INTERNATIONAL COOPERATION FOR SUSTAINABLE AVIATION BIOFUELS

Deliverable 3.5:

SAF Market Development

Task 3.3: Market Development

WP3: Assessment for cost-effectiveness and sustainability

March 2025

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Dissemination level of this report	
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PP	Restricted to other programme participants (including the Commission Services)
RE	Restricted to a group specified by the consortium (including the Commission Services)
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EXECUTIVE SUMMARY

Global interest in reducing the aviation sector's carbon footprint has significantly increased the demand for advanced sustainable biofuels. Complex strategies and policies are being elaborated on with sophisticated regulatory and non-regulatory measures. However, the targets are demanding and must be achieved relatively quickly. In addition, there is only one commercially available SAF technology, HEFA, the widespread deployment of which is limited due to feedstock availability.

New technologies and value chains are being developed; however, these face reliability issues that scare investors. This creates uncertainty about how the SAF market will develop, with high SAF demand on one hand and limited resources with technologies still in the development stage on the other.

To meet the 2030 demand for the total new SAF, a capacity of 5.8 Mt, between $19 billion and $45 billion, is needed for the total estimated CAPEX. The investments in new SAF innovative technologies increased 16 times between 2022 and 2023-2024 to a total of $ 3.61 billion, which is encouraging.

The report's objective is to carry out an in-depth analysis of the SAF market, the status of commitments by the key stakeholders, and the barriers to investing in SAF deployment.

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1 Introduction

Although the aviation sector's greenhouse gas emissions are relatively significantly lower than those from road transport, they are expected to increase faster in the future. This has brought sustainable aviation fuels (SAF), as the most effective measure to reduce aviation's GHG emissions, to the forefront of discussions at international, European, and national levels on a global scale. Numerous strategies, policies, technologies, and market uptake issues are being exploited to develop reliable ecosystems encompassing all stakeholders, including citizens.

1.1. Goal and scope of the report

The primary objective of the ICARUS project is to advance the technological readiness of three promising pathways for sustainable aviation fuel (SAF) production, namely:

- Biocrude oils to SAF via Hydrothermal Liquefaction (HTL),
- Alcohol-to-Jet (ATJ) using isobutanol as feedstock, and
- Syngas to SAF via the Fischer–Tropsch (FT) process.

The project aims to bring these innovative technologies to a Technology Readiness Level (TRL) of 5 (see Section 2.1.2), supporting their future scalability and integration into the broader SAF market.

In parallel to its technical work, ICARUS also comprehensively analyses the current international SAF market. Introducing new fuels into a global industry like aviation is a highly complex. It requires alignment not only with European and national interests but also with global standards, market trends, and international policy frameworks. Critical aspects include fuel specifications and quality, sustainability certification, feedstock availability, production costs, and access to finance for scaling up technologies.

This report offers a detailed snapshot of the global SAF market landscape as of March 2025, covering:

- SAF production technologies and pathways, associated costs and pricing dynamics
- Current demand and supply trends, including airline commitments and airport availability
- Global trade flows and supply corridors, as well as a mapping of key SAF projects worldwide
- Barriers to deployment, trade, and investment, such as regulatory uncertainties, SAF-specific trade restrictions, financing challenges, and policy instability

Importantly, this report is analytical in nature and does not include strategic recommendations, policy actions, or collaboration opportunities between EU and MIC stakeholders. These elements, lessons learned from successful market examples, and strategies to accelerate SAF market development will be addressed in the updated report (Deliverable D3.5), planned for September 2026.

The forthcoming update will also connect the market insights with the ICARUS technology pathways, supporting the market ramp-up of the three SAF production routes developed under the project.

1.2. Relevance of SAF for sustainable aviation and climate protection

All studies and analyses concerning the decarbonisation of aviation conclude that although some aspects, like aircraft innovative technologies and operational improvements, can partially mitigate aviation's CO2 emissions, the main bulk for their reduction can mainly be achieved with SAF,[1,2] as indicated in Figure 1 below[3].

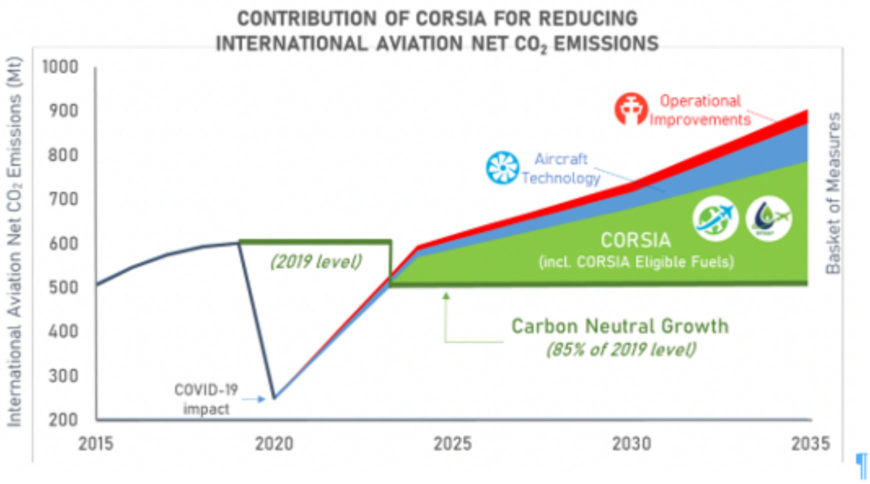

Figure 1: CORSIA's estimated contribution to reducing international aviation CO_2 emissions.

