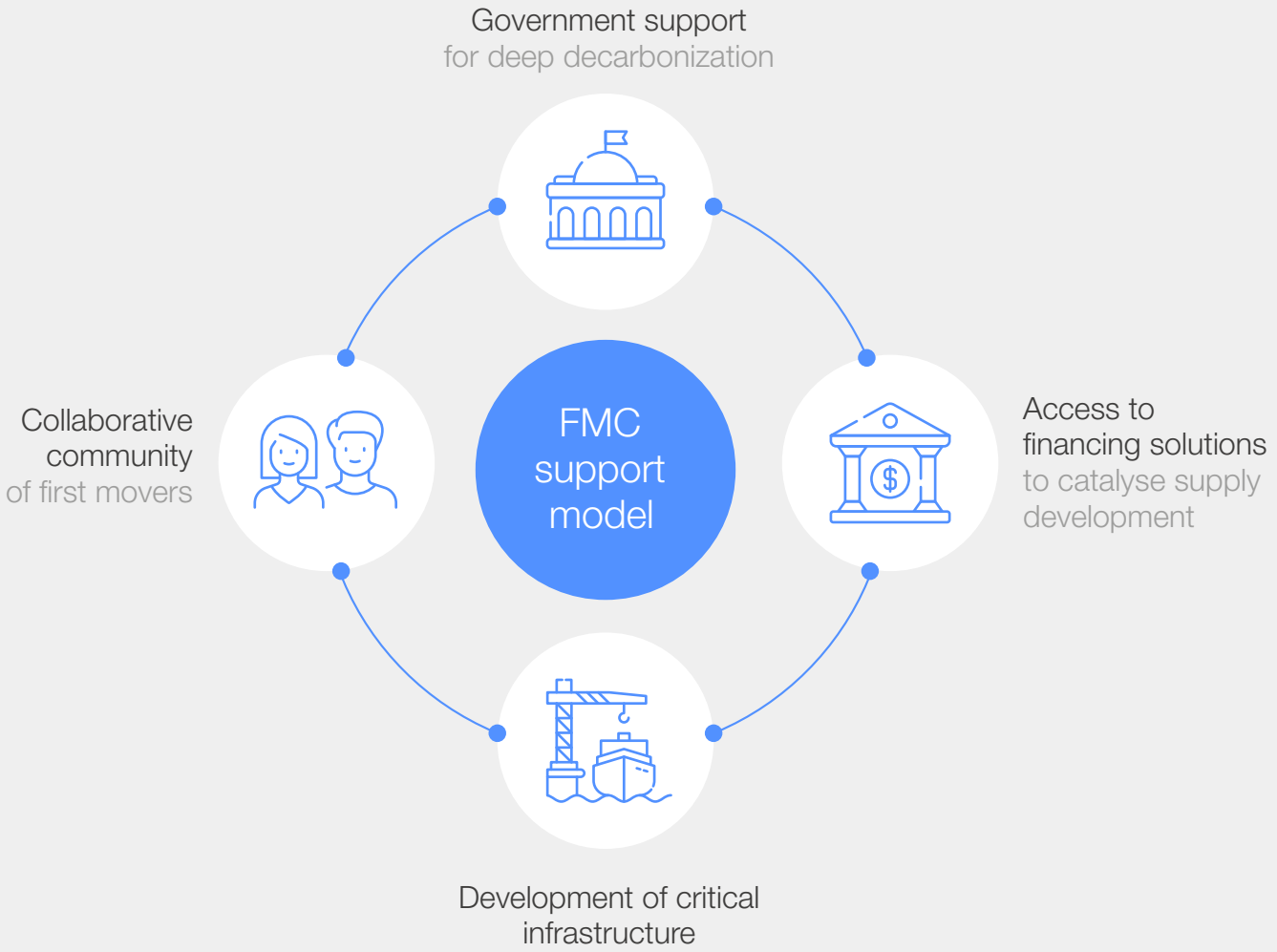
Ultimately, defining processes across the value chain and sharing best practice can contribute to decreased transaction costs and increased efficiency in securing SAF offtake.

# Introduction

## Using demand signals to accelerate deep industry decarbonization.

The First Movers Coalition (FMC) is a group of companies that use their buying power to create strong demand signals for innovative green technologies in seven hard-to-abate sectors. These sectors account for 30% of worldwide emissions, and if substantial advancements in clean technology innovation are not made promptly, this percentage is projected to surpass 50% by the middle of the century.[2] Details on each of the commitments can be found on the FMC webpage.

FIGURE 1 **The FMC partners and enabling environment**




### Aviation commitment

The FMC has set ambitious commitments for airlines, airfare and air freight purchasers:

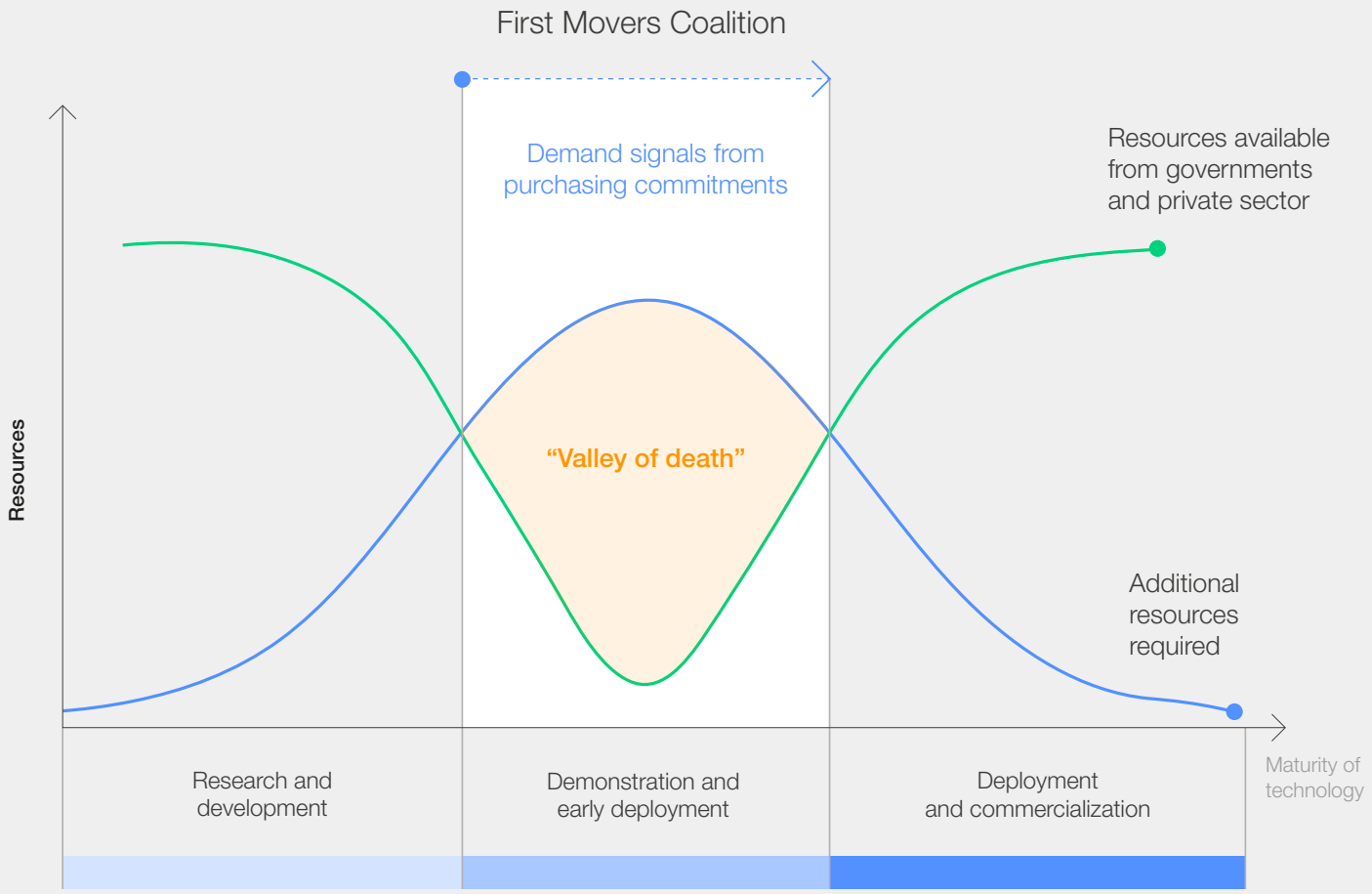
- **Airlines and air transport companies:** "By 2030, we will replace at least 5% of our conventional jet fuel demand with sustainable aviation fuels (SAFs) that reduce life-cycle GHG emissions by 85% or more when compared with conventional jet fuel and/or zero-carbon emitting propulsion technologies."
- **Airfare and air freight purchasers:** "By 2030, we will partner with air transport operators to replace at least 5% of conventional jet fuel demand for our air transport with SAFs that reduce life cycle GHG emissions by 85% or more when compared with conventional jet fuel and/or zero-carbon emitting propulsion technologies."

**Source:** FMC; Boston Consulting Group

The FMC partners with relevant initiatives, governments, financial institutions and other companies; and recognizes their actions to create an enabling environment.

Although formulating purchase commitments and aggregating demand against them is core to the FMC, the coalition's activities go beyond this. Other activities focus on supporting members in delivering on their commitments and moving to bankable demand commitments. This *SAF Offtake Manual* is an example of the activities the programme offers to its aviation members.

FIGURE 2 **Using demand signals to create a bridge across the "valley of death"**




**Source:** Markham, S.K., *Moving technologies from lab to market*, Industrial Research Institute, 2002, p. 32; FMC and BCG analysis.

## Sustainable aviation fuels' essential role in decarbonizing aviation

Sustainable aviation fuels (SAF) are derived from sustainable and renewable sources with low carbon footprints, such as used cooking oils, forestry residues and municipal solid waste. Efforts are under way to develop a pathway for producing synthetic SAF. When used as jet fuel, SAF can reduce the carbon intensity of air travel by up to 100% (in fact, it can even go negative) over its entire life cycle, depending on the choice of feedstock and technological approach. SAF have some key characteristics that position them as the most viable technology in the near term for decarbonizing the aviation sector, including:

1. **Immediate action:** In line with the Intergovernmental Panel on Climate Change's (IPCC) findings, the period between now and 2030 is crucial for emission reduction if global warming is to be limited to below 1.5°C. SAFs' compatibility with existing aircraft and fuel infrastructure eliminates the need for significant modifications to aircraft and airports, easing widespread adoption.

2. **Scalability:** Given sustainable feedstock availability and adequate investment capital, SAF production has the potential to encompass 10% of total jet fuel sales by 2030.