Figure 2 below shows the relevance of SAF over time and the type of commercial flights. Technology developments in electricity and hydrogen use are expected to make some contributions by 2030; however, concerning Medium—and Long-haul flights, SAF remains the key alternative fuel.

	2020	2025	2030	2035	2040	2045	2050
Commuter • 9-19 seats • <60 min. flights • >1% of industry CO_2	SAF	Electric or hydrogen fuel cell and/or SAF	Electric or hydrogen fuel cell and/or SAF	Electric or hydrogen fuel cell and/or SAF	Electric or hydrogen fuel cell and/or SAF	Electric or hydrogen fuel cell and/or SAF	Electric or hydrogen fuel cell and/or SAF
Regional • 50-100 seats • 30-90 min. flights • 3% of industry CO_2	SAF	SAF	Electric or hydrogen fuel cell and/or SAF	Electric or hydrogen fuel cell and/or SAF	Electric or hydrogen fuel cell and/or SAF	Electric or hydrogen fuel cell and/or SAF	Electric or hydrogen fuel cell and/or SAF
Short-haul • 100-150 seats • 45-120 min. flights • 24% of industry CO_2	SAF	SAF	SAF	SAF Potentially some hydrogen	Hydrogen and/or SAF	Hydrogen and/or SAF	Hydrogen and/or SAF
Medium-haul • 100-250 seats • 60-150 min. flights • 45% of industry CO_2	SAF	SAF	SAF	SAF	SAF Potentially some hydrogen	SAF Potentially some hydrogen	SAF Potentially some hydrogen
Long-haul • 250+ seats • 150+ min. flights • 30% of industry CO_2	SAF	SAF	SAF	SAF	SAF	SAF	SAF

Figure 2: Indicative profile of technology developments towards 2050 highlighting the relevance of SAF in sustainable aviation[4,5]

[1] https://www.easa.europa.eu/en/domains/environment/eaer/sustainable-aviation-fuels#saf-price
[2] https://rhg.com/research/sustainable-aviation-fuels/
[3] ICAO Finvest Hub, https://www.safinvestor.com/news/146974/icao-2/
[4] Air Transport Action Group, Waypoint 2050 https://aviationbenefits.org/environmental-efficiency/climate-action/waypoint-2050/
[5] Voices from the Sky, Topsoe https://www.topsoe.com/sustainable-aviation-fuel/saf-voices-from-the-sky

1.3. SAF policy landscape

This section provides a high-level overview of the current SAF policy environment, drawing on the findings of the ICARUS Deliverable 1.7: SAF Policies 2025 Update[6] (see Figure 3). The report presents a comparative analysis of SAF policies across key global regions, highlighting significant disparities in mandates, regulatory frameworks, and financial support mechanisms. Please refer to the deliverable for a more detailed assessment and background information.

Key Developments:

- **Mandates & Regulations:** Binding SAF mandates exist only in the EU, UK, and US, with planned mandates in Brazil, China, India, and South Korea. Some countries, including Japan and Indonesia, have set voluntary targets instead. Only the EU and UK have specific mandates for e-SAF.
- **SAF Ecosystems & Feedstock Strategies:** Countries like Australia, Singapore, and South Africa are working to develop SAF supply chains, though legislative action remains limited. The US, Canada, and India focus on expanding biomass resources, while the EU prioritizes advanced feedstocks to avoid food competition.
- **Financial & Sustainability Challenges:** The US leads in financial support with loan guarantees, but most countries lack strong investment mechanisms. Sustainability certification gaps, particularly in China, risk market fragmentation.

Despite regulatory progress, SAF remains economically uncompetitive without additional financial support. The absence of globally harmonized sustainability standards further complicates market development. Future policy updates will need to address these gaps, with the next SAF policy review scheduled for 2026.