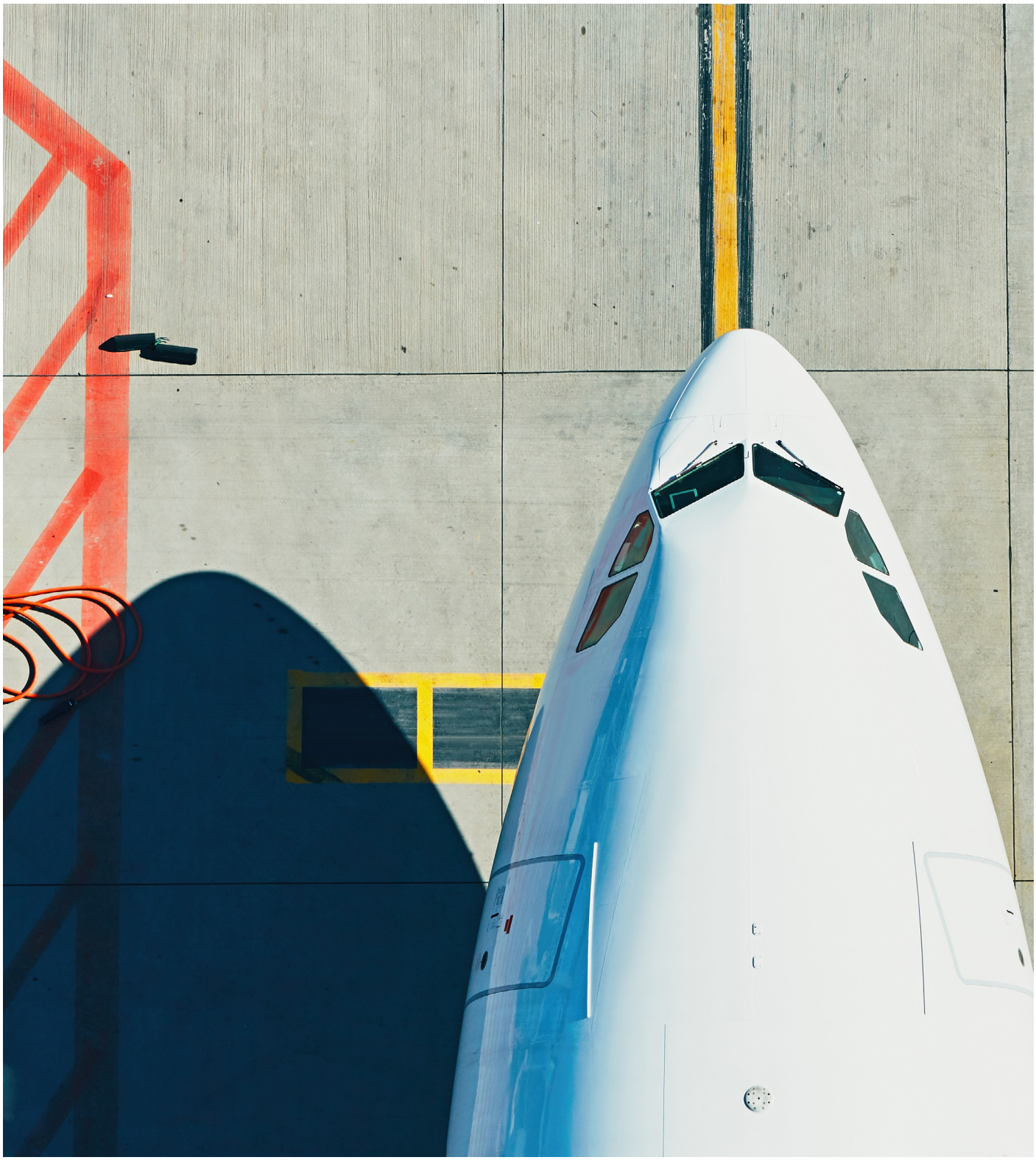
3. **Integration within the aviation value chain:** Currently, SAF stands as the only viable decarbonization solution within the aviation

industry. While hydrogen and electric flight technologies are expected to develop on a large scale in the coming decade, their suitability for long-haul flights remains uncertain.

4. **Co-benefits:** SAF production not only generates new high-quality green jobs but also introduces significantly lower levels of sulphur and particulate matter into the environment compared to fossil-based jet fuel. The SAF industry should use feedstocks to promote wider adoption, create employment opportunities and enhance energy security in many nations.

However, a significant barrier to the rapid expansion of SAF is its current price, which is at least two times that of fossil jet fuel. Nonetheless, as economies of scale come into play, the cost of SAF is expected to decrease. Currently, the cost of feedstocks surpasses the price of finished fossil-based jet fuel.

Unlike fossil fuels, feedstocks used in SAF production may require additional pre-processing before being refined. Moreover, higher transport costs, blending requirements with conventional jet fuel and fees associated with additional safety testing and certification contribute to the premium cost of SAF.



# 1 Key definitions

Critical insights to understand the path to a net-zero aviation sector.

## 1.1 What are sustainable aviation fuels?

**Sustainability is vital for assessing SAF and ensuring a thorough methodology for assessing emissions life cycle improvements and broader sustainability considerations.**

Sustainable aviation fuels are a safe replacement for conventional (fossil-based) fuel that can reduce carbon emissions. It is almost chemically identical to traditional jet fuel and can be created using different combinations of technology and raw materials, some of which can absorb carbon dioxide ($CO_2$). This process includes capturing $CO_2$ from the atmosphere and utilizing renewable electricity to produce SAF. Achieving a net reduction in $CO_2$ emissions when compared to fossil fuels of between 60% and 100% is feasible. Today, SAF must be blended with conventional kerosene in ratios of up to 50% SAF to ensure compatibility with aircraft, engines and fuelling systems. The aviation industry is working towards understanding any modifications necessary for commercial aircraft to be certified as safe to fly with 100% SAF in the future. Further, sustainability is vital for assessing SAF and ensuring a thorough methodology for assessing emissions life cycle improvements and broader sustainability considerations. The economics of SAF remain one of the key challenges for faster adoption, and policy intervention is seen as important for building the global SAF market. These days, SAF is the widely used term, however, in some cases or older documents, terms such as biofuel, renewable aviation fuel, renewable jet fuel, alternative fuel and biojet fuel may be used. These terms have similar intended meanings to SAF.

### SAF technology

The technology for producing SAF has been actively worked on for more than 15 years. There are currently seven SAF production pathways approved by the American Society for Testing and Materials (ASTM) International, with each pathway representing different processes for production depending on the type of feedstocks. A number of other pathways are also going through the rigorous assessment process for their viability for use in aviation. Each pathway has potential benefits such as feedstock availability and cost, total carbon reduction or processing complexity and cost. Some SAF pathways may be more suitable than others in certain areas of the world, depending on feedstock availability and processing capabilities. All pathways, however, have the potential to enable the aviation sector to reduce its carbon footprint significantly, assuming all sustainability criteria are met.

### SAF feedstock

Sustainable aviation fuel can be produced from a wide range of biogenic and non-biogenic feedstock. While the feedstock pool is diverse, strict criteria must be observed to be considered sustainable.

The aviation industry has been careful to promote only sustainably sourced alternative fuels, to avoid negative environmental impacts. Some of the feedstock used or expected to be used to produce SAF are listed in the following section.

TABLE 1 **SAF feedstock categories**

| Conversion pathway | Feedstock categories |
|---|---|
| **Fat-to-fuel** | Waste oils and fats: This typically comes from plant or animal fats and greases that have been used for cooking and are no longer usable for further cooking (used cooking oil), or as waste from food production (such as tallow). This is currently the most widely used feedstock for SAF production, but supply is not endless and even though it will continue to play a role in SAF, other sources will grow to form a larger portion of the market.<br><br>Cover crops or rotational oil seed crops such as camelina, carinata and pennycress that are grown in rotation with wheat and other cereal crops within the same year, when the land would otherwise be left fallow (unplanted) as part of the normal crop rotation programme. This provides growers with an opportunity to diversify their crop base and reduce monocropping (planting the same crop year after year), which has been shown to degrade soil and reduce yields and resistance to pests and diseases. With camelina, the leftover "meal" from the oil extraction can also be used as animal feed in small proportions. Carinata is a non-edible oilseed crop with similar promise. |
| **Waste-to-fuel** | Municipal solid waste: Carbon-based waste that comes from households and businesses. Some examples include: product packaging, grass clippings, furniture, clothing, bottles, food scraps and newspapers. There is great potential to use municipal solid waste as a sustainable feedstock, due to its vast supply. Rather than simply dumping municipal waste in a landfill site, where it will emit methane and other gases into the atmosphere, it can be used to create jet fuel instead.<br><br>Cellulosic waste: This comes from excess wood, agricultural waste (such as corn stalks), and forestry residues (branches and leaves that are not tradeable). These residues can be processed into synthetic fuel through proven chemical reactions (i.e. the Fischer-Tropsch pathway) or converted into renewable isobutanol or ethanol and, further, into jet fuel through the "alcohol-to-jet" (AtJ) pathway. Other pathways are also under development. |
| **Air-to-fuel** | Non-biogenic fuels: "power-to-liquid" (PtL) typically involves creating jet fuel from carbon sources such as industrial point source waste gases or, in the future, direct air captured carbon, combined with green hydrogen produced using renewable energy powered electrolysers. Alternatively, industrial waste gases can be converted into ethanol using biological conversion processes, and the ethanol subsequently converted into jet fuel. While direct PtL options are based on technically proven steps, the process is currently expensive and needs further technological and commercial development. |
| **Sun-to-fuel** | Solar jet fuel (or sun-to-fuel) uses highly concentrated sunlight to break up water and $CO_2$ molecules. These processes do not rely on waste resources or non-food crops, so there is theoretically an unlimited supply available, and this will likely make up a large proportion of SAF production in the future. |

**Source:** US Department of Energy, US Department of Transportation and US Department of Agriculture, *SAF Grand Challenge Roadmap Flight Plan for Sustainable Aviation Fuel*, 2022.

## SAF economics

The costs associated with producing SAF exceed those of conventional fossil jet fuel. Various economic frameworks exist for establishing a SAF production facility, including using diverse feedstocks and technology pathways and incorporating offtake structures or policy incentives. As a general guideline, the production cost of SAF is estimated between 1.5 times to 3 times that of conventional fossil jet fuel, depending on the maturity of the technology and feedstock logistics. ICAO has produced a SAF "rule of thumb" analysis, specifically generating results for estimated total capital investment (for pioneer and nth facility) and minimum selling price for the production facility to achieve the hurdle rate of return.[3]

### What are the major challenges?

The advancement and implementation of SAF face several challenges that restrict its progress. These include the cost differential between SAF and traditional kerosene, the existing elevated production costs associated with SAF, the scarcity of cost-effective and sustainable feedstock for SAF and the inadequate infrastructure for feedstock production. Additionally, limited investment and the high costs of financing the infrastructure for SAF fuel production pose obstacles. Moreover, competition for resources and incentives from other sectors like road transport and renewable power further complicates the development and deployment of SAF. There is also uncertainty on sustainability criteria and diverging views in different geographies (e.g. EU vs US).

Uncertainty on advanced SAF technologies and first-mover dilemma – everyone knows more technologies than hydroprocessed esters and fatty acids (HEFA) are needed. Still, investment into advanced technologies (especially power-to-liquid) is slow due to the first-mover dilemma and uncertainty regarding the right sub-route.

While SAFs' production cost exceeds conventional fossil kerosene, feedstock and production infrastructure will struggle to attract debt and equity capital, and SAF risks not being prioritized.

### What can improve the economic viability of SAF?

Any new industry typically has untapped efficiency improvement potential. This is often called the learning curve or economies of scale opportunity. This is typically true for SAF, with improvements in production technology, lower-cost feedstocks and larger-scale production facilities being great opportunities to improve SAF economics. The largest potential to improve SAF economics is through policy support.

TABLE 2 | **Main key pathways to produce SAF, with unique challenges and potential**

| | HEFA | Alcohol-to-jet | Gasification Fischer-Tropsch (FT) | Power-to-liquid |
|---|---|---|---|---|
| **Opportunity Description** | **Mature technology:** Safe, proven and scalable technology | **Technology in commercial pilot:** Potential in mid-term, given higher greenhouse gas (GHG) reduction possible vs fossil jet fuel; however, significant techno-economical uncertainty | | **Technology in development:** Proof of concept 2025+, primarily where cheap high-volume green electricity is available |
| **Feedstock** | Waste and residue lipids, purposely grown oil energy plants | Agricultural and forestry residues, municipal solid waste, purposely grown cellulosic energy crops | | $CO_2$ and green electricity: unlimited potential via direct air capture |
| **Cost drivers** | Price of feedstock accounts for majority of production cost and is market-driven, not likely to get cheaper<br>Cost of (green) hydrogen presents the biggest opportunity for HEFA production cost improvement | Refining ethanol into jet fuel presents biggest cost bucket<br>Both steps (ethanol production and jet production) are capex-intensive with decline potential in refining due to learning effects | Gasification-FT production cost is largely driven by capital cost<br>This process is highly flexible with regards to type of feedstock used, leading to wide projected range but high potential cost savings | Most uncertainty due to range of technologies and diverging cost of green electricity, as well as uncertainty on point-source carbon capture<br>Synthetic fuels should enable significant cost reduction potential, driven mainly by lower-cost electrolysers and scale effect |

**Source:** FMC and BCG analysis.

## SAF policy

The purpose of a policy is typically to change behaviour or an outcome. In the case of SAF, production facilities are not being built because the risk of not achieving a return on the project is high. Some of these risks are whether there is a market for the SAF, how predictable the feedstock and construction costs are, the cost of capital or new technologies that might displace the long-run value of SAF.

Long-term, stable policies are necessary to create a sustained market for SAF. The best policies for SAF development will likely vary for each state and region based on their unique climate, resources, political, social and economic factors. In the case of states with already well-developed renewable energy policies (e.g. for ground transport) or carbon legislation, there may be an opportunity to include SAF in those existing mechanisms. **Any offtake agreement for SAF should carefully note the policy framework in the construction jurisdiction and where the product may be used.** Applying policy advocacy in the context of offtake discussion is often relevant to find the most optimal economic conditions for developing a SAF project.[4]

# 1.2 How to account for SAF

Tracking the environmental benefits of SAF is important and must be considered before an offtake agreement. There are various established methods for doing this, but the four most common are:

- Identity preservation
- Physical segregation
- Mass balance
- Book and claim.

Identity preservation is unrealistic for SAF at any scale. It is more suited to something boutique in the food industry, where one might like to know the exact paddock or piece of earth their food is from and everything about it.

TABLE 3 **SAF accounting approaches**

| |  Physical segregation |  Mass balance |  Book and claim |
|---|---|---|---|
| **Description** | A physical segregation approach requires "separation" of different product streams (e.g. certified material from non-certified material) throughout the supply chain. This chain of custody approach delivers consignments that physically contain 100% of the specific product stream, but they can be from a variety of sources. It does not necessarily provide traceability back to the source of the feedstock (e.g. a specific farm or plantation) but could. Physical segregation can either be by location (e.g. separate storage or distribution channels) or by time (e.g. batch-wise processing or delivery) | A mass balance approach allows products with different characteristics to be physically mixed but kept administratively separate (think HEFA SAF from used cooking oil, where the oil has been collected from various restaurants). At each step in the supply chain, companies do not sell or produce more products with specified characteristics than they sourced. Mass balance is required in the EU under REDII.[5] | A book and claim approach enables the decoupling of the physical fuel from environmental attributes associated with the fuel. For the volume of SAF that is claimed to be used, it can be claimed that sufficient material with those characteristics has been added to the system (considering relevant conversion factors). A more complex approach might involve applying value to scope 1 and 3 emissions, encouraging non-physical fuel users to participate in these transactions. |
| **Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) considerations** | CORSIA recognizes eligible fuels. | Mass balance is accepted under CORSIA with the "control point" being the blend location, typically the airport. | CORSIA already includes some elements of book and claim chain of custody after SAF blending. |
| **Comparison** | Physical segregation is cost prohibitive due to green premium associated with SAF compounded by dual physical infrastructure. | Mass balance means more control points compared to book and claim and more limited supply options for SAF producers resulting in some SAF (or feedstocks) being shipped around the world to demand geographies. | Book and claim offers maximum flexibility for tracking the environmental benefits from SAF with an opportunity to accelerate uptake by injecting SAF into the aviation fuelling system at the most logical logistical locations (especially 2025-2035 while supply scales) in a manner suited to incorporate corporate demand. |

FIGURE 3 | **Book and claim chain of custody model**

**Source**: Roundtable on Sustainable Biomaterials, *RSB Book & Claim Manual*, 2021.

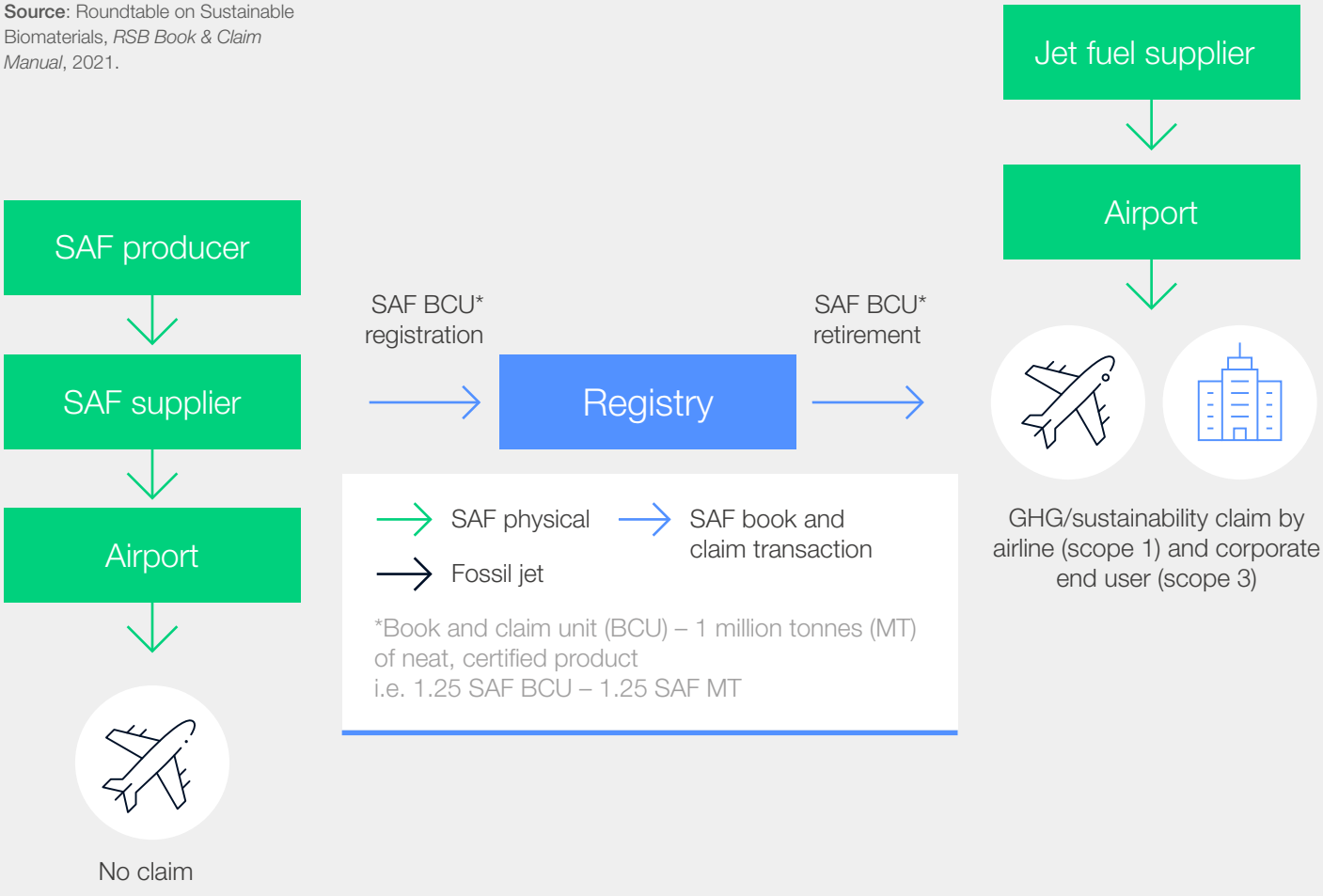
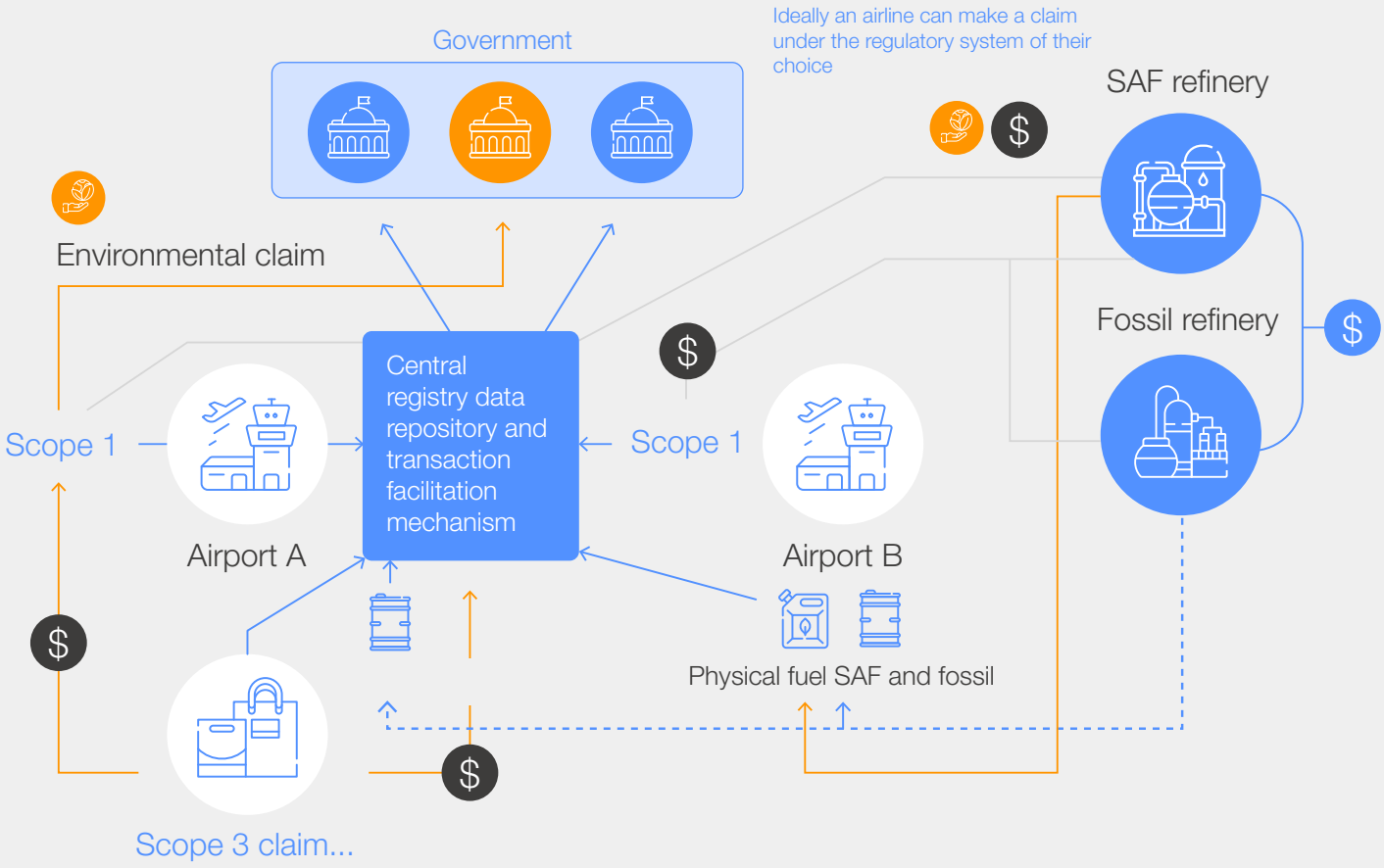