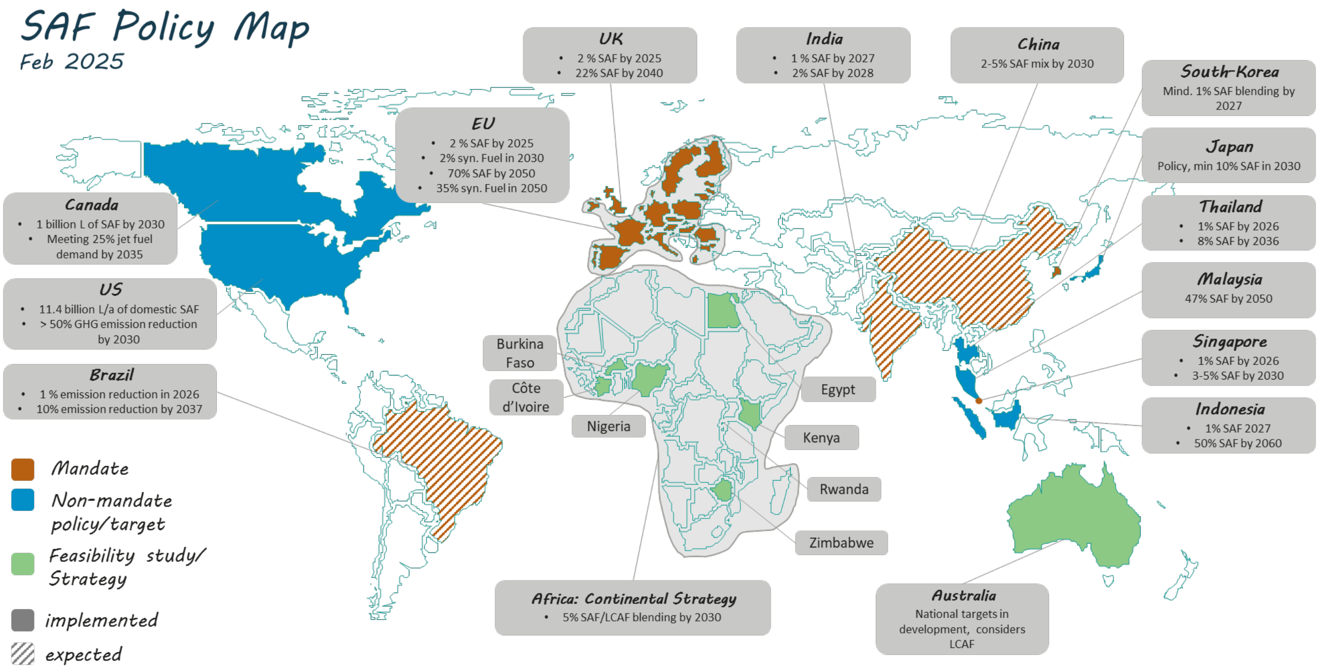

Figure 3: SAF Policy Map, updated in February 2025[6].

[6] ICARUS Deliverable 1.7: SAF Policies 2025 Update (March 2025), https://www.icarus-biojet.eu/

1.4. SAF standardization and certification: market entry and compliance

SAF plays a crucial role in the aviation industry's decarbonization efforts. However, before reaching the market, SAF must undergo rigorous approval and certification processes to ensure both technical viability and compliance with sustainability criteria. This section outlines the key steps in bringing SAF to market, from ASTM approval to regulatory certification under CORSIA and EU RED.

1.4.1. ASTM approval – the first market entry step

The approval process for SAF follows a structured framework to ensure safety and compatibility with existing aviation infrastructure (see Figure 4). New fuel pathways are first evaluated under ASTM D4054[7], establishing testing requirements for fuel properties, material compatibility, and engine performance. Upon successful evaluation, the fuel can be certified under ASTM D7566[8], designated as neat SAF under a specific annex. Since neat SAF cannot be used directly in aircraft, it must be blended with conventional jet fuel (Jet A/A-1, ASTM D1655[9]) according to the blending limits specified in ASTM D7566 Table 1. Once blended, the SAF blend undergoes final recertification under ASTM D1655, making it fully drop-in compatible with existing aircraft and fueling infrastructure. A Certificate of Quality (CoQ) is issued at each stage of this process to verify compliance with the respective ASTM standards, ensuring that the fuel meets industry requirements for commercial aviation use.

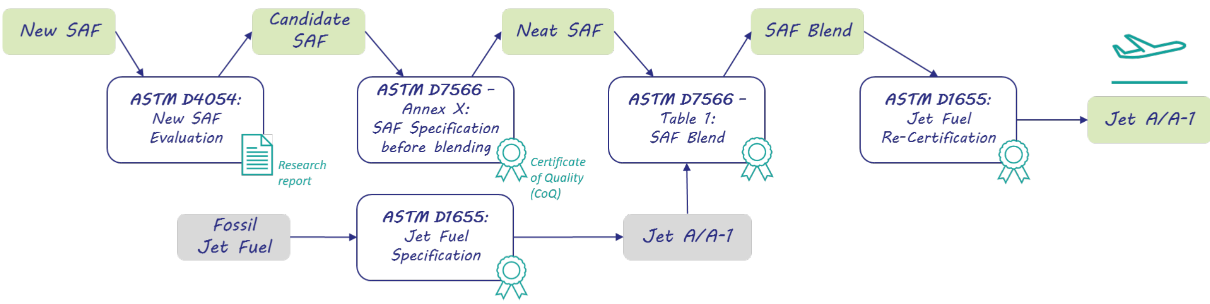

Figure 4: Overview of key ASTM standards for aviation fuels (adapted from[10]).