FIGURE 4 | **Potential global book and claim design concept**




**Source**: International Air Transport Association (IATA), 2019

**Note:** Once the fuel enters the airport it can be distributed to the wing via Joint User Hydrant Installation (JUHI), akin to a fuel farm book and claim.

## 1.3 What is a SAF offtake agreement?

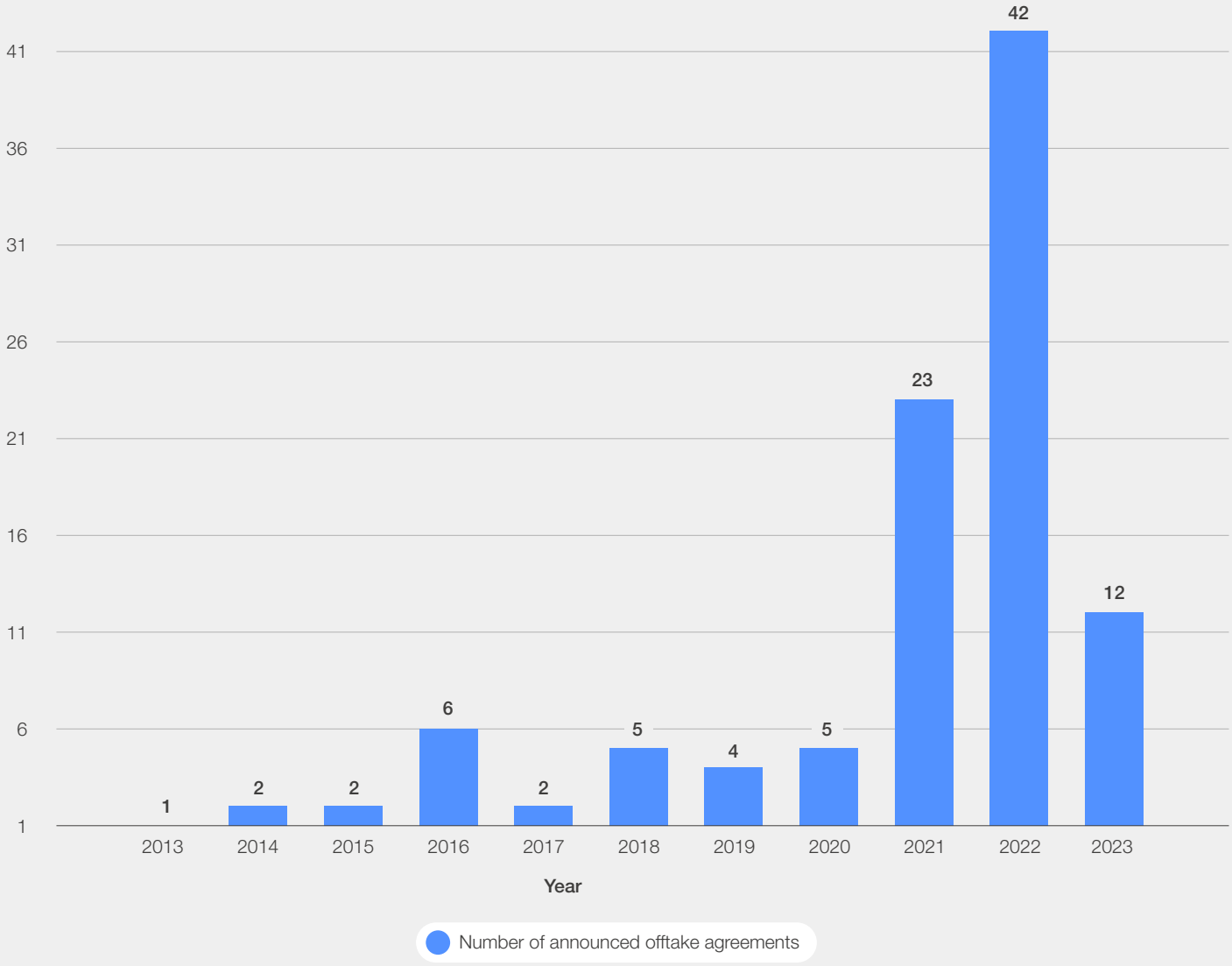
A SAF offtake agreement is an agreement between a supplier and a buyer to purchase a volume of SAF produced by a plant, either established or under construction. This agreement can take the form of a purchase agreement or a service contract. It should include several terms, but at the very least, it must cover:

- Record of the producer and the buyer
- Information on the airports where the product will be used
- Offtake production per year (SAF volume) provided
- Time horizon.

It is not uncommon for major airlines to have offtake agreements with a range of different suppliers to make use of as many stakeholders as possible in the SAF production industry. This helps to diversify risk while ensuring enough feedstock is available to suit their needs.

ICAO maintains a comprehensive log of disclosed offtake agreements for SAF. This record includes details of the producer and the buyer, along with supplementary information regarding the airports where the SAF will be used. When accessible, it also presents data on the annual offtake production. Figure 5 provides an overview of publicly disclosed offtake agreements involving global SAF producers and/or airlines. It is likely that the demand for SAF will only increase in the coming years, particularly as legislated SAF mandates in Europe enter into place.

FIGURE 5 | **SAF offtake agreements over the last decade**




*2023 ranks low because it only represents the first four months of the year.

**Source**: "ICAO SAF Offtake Agreement Tracker", *ICAO*, 2023.

# 2 Considerations for airlines and other SAF buyers

SAF have several unique characteristics that need to be considered by airlines during procurement.

Entering into a discussion for the procurement of SAF can initially seem straightforward. After all, airlines have deep experience buying conventional jet fuel while negotiating prices and logistics. However, SAF have several unique characteristics that need to be considered in an overall negotiation, and this will typically involve an expanded group of airline stakeholders relative to the traditional conventional fossil fuel procurement.

## 2.1 Introduction

When commencing research or preliminary discussion for a potential SAF offtake, it is valuable to include all the relevant stakeholders from the start. At a minimum, a basic level of the fundamentals of SAF is important and can be consolidated into four major themes:

- SAF technology
- SAF feedstock and sustainability
- SAF economics
- SAF policy and regulation.

## 2.2 Environment and sustainability department

This department should be involved from the start and will likely have identified the potential offtake opportunity. Specific expertise for understanding sustainability metrics and regulation will be essential. The sustainability expert should lead in assessing criteria such as the appropriateness of feedstock and what sustainability certification should apply. They will also be relevant for sustainability regulation and compliance. The sustainability expert will likely be the outward-facing expert to address why a particular offtake agreement was struck and how this contributes to the overall decarbonization strategy of the offtaker.

## 2.3 Fuel procurement

This team will have the skills and experience for executing conventional fossil fuel offtake and logistics supply agreements. Some of the SAF offtake considerations will be identical to a conventional fossil fuel offtake, and the fuel procurement experts will need to work closely with the sustainability experts throughout the offtake process. The fuel procurement experts will lead on traditional energy relationships, blending criteria and compliance with technical fossil fuel specifications. Typically fuel procurement will negotiate fuel delivery terms, particularly where variable pricing applies to logistics.

## 2.4 Finance

Including the airline finance team early in the potential offtake discussion is important as they will finance the transaction and want to understand potential supply or currency risks. Some airlines implement hedges to protect against fuel price volatility or exchange rate movements. West Texas Intermediate (WTI) or Brent crude is commonly used today as a proxy for jet fuel, and derivative or futures contracts can be structured to protect against large price movements in jet fuel. As SAF transactions become larger, treasury teams will likely seek to understand the price drivers of SAF and whether these can be hedged. Additionally, it is worth noting that the term of a SAF offtake agreement has the potential to be longer than that of a conventional fossil jet fuel offtake agreement. This aspect makes it an interesting consideration.

## 2.5 Maintenance, repair and overhaul

Maintenance, repair and overhaul (MRO) is often the overlooked department in a SAF offtake as they are typically not explicitly required for signing the agreement. However, it is likely that information about a pending agreement will be more widely shared before signing the agreement, which, if MRO has not been adequately informed, can prompt questions including: Will this impact the maintenance cycle of the aircraft? Are there performance issues? Or, is this fuel safe? These are simple but important questions to address, and MRO leaders are important members to include in the offtake awareness from the start.

## 2.6 Government relations

Increasingly, SAF use is being required or will be required in many jurisdictions. ReFuel EU is one example that will impact many aircraft operators from 2025. Further, SAF is included as an eligible method to reduce a compliance obligation under CORSIA. To date, many of these regulations have slight variations regarding the eligibility of feedstock or thresholds for carbon intensity reduction or even accepted methodology for calculating the life cycle performance of the SAF. While government relations will not necessarily be involved in technical reporting and verification of SAF, they can play a valuable role in policy-maker interactions and advocating for mutual recognition and harmonization of standards, reducing compliance complexity and inefficiency for aircraft operators.

## 2.7 Legal

The airline legal experts will be essential in the SAF offtake process. Unlike a traditional fossil jet fuel offtake agreement, a SAF offtake can have significantly more negotiated variables such as feedstock conditions, sustainability conditions, volume and timeframe variables, compliance and regulatory conditions, and specific financial conditions, potentially including project equity and associated off-ramp clauses. The deeper the subject matter understanding from the legal team, the faster the agreement will proceed. It is recommended that legal engage with the environment and sustainability experts early in the offtake process to build a basic SAF knowledge foundation.

## 2.8 Corporate communications

When an airline procures its annual jet fuel needs as fossil fuel, it will not be accompanied by a press release. However, because SAF are so closely linked to the aviation industry's decarbonization strategy and because SAF are still relatively new and often involve less-known producers using novel technology and feedstock, companies share this news via a press release. Furthermore, corporate communication will be the coordinating company voice for media enquiries or the inclusion of detail in annual reports or executive-level presentations. It is a major advantage if the corporate communication team has a foundational understanding of SAF, especially understanding sustainability and feedstock and how SAF align with the whole of the industry decarbonization strategy.

## 2.9 Executive committee

It can be easy to overlook the airline executive committee until the later stages of an offtake discussion, although with many airlines now having an executive-level chief sustainability officer and SAF generally being a core element of strategy, this is less likely but remains an important point. Particularly for an airline engaging in the first offtake discussion, it is vital to have senior management support, especially the chief executive officer, chief financial officer, chief operations officer and chief sustainability officer. While the executive committee are unlikely to negotiate the fine print, they will be interested in some detail and a lot more than a conventional fossil fuel offtake. Helping the executive committee build foundational SAF knowledge early in the SAF offtake process will expedite the time to reach an agreement.

# 3 Corporate buyer perspective

Corporates looking to reduce their scope 3 emissions can demonstrate long-term durable demand for SAF and its environmental benefits.

## 3.1 Introduction

The involvement of the private sector is crucial in promoting the adoption of SAF. Corporate travellers represent businesses whose employees frequently engage in air travel using commercial airline-operated aircraft. As companies seek ways to tackle scope 3 emissions within their supply chains, a growing number have demonstrated their willingness to contribute financially towards emissions reduction by using SAF.

### From offsetting to insetting

In contrast to offsetting, which focuses on emissions reduction or prevention through initiatives like tree planting or cleaner cooking methods, insetting offers a more direct approach to travellers. By purchasing SAF, travellers can directly contribute to eliminating emissions throughout the aviation life cycle. Using SAF in flights replaces conventional jet fuel, ensuring that carbon stored in fossil fuels remains untouched underground. Furthermore, any $CO_2$ generated during SAF combustion is absorbed during the production process itself. Insetting, as a result, directly supports the decarbonization of the aviation sector.[7]

### How to inset with SAF?

A number of airlines provide passengers with the opportunity to buy SAF directly when making their bookings. Additionally, business jet users may be able to purchase SAF directly from their fuel supplier at select airports. Another avenue for SAF procurement is through specialized purchase platforms, where consumers can calculate their travel-related emissions and choose the percentage of emissions they wish to mitigate by purchasing SAF. These dedicated purchase sites offer a convenient means for individuals to actively participate in reducing their carbon footprint through SAF use.

### Best practices from FMC members

First Movers Coalition aviation members have had varied experience in securing offtake for SAF generally and SAF85 in particular, a process which requires a clear understanding of production pathways, feedstock and life cycle analysis (LCA). Accelerating the uptake of SAF85 uptake is heavily dependent on streamlining member interaction with suppliers. Exchanging best practices from prior SAF purchases will help to decrease the associated transaction costs of securing new offtakes. In this section, best practices from FMC members have been sourced.

> **Companies always ask how much SAF should I buy? And the answer, always, must be – what the climate science dictates. Convert carbon to gallons of SAF (~1 million tonnes of $CO_2$ equals ~112 gallons of HEFA-based SAF) and replace approximately 50% of jet fuel with SAF by 2030 and 100% by 2050, depending on company-specific trajectories and science-based/net-zero targets. If SAF procurement at such high levels is not immediately feasible for your company, then start small and scale fast – it is easier to build the business case based upon real-life experience. The ambitions set forth by Clean Skies for Tomorrow targeting 10% SAF by 2030 and First Movers Coalition targeting 5% of 85+ SAF by 2030 – are great guideposts. There is no time like the present, to invest immediately, for high quantity and quality SAF to exist in future.**
>
> Nora Lovell Marchant, Vice-President, Global Sustainability, American Express Global Business Travel

**What is a scope 3 credit for SAF?**[8]

By using scope 3 credits, companies can attain GHG emissions reductions for their air transport activities without taking ownership of the physical SAF or being responsible for its safety considerations and liabilities. This decoupling of the physical SAF from its environmental attributes eliminates the need to manage administrative tasks, or bear transport costs related to delivering SAF from the production site to the airport aviation fuelling system. In essence, this approach allows firms to benefit from emissions reductions associated with SAF without the logistical and operational burdens typically associated with its physical handling.

These guidelines only apply to corporate travellers that make use of commercial airlines. In the case of companies with private aircraft, the methodology differs. This section provides recommendations and step-by-step instructions for corporates willing to fly on SAF in exchange for scope 3 credits.

BOX 1 **How does a sustainable aviation fuel certificate (SAFc) scope 3 credit work?**

- The fuel producer generates eligible SAF from sustainable feedstocks and is issued with a corresponding number of SAFc based on either a volumetric calculation or an emissions-based calculation.
- The producer can then sell the actual SAF produced and the virtual SAFc credit that was issued separately.
- The SAF buyer can claim the emissions reduction value of the sustainable fuel itself once consumed (scope 1), depending on local regulations.
- The eventual buyer of the SAFc – an air transport customer such as a corporate can retire the certificate and claim the related scope 3 emissions reduction.
- SAFc helps address the supply and demand deadlock that is limiting the growth of SAF, catalysing additional demand for SAF by generating new funding that can be used to cover this premium.

**Source**: World Economic Forum, *Sustainable Aviation Fuel Certificate (SAFc) Emissions Accounting and Reporting Guidelines*, 2022.

## 3.2 Procuring and contracting SAF

As discussed in the previous section, the first step is distinguishing between what is being bought: the physical SAF or its environmental attribute through a scope 3 credit. The primary emphasis for most corporations will be on obtaining scope 3 credits for the environmental attributes of SAF, while the ownership of the physical fuel volume remains with the producers/suppliers and airlines.

This preference arises from the recognition that involving organizations outside the aviation industry in the physical fuel supply chain is both impractical and burdensome. Therefore, corporations choose to focus on securing the environmental benefits of SAF through scope 3 credits without assuming the complexities associated with managing the physical fuel supply.

BOX 2 **Example: Neste's corporate buying programme**

Companies contract scope 3 credits with the fuel producer (Neste), pay the SAF premium, and then Neste will deliver its SAF to partner airlines. While doing so, Neste provides visibility of impact to its customers through reporting and documentation.

**Source:** Neste's corporate buying programme; Freed, Jamie, "Corporate travel propels boom in sustainable aviation fuel", *Reuters*, 8 December 2022, https://www.reuters.com/business/aerospace-defense/corporate-travel-propels-boom-sustainable-aviation-fuel-2022-12-07/.

Corporate procurement of SAF is a complex process involving several players that range from high-level executives to legal departments. As such, an extensive internal alignment is necessary for SAF investments, which can be time-consuming.

TABLE 4 | **Key stakeholders for corporate buyers of SAF**

| | |
|---|---|
| **Chief executive officer (and broader executive committee)** | Tone at the top mission is critical. If you don't have C-suite buy-in yet, then build the business case for your executives.<br>– Secure consensus among a small cohort of senior leaders before pitching to the chief executive officer. |
| **Chief sustainability officer** | SAF helps your company – and the world – achieve science-based and net-zero GHG emissions reduction targets.<br>– Note that a chief sustainability officer would also have questions about biodiversity and community implications as well as sustainability criteria and food supply, for example. If you don't have this expertise, there are plenty of consultants and non-governmental organizations ready, willing and able to help you, e.g. Sustainable Aviation Buyers Alliance (SABA).<br>– Involve at least one person from the reporting side of the company to ensure that proper emissions reduction accounting and disclosures occur (including audit trail). |
| **Chief financial officer** | SAF is a premium product that will require a significant investment.<br>– One option to fund SAF is to implement an internal carbon pricing to create a self-sustaining budget and funding mechanism for SAF and other decarbonization solutions.<br>– Combine the premium price of SAF within your science-based/net-zero targets and carbon pricing to account and budget for reductions, offsets/insets and remaining removals. |
| **Procurement department** | SAF can be procured via airlines, fuel producers and service providers such as travel management companies or logistics service providers.<br>– A diversified portfolio can help mitigate procurement risk because SAF supply is scarce and projects can get delayed or cancelled. Depending on the volumes and LCA, SAF may not be available for 12 to 24 months further underscoring the importance of getting started as soon as possible on procurement and contracting due to limited supply and timing delays.<br>– Purchasing SAF does not necessarily require a formal bidding process as SAF can be immediately procured via your existing business partners. |
| **Commercial departments** | Perform a 360° review of your clients, investments and ventures, vendors and suppliers to identify parties already producing, supplying, financing or developing SAF and related technologies. |
| **Legal department** | SAF contracting is legally complicated. If it goes wrong in the first couple of instances, it may taint the whole market. It is worth taking the time to get it right.<br>– Engage the legal department from the very first moment. |
| **Travel department** | – Your head of travel has probably already sorted this, so be sure to engage them. |

# 3.3 Watchouts for SAF procurement

BOX 3 **Key considerations before purchasing SAF:**

a. Not all SAF are the same: sustainability criteria
b. Claiming emissions reduction is a multi-step process
c. Emissions accounting and reporting
d. Physical SAF are not available in all airports (yet)
e. $CO_2$ calculations vary
f. The price may seem high (because it currently is)
g. Stakeholder alignment

## a. Not all SAF are the same: sustainability criteria

SAF describes non-conventional (fossil-derived) aviation fuels produced from biological (plant or animal material) and non-biological sources (e.g. municipal waste or waste $CO_2$). SAF are typically produced using a range of technological pathways and feedstocks. SAF are known as "drop-in" fuels because little to no change needs to be made to aircraft or infrastructure, and they can be blended with conventional jet fuel.

To produce SAF, the industry needs to tap into a range of options, as no single sustainable feedstock will answer every need. Given the range of feedstocks, production methods and locations, the final emission reduction of a given batch of SAF may therefore differ. However, one of the benefits of purchasing SAF through a book and claim system is that all of this is considered. The volume of SAF purchased is adjusted to match the $CO_2$ the flight generates.

Consider getting third-party support to navigate complexity and improve transparency, given that this space is constantly evolving.

## b. Claiming emissions reduction is a multi-step process

Many travellers, especially corporate travellers and their organizations, will need to provide proof of $CO_2$ reduction for mandatory or voluntary emissions reporting procedures. SAF certificates are the way to do that.

Some SAF producers and airlines provide companies with the option of reducing air transport emissions through direct SAF credits purchase. A certificate of credit for the $CO_2$ reduction should be available once the SAF order volume has been used. Corporates select and commit to paying for an annual SAF volume based on their targets. All delivery and emission claims are verified by an independent third-party auditor, with each member receiving an annual impact report.

Purchasers should be aware that SAF supplies are limited, and as such, it may take several months for the SAF purchased to be delivered to an airport and used in an aircraft. It is, therefore, important that corporate travellers in particular check that the chosen supplier (airline or purchase platform) will:

1. Issue a certificate
2. Do so within a timeframe that meets corporate or personal reporting requirements.

❝ Purchasers should be aware that SAF supplies are limited, and as such, it may take several months for the SAF purchased to be delivered to an airport and used in an aircraft.

## c. Emissions accounting and reporting

Corporates should account for and report total business air travel emissions under scope 3 category 6, which should comprise LCA emissions of the associated airlines. The emissions calculation should be based on the consumption and life cycle emissions of conventional jet fuel. The data used in the calculation will be both activity-based primary data as well as third-party-provided secondary data. Some sample calculations can be found in Appendix 1 of the *Sustainable Aviation Fuel Certificate (SAFc) Emissions Accounting and Reporting Guidelines*.