Currently, eight SAF production pathways are approved under ASTM D7566, including HEFA (Hydroprocessed Esters and Fatty Acids) and Fischer-Tropsch (FT) Synthetic Paraffinic Kerosene (see Figure 5).

[7] ASTM D4054-21, Standard Practice for Evaluation of New Aviation Turbine Fuels and Fuel Additives (https://www.astm.org/d4054-21.html).
[8] ASTM D7566-21, Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons (https://www.astm.org/d7566-21.html).
[9] ASTM D1655-21, Standard Specification for Aviation Turbine Fuels (https://www.astm.org/d1655-21.html).
[10] https://skynrg.com/sustainable-aviation-fuel-certification-and-astm-international-what-is-it-why-does-it-matter/

PATHWAY NAME	FEEDSTOCK*	CONVERSION PROCESS	RFEUA SAF CATEGORY	BLEND PERCENTAGE
FT-SPK	Biomass or waste (syngas)	Fischer-Tropsch synthesis	• Synthetic aviation fuel • Advanced aviation biofuel • Recycled carbon aviation fuel • Synthetic low-carbon aviation fuel	50%
HEFA-SPK	Fats, oils and greases	Hydroprocessing	• Advanced aviation biofuel • Aviation biofuel • Other aviation biofuel	50%
SIP	Sugars	Hydroprocessing	*Likely not eligible due to food crop processing*	10%
FT-SPK/A	Biomass or waste (syngas)	Fischer-Tropsch synthesis	• Synthetic aviation fuel • Advanced aviation biofuel • Recycled carbon aviation fuel • Synthetic low-carbon aviation fuel	50%
ATJ-SPK	Alcohols	Dehydration and oligomerisation	• Advanced biofuel • Aviation biofuel • Other aviation biofuel • Recycled carbon aviation fuel	50%
CHJ	Fats, oils and greases	Catalytic Hydrothermolysis	• Advanced aviation biofuel • Aviation biofuel • Other aviation biofuel	50%
HEFA-SPK/A	Fats, oils, greases and specific algae	Hydroprocessing	• Advanced aviation biofuel • Aviation biofuel • Other aviation biofuel	10%
ATJ-SKA	Alcohols	Dehydration and oligomerisation	• Advanced biofuel • Aviation biofuel • Other aviation biofuel • Recycled carbon aviation fuel	50%

Figure 5: Overview of ASTM approved pathways and blend percentages[11].

1.4.2. Regulatory certification – enabling market access

After achieving ASTM approval, SAF must undergo sustainability certification to ensure compliance with regulatory frameworks at global and regional levels. Certification verifies that SAF meets stringent environmental and sustainability criteria, enabling its market acceptance and use in emissions reduction programs. SAF sustainability certification is implemented through structured schemes that assess sustainability performance via accreditation, auditing, and compliance verification. These certification schemes are essential for ensuring transparency, preventing double counting, and maintaining credibility in the market (see Figure 6).

Scheme Provider	**SAF Certification Scheme[4]**		
	For compliance with ICAO CORSIA	For compliance with EU RED	For voluntary market
ISCC	ISCC CORSIA	ISCC EU	ISCC CORSIA, ISCC EU, ISCC PLUS
RSB	RSB ICAO CORSIA	RSB EU RED	RSB ICAO CORSIA, RSB EU RED, RSB Global

Source: ISCC and RSB

Figure 6: Overview of SAF certification schemes[12].

[11] EASA 2024 Report, State of the EU SAF market in 2023, https://www.easa.europa.eu/en/document-library/general-publications/state-eu-saf-market-2023

[12] IATA, Understanding SAF Sustainability Certification (2024), https://www.iata.org/contentassets/0bf212bfcb0548f2b6ad4c1e229f7e94/guidance-document-on-saf-sustainability-certification-v0.41_rm-indepth.pdf

Two primary organizations provide SAF sustainability certification: the Roundtable on Sustainable Biomaterials (RSB) and the International Sustainability and Carbon Certification (ISCC). Both RSB and ISCC offer certification schemes that align with regulatory mandates and voluntary sustainability commitments:

- **CORSIA (ICAO):** Under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), SAF must achieve a minimum greenhouse gas (GHG) reduction threshold and be certified under RSB CORSIA or ISCC CORSIA. Certification ensures that sustainability and operational criteria are met, with third-party verification preventing double counting and ensuring credibility in emissions accounting.
- **EU RED (Renewable Energy Directive) & ReFuelEU Aviation:** To be counted toward the EU's SAF blending mandates, SAF must meet sustainability and GHG reduction criteria under recognized schemes such as RSB EU RED or ISCC EU. The European Union's Union Database (UDB) is under development to track SAF transactions, prevent fraud, and ensure compliance with SAF mandates.

SAF certification operates within a complex system of oversight bodies, accreditation entities, certification schemes, and independent auditing organizations. These components work together to ensure compliance, integrity, and transparency across the supply chain. The figure below provides a high-level overview of the RSB ICAO CORSIA certification process, illustrating the interactions between key actors in the process.