**Carbon accounting vs financial accounting**

SAF are accounted for upon consumption; when the fuel is burned in an aircraft.

– Engage your audit and finance teams early and often to ascertain how your company plans to account for SAF on an annual basis with respect to consumption and expenditure on fiscal timelines. These analyses take time because carbon accounting and financial accounting are not the same.

Additionally, it is worth considering that SAF scope 3 reductions are not necessarily accounted

> SAF are currently produced in a limited number of locations and not transported widely (doing so would increase its life cycle emissions).

for when the SAF is burned – you can carry the certificate to claim emissions reductions.

- In order to enable this, the development of standardized accounting and reporting guidelines is of utmost importance. This will facilitate the recognition and use of SAF's environmental attributes while ensuring environmental integrity and preventing any potential adverse consequences.

- Incorporating SAF scope 3 credits into international GHG accounting standards such as the SBTi[9] and Greenhouse Gas Protocol (GHGP) is important to accelerate the speed and scale of investment required to decarbonize the aviation sector and others. Ultimately, the expectation is that SAF scope 3 credits will become the go-to option for institutional air transport customers to address their air transport emissions, increasing the use of SAFs and driving down air transport emissions.

## d. Physical SAF are not available at all airports (yet)

SAF are currently produced in a limited number of locations and not transported widely (doing so would increase its life cycle emissions). This means they are not available at all airports. As a result, the industry uses a book and claim system. This is similar to the common approach of purchasing "green" electricity. There are two impacts of purchasing via a book and claim scheme.

1. While SAF may not be available for the travellers' specific flight, the purchase puts the volume of SAF consumed into the global fuel supply. Therefore, this displaces the purchase of conventional fuel, reducing the volume of fossil fuels being burnt and the associated emissions.

2. Any SAF purchased also helps strengthen demonstrable demand, ultimately leading to a systemic increase in the volumes of SAF produced.

For further information on the purchase of SAF and how book and claim systems enable these kinds of purchases, refer to:

- World Economic Forum, *Powering Sustainable Aviation Through Consumer Demand: The Clean Skies for Tomorrow Sustainable Aviation Fuel Certificate (SAFc) Framework*, 2021.

- World Economic Forum, *Sustainable Aviation Fuel Certificate (SAFc) Emissions Accounting and Reporting Guidelines*, 2022.

## e. $CO_2$ calculations vary

Airlines and purchase platforms typically estimate the $CO_2$ emissions caused by the fossil fuel needed for a particular flight and bring the respective amount of SAF into airline operations to fully account for those emissions. However, the exact methods used to calculate $CO_2$ and the volume of SAF to purchase for a given flight may differ across platforms or airlines based on the variables included in the calculations. Variables that may influence this include the type of SAF, fare class, routing and aircraft type to name a few.

**Be careful how much $CO_2$ reduction you claim**

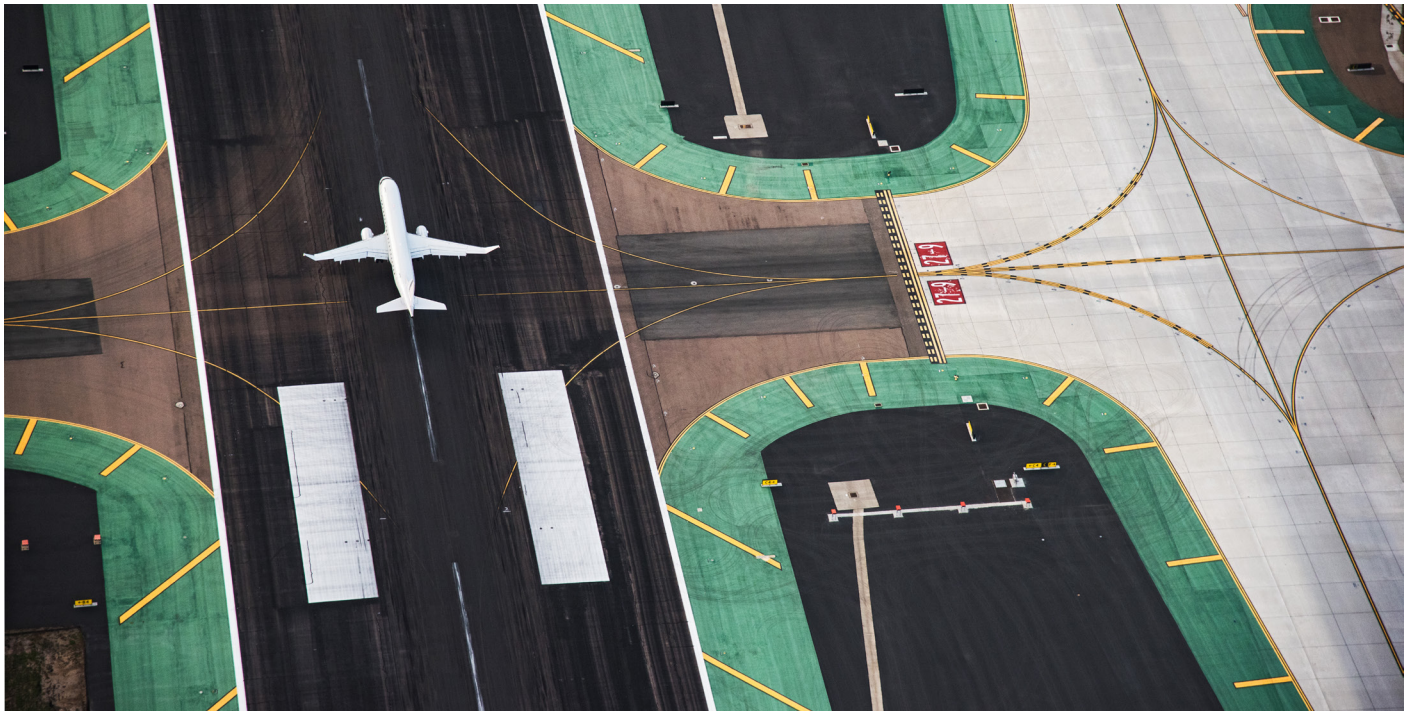
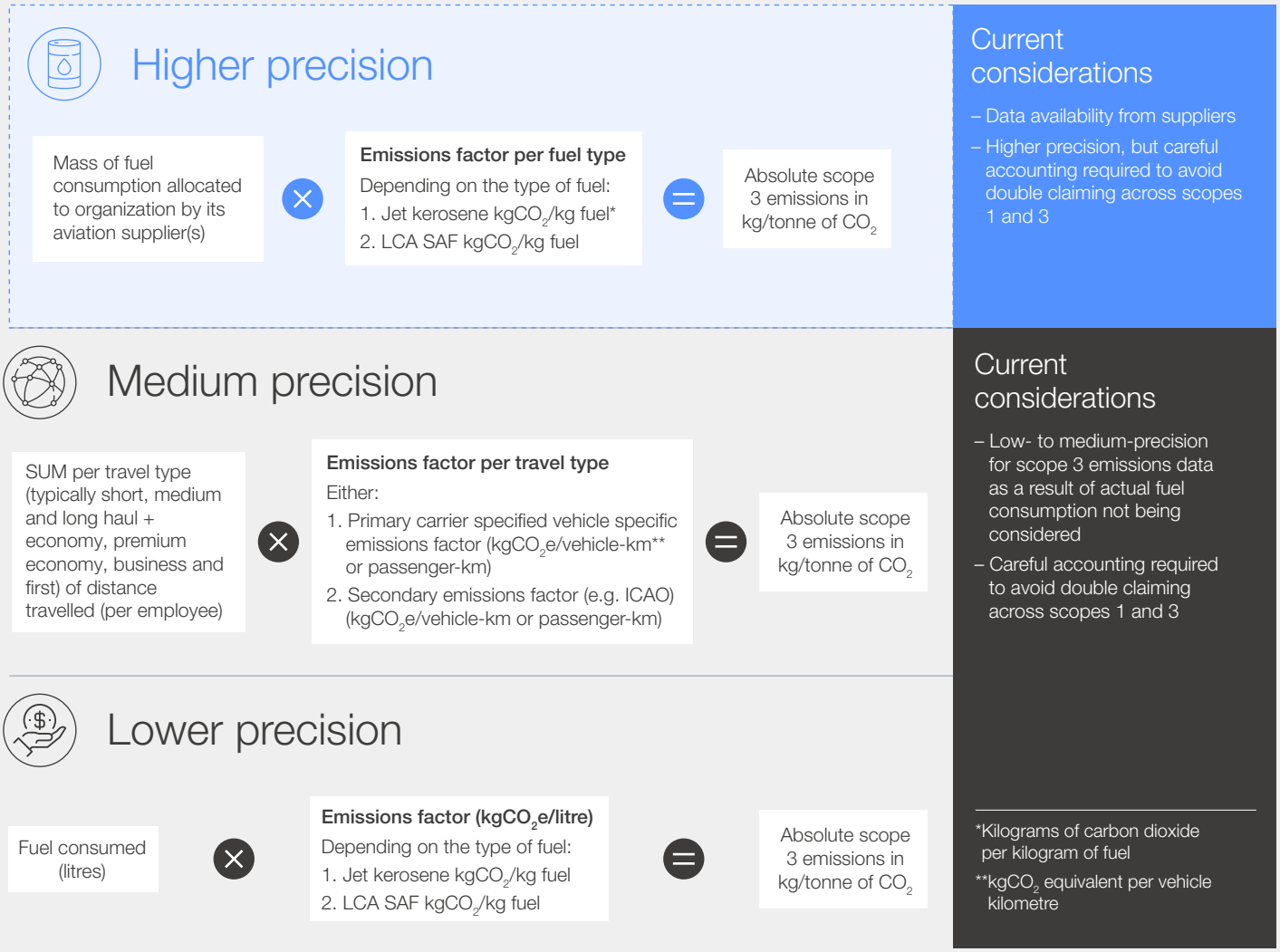


FIGURE 6 | **Calculating scope 3 emissions**




**Source:** World Economic Forum, *Powering Sustainable Aviation Through Consumer Demand: The Clean Skies for Tomorrow Sustainable Aviation Fuel Certificate (SAFc) Framework*, 2021.

## f. The price may seem high (because it currently is)

As a nascent market entrant, SAF currently have a price premium of at least twice that of conventional jet fuel. However, as demand surges, concerted efforts are underway to develop novel technologies and establish new facilities aimed at enhancing production efficiency and expanding the availability of SAF. Budget is always an issue. Carbon pricing is recognized by the world's leading economists as the best way to align profit motive with the imperative to cut emissions and so unleash the power of markets to reallocate capital quickly and efficiently. Introduce a carbon price to create a budget to pay for SAF, which can be equally scaled to other decarbonization solutions.

## g. Stakeholder alignment

Grounding the SAF approach in a corporate's purpose and strategy is highly important. Ultimately, with all uncertainties on accounting, quality and other standards, the key decision factor needs to be, "Is it the right thing to do for clients, the planet etc.?" more so than, "Can the impact be reflected in the footprint?"

While it is necessary to invest in SAF, don't underestimate the time or politics – be patient to build consensus and impatient to get the job done.

BOX 4 | **Deloitte's experience pioneering early SAF transactions**

Deloitte purchased the right to claim scope 3 emissions reductions and avoided the emissions from over 15,000 metric tonnes of carbon dioxide.

One challenge identified in the pilot was the lack of a standard for calculating emissions benefits – something that could be useful for scope 3 SAF buyers. Future SAFc guidance should provide a standard method for all airlines and customers on a well-to-wake basis.

In addition to sustainability assurance, it's critical to structure SAF transactions and their outcomes in a standardized way to enable this market to scale efficiently and credibly.

Standardization and transparency of claims (and the data that underlie them) are important as they allow buyers to compare fuel attributes on an equivalent basis and send a clear signal for the highest integrity SAF through SAFc purchases.

For instance, feedstock disclosure allows differentiated demand and favourable pricing for the most sustainable options. This would let corporations interested in purchasing scope 3 emissions reductions, like Deloitte, credibly claim and disclose the sustainability attributes associated with their SAF certificate purchases.

**Source**: Connell, Allison, Duncan Masland and Lisa Newman-Wise, *Pioneering early SAF transactions: Takeaways and lessons learned*, Deloitte, 2021.

## 3.4 Risks involved in SAF scope 3 emissions reduction

a. **Sustainability framework development**

Setting a robust framework to support high-integrity SAF by evaluating emissions over the entire life cycle of the fuel, establishing sustainability criteria, ensuring an emission reduction impact and adopting a transparent accounting approach that prevents erroneous double counting.[10] There is a need for added transparency and best practice difference in criteria of how sustainable the SAF is due to different choices in the upstream.

b. **Avoiding scope 1 and scope 3 erroneous double counting**

To ensure the credibility of any climate solution, it is imperative to avoid the flawed practice of double counting emissions reductions. This occurs when multiple entities assert ownership over the same emissions reductions within the same scope. For instance, when an aircraft operator procures SAF, the scope 3 benefits need to be distributed proportionally among all its customers.

c. The use of SAF scope 3 credits presents a perceived risk of multiple claims to reductions in scope 3 emissions. For instance, erroneous double counting may transpire when an air transport customer reduces its scope 3 emissions through SAFc. In this scenario, the partnered aircraft operator benefits from the associated scope 1 emissions reduction enabled by SAFc. Consequently, the aircraft operator's other customers who are not part of the SAF credits partnership might erroneously assume that they can assert a portion of the scope 3 emissions reductions attributed to the SAF facilitated by SAFc.

d. **Tracking and registry development**

The implementation of a robust book and claim process, along with a registry system, is necessary to effectively scale, allocate and retire the entitlements associated with claiming the environmental attributes of SAF. Such a system could help ensure the integrity of the process and safeguard the accurate tracking and management of SAFs' environmental attributes.

It is crucial to prioritize learning from other sectors and avoid duplicating their mistakes or complexities. In various sectors, multiple standards coexist,[11] each maintaining its independent registry. However, this diversity of "standards" and "registries" has raised questions regarding effectiveness. Therefore, it is essential to draw lessons from these experiences and strive for a unified approach that ensures transparency, reliability and credibility to mitigate these challenges.

Currently, there is no centralized meta-registry for SAF certificate transactions, which creates challenges around transparent emissions reduction reporting and accounting – which the industry is working to solve. The following are some examples:

– Avelia is a blockchain-powered book and claim system powered by Shell Aviation and Accenture with support from Energy Web Foundation together with American Express Global Business Travel and used by airlines

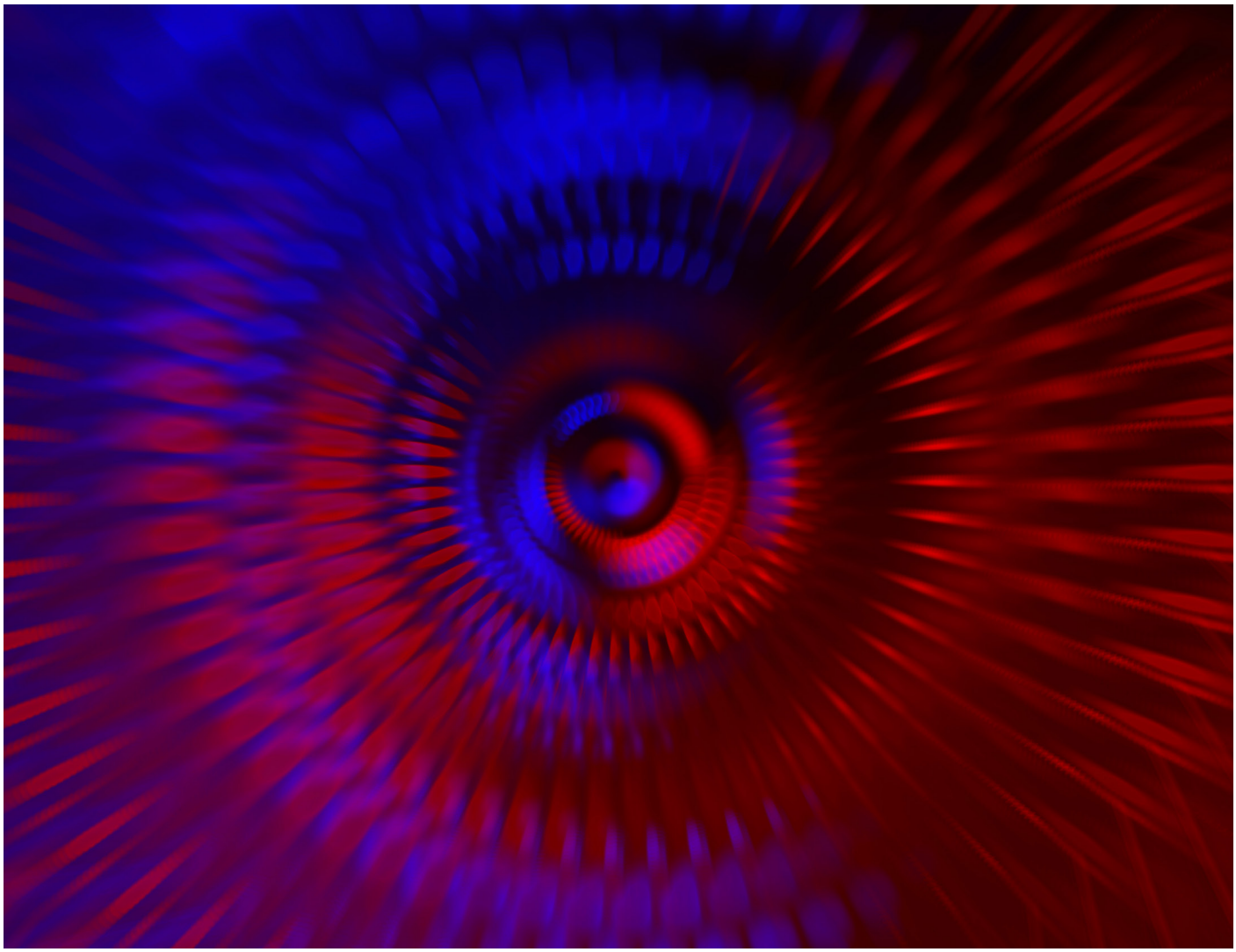
Cathy Pacific, Alaska, Delta, Jet Blue, alongside corporate buyers.

- The SABA, RMI and Energy Web are building a digital SAFc registry. The *SAFc Registry Rulebook* outlines features of the registry system and provides details on application including “issuance, holding, transfer and retirement” of SAFc.

- *RSB Book & Claim Manual*

e. **Price fluctuations and market volatility**

The SAF landscape is not yet a stable market as this is a relatively new innovation and prices are expected to fluctuate over time. However, demand aggregation and offtake contracts from corporate buyers through SAFc purchases will stimulate the market and incentivize suppliers to advance and accelerate SAF production, ultimately lowering the price premium.



# 4 Supplier perspective: SAF offtake template

## SAF offtake agreements are the best supply acceleration catalyser.

Conventional jet fuel purchase agreements should structurally only need modest amendments to accommodate SAF, but the detail of these amendments will be important.

## 4.1 Introduction

In most cases, the seller of the fuel will typically be one of the following four parties:

- SAF producer
- Petroleum refinery
- Blender
- Airport fuel depot.

In all cases, purchase agreements should list the agreed conditions for fuel specification, SAF tracking, sustainability certification and the assignment or ownership of any renewable energy and carbon credits, including scope 3. Standard insurance is part of a fossil fuel offtake and should be the same as a SAF offtake and typically covers third-party liability and business-related risk.

## 4.2 Potential changes to fossil templates

Some of the potential changes to the standard fossil fuel supply agreement (generally referred to as the specimen agreement) could include the following:

- General terms and conditions
- Location agreements
- Safety, quality and operations terms and criteria
- Administrative arrangements
- Service agreement

The specimen agreement is a master agreement that establishes the overall framework of the agreement, including scope, parties, duration, pricing mechanism, point of delivery and insurance. In addition, it typically includes all annexes by reference. The advantage of this structure is that it allows for changes to the annexes without having to re-negotiate the entire agreement. This is particularly helpful with respect to the location agreements as these are likely to be modified from year to year to reflect changes in the operation of the airline, such as contracted volumes and prices.

Some of the changes that are expected to be incorporated into this type of agreement to include SAF are discussed below.

### Potential changes to the specimen agreement:

Changes in the specimen or master agreement could include the following:

- **Scope:** This section can serve to educate the nature of the inter-party dynamics, the projected timeframe, and the aggregate volumes of SAF to be negotiated, along with any overarching guiding principles that the parties wish to articulate.
- **Prices and price adjustments mechanism:** Typical price arrangements for conventional jet fuel include market prices and formula prices. Market prices are fixed for a period of time, while formula prices are based on a published market price index that varies periodically (e.g. daily, weekly or monthly). To the extent that the price for the SAF may be determined differently,

> A main reason for an airline to procure the SAF is to receive environmental and other credits associated with the use of SAF.

those modifications could be incorporated here or directly into the location agreements.

- **Point of delivery:** This could be a good place to specify where delivery of the blended SAF would occur, for example, at the airport fuel farm (e.g. into-storage) or at the wing of the aircraft (e.g. into-wing). The point of delivery may also be different at different airports; therefore, it could also be specified in each location agreement.

- A key consideration that is not currently contemplated in the aviation fuel supply model agreement (AFSMA) is how and where blending will take place.[12] In particular, it should be determined which party will be responsible for blending and for ensuring that the blend meets the ASTM D7566 specification. The blend ratio should also be indicated; in addition, the party responsible for procurement of the conventional fuel component should be specified. Under certain circumstances, airlines may be better positioned to procure conventional fuel, given that they already purchase it from conventional providers at the airports they serve. The location for blending should also be considered. This decision, however, could depend on a number of factors that can vary from location to location. This is another item that can be incorporated into each location agreement.