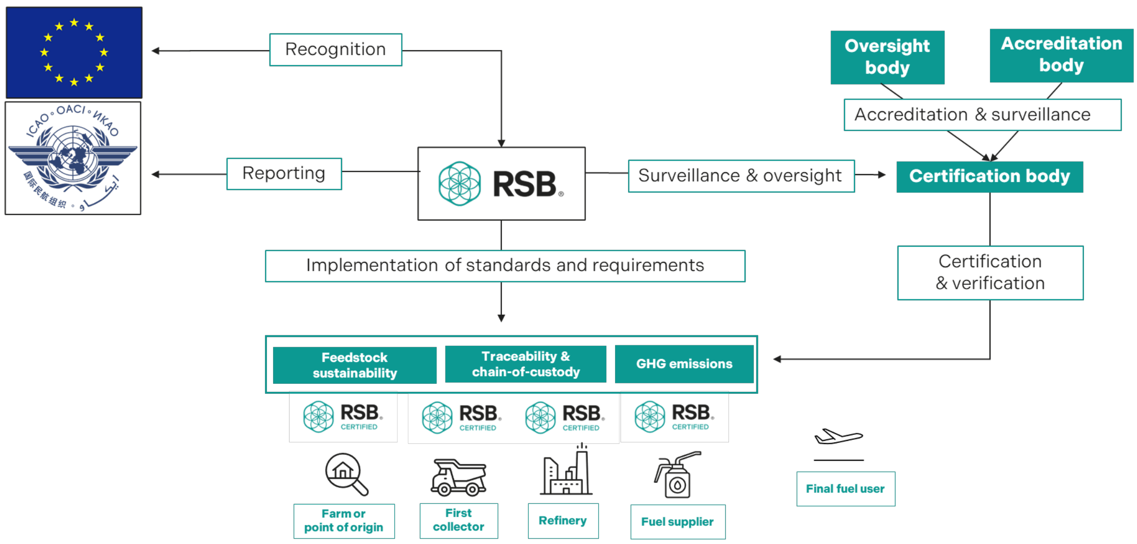

Figure 7: Illustration of the SAF certification ecosystem using RSB as an example[13].

Achieving SAF certification follows a structured and standardized process that ensures biofuel meets regulatory and sustainability criteria. From defining the certification scope to undergoing independent audits, the process is designed to provide a clear and verifiable pathway for SAF producers and suppliers to demonstrate compliance. The figure below outlines the step-by-step certification process, highlighting key milestones from application to ongoing compliance.

[13] Provided by the Roundtable on Sustainable Biomaterials (RSB).

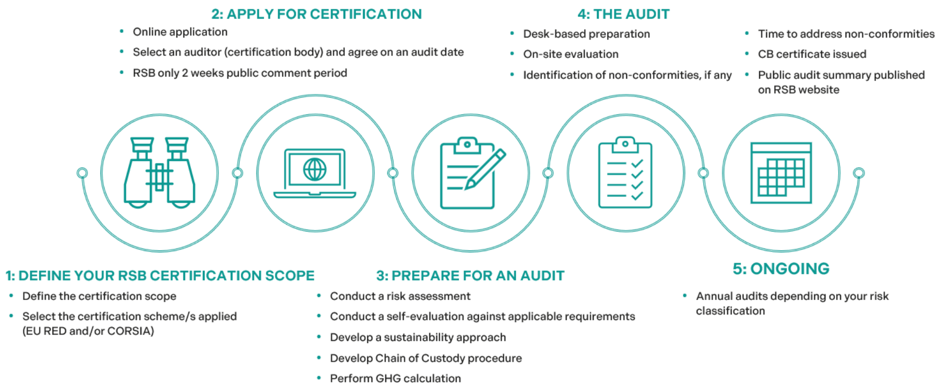

Figure 8: Overview of SAF certification process according to the RSB[13].

Certified SAF must be accompanied by a Proof of Sustainability (PoS) document, which airlines require to claim emissions reductions under regulatory schemes like EU ETS and CORSIA. The PoS verifies that the SAF batch meets sustainability criteria under recognized schemes such as RSB and ISCC. Certification bodies—which are independent third-party auditors accredited under these schemes—issue the PoS after verifying compliance with sustainability standards.

In addition to PoS, Guarantees of Origin (GOs) are used in certain chain of custody models, particularly in book-and-claim systems, to certify the environmental attributes of SAF. While a PoS is required for regulatory compliance, GOs serve as tradable certificates that allow SAF's sustainability benefits to be transferred independently from the physical fuel. This enables more flexibility in SAF deployment, particularly for airlines purchasing SAF through decentralized supply chains.

To track SAF transactions effectively, different chain of custody systems are utilized (see Figure 9), including:

- Physical segregation: Neat SAF always remains physically separated from conventional jet fuel and other SAF batches along all stages of the fuel supply chain until it needs to be blended to uplift.
- Mass balance system: Ensures that SAF volumes remain consistent as they move through the supply chain, preventing double counting.
- Book-and-claim system: Allows SAF environmental attributes, tracked via PoS and GOs, to be traded separately from the physical fuel, increasing market flexibility and accessibility.

Efforts are underway to harmonize certification frameworks globally, ensuring better alignment between PoS, GOs, and chain of custody models across CORSIA, EU RED, and voluntary markets.

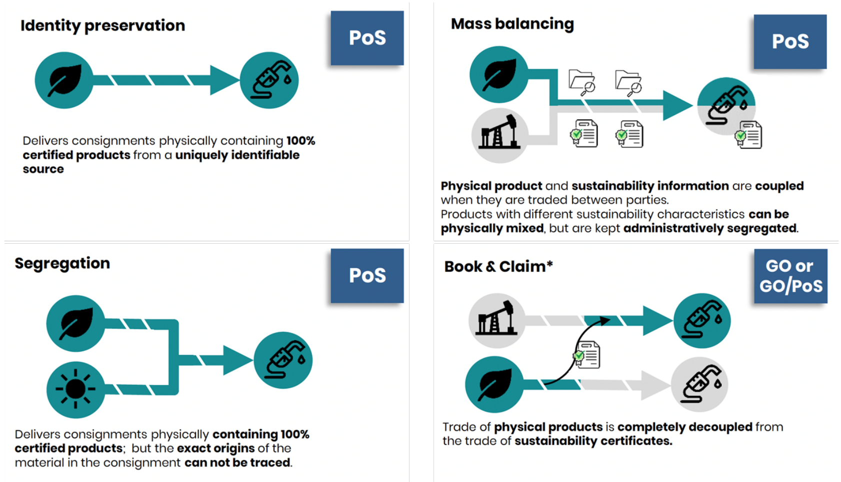

Figure 9: Models and definitions for SAF chain of custody systems[14].

Among the different chain of custody models for SAF, the book and claim system is receiving growing attention as a practical and scalable approach. Unlike physical tracking models, book and claim decouples the physical movement of SAF from the associated environmental attributes, allowing emission reduction claims to be made independently of fuel location. This approach offers significant logistical advantages, particularly when SAF production and use are geographically disconnected. By eliminating the need for physical transport, book and claim can facilitate global SAF uptake while minimising related emissions and infrastructure constraints. It enables broader market access for producers and allows operators—especially those at locations without SAF supply—to claim the benefits of SAF use credibly. Major industry actors and certification bodies are increasingly developing standardised frameworks and registries to ensure credibility, traceability, and avoidance of double counting. As such, book and claim are key enablers in accelerating SAF deployment across the aviation sector. A simplified illustration of this process is shown in Figure 10.

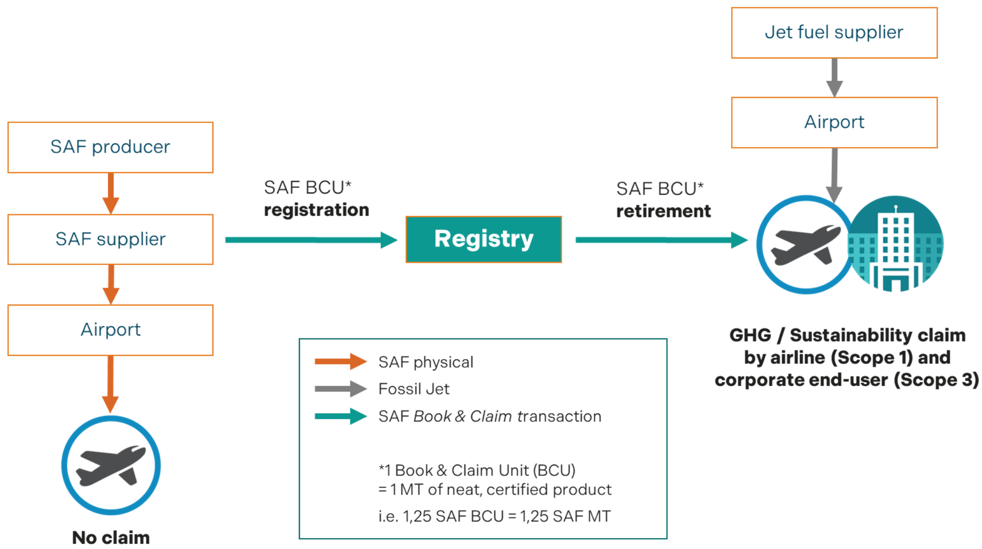

Figure 10: Simplified scheme of the Book & Claim process[13].

[14] German Energy Agency (DENA), Workshop: Traceability of Powerfuels, October 2022

1.4.3. The EU SAF Clearing House

To facilitate European SAF technology developers, the European Commission, in coordination with EASA, established the EU SAF Clearing House (EU SAF CH) via a tender that was won by a Ricardo consortium. The EU SAF CH is an impartial one-stop shop for fuel producers and original equipment manufacturers to get the support they need to develop new SAF, as indicated in Figure 11.