- A main reason for an airline to procure the SAF is to receive environmental and other credits associated with the use of SAF. It should be noted that SAF production can potentially generate credits to both the producer and the user of the fuel. Thus, the master agreement should specify how any credits associated with production and the consumption of the SAF will be allocated. In the case of credits accrued to the user of the SAF, the agreement should specify the type of documentation (e.g. a certificate of sustainability) that the seller needs to provide to the user.

## Potential changes to the location agreement:

The location agreements are a good place to reflect elements that depend on the particular circumstances at individual airports, such as:

- Delivery point

- Quantity (also, whether the SAF will be delivered neat or blended)

- Price in addition, the location agreement can be modified to include other elements, such as:

- Party responsible for blending

- Party responsible for sourcing conventional fuel

- Blend ratio.

## Potential changes to safety, quality and operations management

In principle, safety, quality and operations management should not represent major change, as the blended fuel must still meet ASTM D1655 or Def Stan 91-91 and will not require any additional procedures. However, ensuring there is a document trail of the neat SAF certification under ASTM d7566 and the recertification under ASTM d1655 is advised. Airlines may need to spend additional time with suppliers, third-party service providers and stakeholders to ensure everyone is comfortable with handling and storing the blended SAF.

## Administrative changes

Invoicing may be adjusted to reflect the type of information that the airline would want to receive with respect to the purchase of SAF. This information could include:

- Volume and mass of SAF purchased

- Feedstock used for the production of the SAF

- Blend ratio

- Quality documentation such as a refinery certificate of quality (RCQ) or a certificate of analysis (COA) demonstrating physical compliance with ASTM D7566 (or equivalent such as Def Stan 91-91) shall be provided for each batch of SAF blend. The RCQ or COA should clearly indicate the SAF blend percentage in volume, as well as the density of the SAF component, to ensure proper tracking.

- Documentation of any environmental or other credits associated with the purchase of the fuel, such as a certificate of sustainability (CoS). The CoS is generally required if an airline intends to claim credit for SAF use under various renewable energy incentive programmes (e.g. EU-ETS).

# 5 Policy examples: compliance

## Long-term, stable policies are necessary to create a sustained market for SAF.

Each policy that includes SAF (obligated or voluntary compliance) should be a trigger for review in advance of executing an offtake agreement. In particular, consideration should be given to the documentation trail expected to be necessary for compliance and this should be stipulated in the offtake agreement.

## 5.1 Introduction

Some 40 countries have a policy including SAF in place or under development. It is beyond the scope of this document to assess each example; however, CORSIA is relevant, given that it will potentially apply to all aircraft operators. The monitoring, reporting and verification methodology for CORSIA was developed by hundreds of international experts over several years and, while potentially not exhaustive, is a comprehensive guide for the type of considerations and document requirements expected to demonstrate compliance.

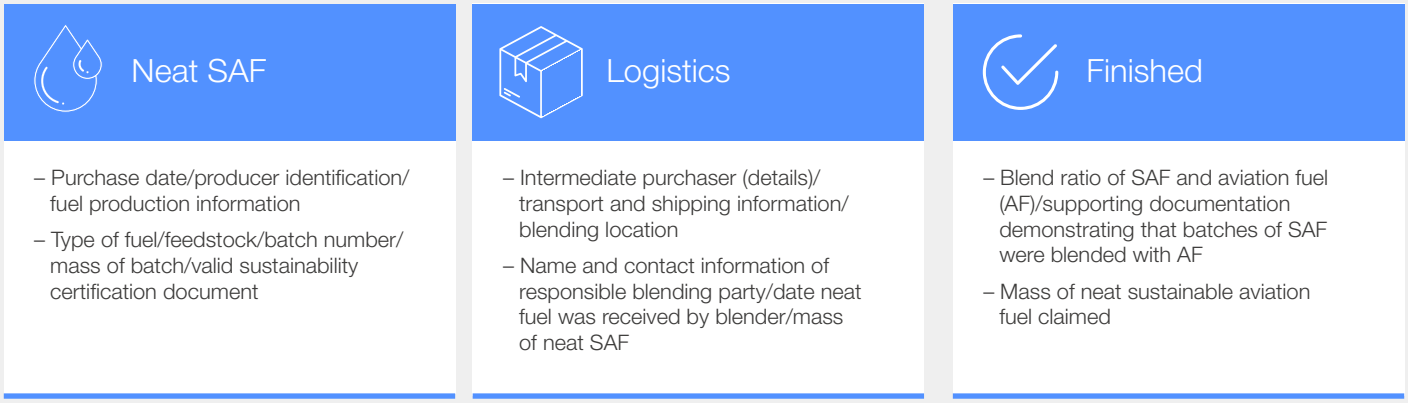
## 5.2 CORSIA example

Under the CORSIA scheme, aircraft operators must purchase and cancel "emissions units" to offset the growth in $CO_2$ emissions covered by the scheme. The aim of the scheme is to address any annual increase in total $CO_2$ emissions from international civil aviation above 85% of 2019 levels.

An aircraft operator may reduce its offsetting requirements based on life cycle emissions saving from SAF, provided the SAF meets the defined sustainability criteria. As of 2023, there are 12 separate sustainability criteria, of which seven are mandatory and must be verified by an approved sustainability verification scheme, three can be assessed by national attestation, and two are voluntary. It is essential to have appropriate documentation for the seven compulsory sustainability criteria. Detailed sustainability information can be found in the key reference documents.

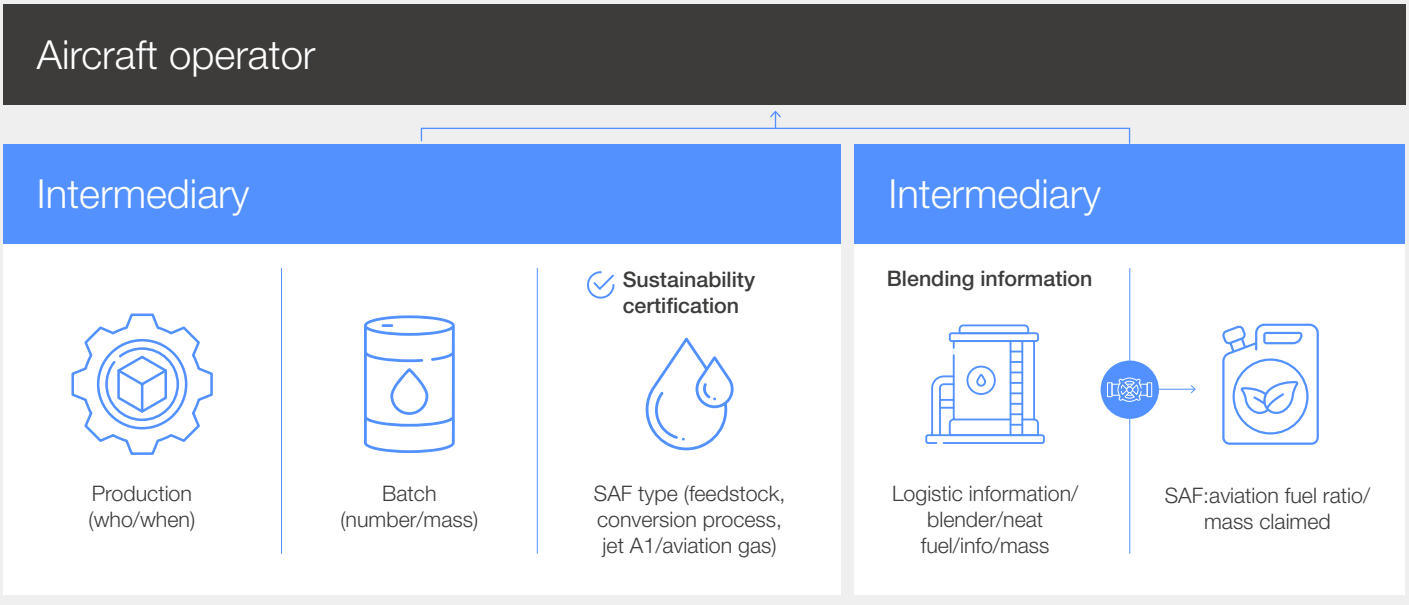
Additionally, fuel production verification data is necessary. The data references listed below from the Chicago Convention Annex 16-4 serve as a useful guide for the type of requirement to consider explicitly requesting in an offtake agreement.

FIGURE 7 **SAF supplementary information to the aeroplane operator's emissions report to the state**




**Source:** CORSIA, *Annex 16 – Environmental Protection – Volume IV*, 2018.

FIGURE 8 **Information collection by the aircraft operator from intermediaries**




**Source:** CORSIA, *Annex 16 – Environmental Protection – Volume IV*, 2018.

# Conclusion

The concept of early market commitment applied to groundbreaking technologies within the challenging sectors of heavy industry and long-distance transport forms the core of the First Movers Coalition's approach. Remarkably, the coalition has generated an unprecedented demand signal, with the private sector pledging a remarkable $12 billion by 2030 to procure innovative green technologies. Moreover, the First Movers Coalition has gained substantial support from various government partners who not only endorse the coalition's endeavours but also strive to implement policy agendas that facilitate the expansion of transformative technologies championed by the First Movers Coalition.

Navigating the climate crisis will require the largest capital deployment in history, driving at least a yearly investment of $3 trillion. While relevant progress can be made with existing and deployed technologies to reach net zero, the global cost curve of innovative green technologies must be brought down. This is particularly critical for the seven hard-to-abate sectors: aluminium, aviation, cement and concrete, chemicals, shipping, steel, and trucking. Public-private partnerships, like the First Movers Coalition, enable companies to move together and make greater progress while reducing risk and cost. Companies should partner closely with other companies, governments and everyone across the value chain to accelerate the decarbonization journey.

SAF is essential to aviation's decarbonization pathway, and while a rapid scale-up is required to meet the net zero target, global progress needs speed and scale that can be achieved through offtakes. Through collaboration across its members, the First Movers Coalition is working to accelerate the decarbonization of the sector, harnessing the purchasing power of its members to accelerate the deployment of high-quality SAF while bringing the global cost curve down.

The First Movers Coalition is a compelling example of how aggregated demand for innovative green technologies through demand commitments can achieve ripple effects at the global scale. Through the collaborative work within the First Movers Coalition, aviation's more sustainable future is closer than before.

# Appendices

## A1 Key documents

### SAF technology

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# Acknowledgements


The proposed *SAF Offtake Manual* is the result of an extensive review of leading practices from the First Movers Coalition members. The interpretations and suggestions herein were refined through stakeholder consultations facilitated by the First Movers Coalition for Aviation. We would like to express special gratitude to the below organizations and individuals for their contributions and support, this collaborative effort would not have been possible without their substantial contributions:

**American Express Business Travel, Bank of America, Boston Consulting Group (BCG), Breakthrough Energy, Deloitte, Deutsche Post DHL Group, PwC, Rio Tinto, Salesforce, United Airlines**

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# Endnotes


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8. It is however worth noting that the GHGP is not yet clear on accounting, so risks should be considered.
9. According to SBTi: "SAF may be used by consumers of aviation services to achieve science-based targets set against jet fuel-related emissions. Use of SAF by consumers of aviation services could follow a book and claim approach if consistent with the GHGP accounting framework". It is however worth noting that the GHGP is not yet clear on accounting, so risks should be considered. Engage an expert to help navigate the SBTi process and build buffers of time because the backlog is months long.
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