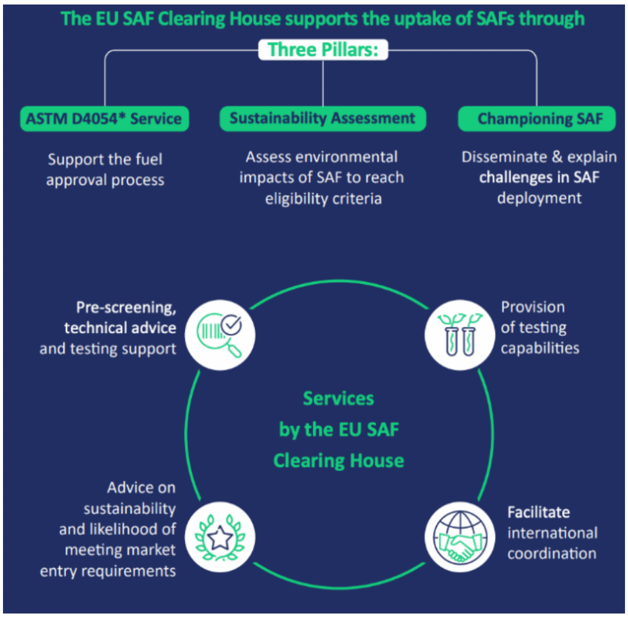

Figure 11: Schematic of the EU SAF Clearing House[15].

Like its counterparts in the US and UK, the EU SAF Clearing House will support the approval of new SAF pathways using the ASTM D4054 process. This will reduce the high cost and complexity of certification and is key to unlocking higher volumes and encouraging a variety of feedstocks.

The EU SAF Clearing House will also provide sustainability services for prospective fuel producers and focus on nurturing a mature SAF supply chain in Europe, participating in technical events, advising on research and innovation, and promoting policy coherence.

In July 2024, CATAGEN LIMITED - a Net Zero Technologies company - became the first sustainable aviation fuel (SAF) supplier to submit a sample to the EU SAF for testing[16]. The fuel is being developed from wind, water and air (e-SAF) and wind and sustainable organic waste (bio-SAF).

[15] https://www.easa.europa.eu/sites/default/files/dfu/saf-clearing-house_services.pdf
[16] https://www.ricardo.com/en/news-and-insights/industry-insights/catagen-saf

2 Current market and technology landscape

2.1. SAF production pathways

The aviation industry increasingly turns to SAF as a critical solution for reducing carbon emissions and advancing decarbonization efforts. Unlike conventional fossil-based jet fuels, SAF can be produced from various renewable and waste-based feedstocks, significantly lowering greenhouse gas (GHG) emissions over its life cycle. Multiple SAF production pathways are currently in use or under development, each offering distinct advantages and challenges regarding scalability, cost, and environmental impact.

2.1.1. Established SAF production pathways

Currently, four primary SAF production technologies have been approved by regulatory bodies, such as the American Society for Testing and Materials (ASTM) and the International Civil Aviation Organization (ICAO) (see Figure 12 and Figure 13). These pathways have demonstrated feasibility and are considered the most promising for near-term scaling:

- **Hydro-processed Esters and Fatty Acids (HEFA)**: Derived from waste oils, animal fats, and purpose-grown oil crops, HEFA is the most widely used and commercially mature SAF pathway. The process involves hydrotreatment, where feedstocks are treated with hydrogen to remove oxygen and convert them into jet fuel-compatible hydrocarbons. While HEFA fuels offer significant emissions reductions (up to 84%), their scalability is constrained by limited availability of waste oil feedstocks and competition with other biofuel applications (e.g., renewable diesel).
- **Biomass Gasification and Fischer-Tropsch Synthesis (G-FT):** This method converts solid biomass (e.g., agricultural residues, forestry waste, and municipal solid waste) into syngas, a mixture of hydrogen and carbon monoxide. The syngas is then synthesized into liquid hydrocarbons through the Fischer-Tropsch process, producing a high-quality SAF with broad feedstock flexibility. While G-FT pathways offer high emissions reductions (up to 94%), they require complex infrastructure and high capital investment, making large-scale adoption slower.
- **Alcohol-to-Jet (AtJ):** This pathway converts alcohols such as ethanol, methanol, or butanol into SAF-compatible hydrocarbons through dehydration, oligomerization, and hydroprocessing. AtJ is advantageous because ethanol production is already widespread, allowing for potentially rapid scaling. However, challenges include conversion efficiency limitations and the need for significant investments in refining infrastructure.
- **Power-to-Liquid (PtL) (Synthetic SAF or e-fuels):** PtL is a next-generation SAF pathway that synthesizes jet fuel from green hydrogen (H_2) and captured CO_2. The process, known as electrofuel synthesis, relies on renewable electricity to power hydrogen production via electrolysis, which is then combined with CO_2 to create liquid hydrocarbons. While PtL can achieve nearly 99% emissions reductions, it remains the most expensive pathway, requiring cheap renewable energy and advancements in direct air capture (DAC) technologies.

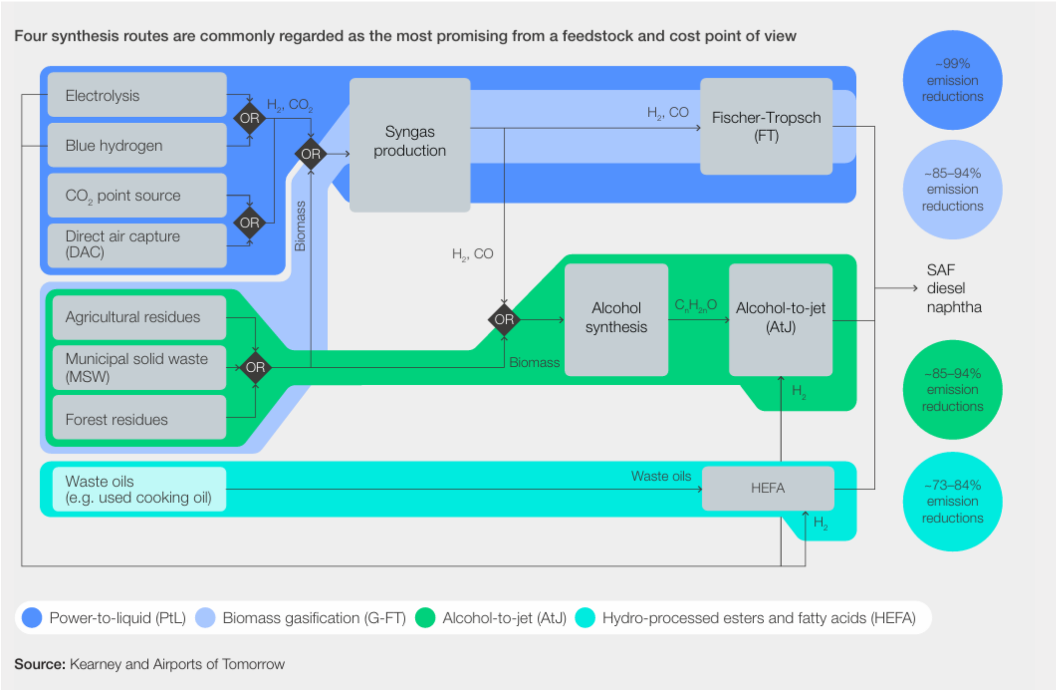

Figure 12: Overview of key SAF production pathways by WEF[17].

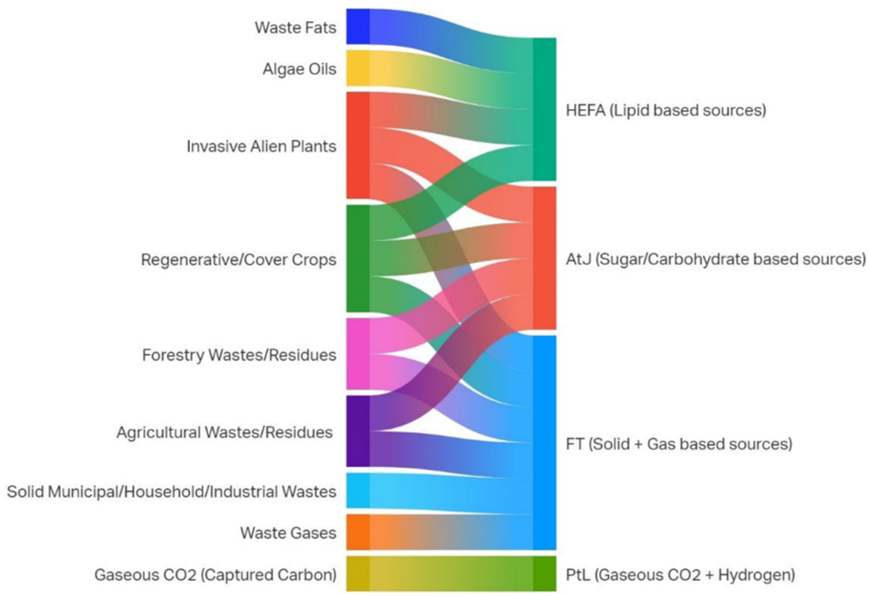

Figure 13: Link between key SAF feedstocks and production pathways[18].

There is currently no universally agreed-upon nomenclature for SAF production pathways and the resulting fuels, leading to variations in terminology across regions and regulatory frameworks. Different countries and organizations classify SAF based on specific feedstocks, conversion technologies, or sustainability criteria, resulting in multiple names for similar processes.

[17] World Economic Forum, Scaling up SAF Supply, March 2024, https://www3.weforum.org/docs/WEF_Scaling_Sustainable_Aviation_Fuel_Supply_2024.pdf
[18] IATA, SAF Handbook, May 2024, https://www.iata.org/contentassets/d13875e9ed784f75bac90f000760e998/saf-handbook.pdf

Figure 14 gives a classification of eligible European aviation fuel types and associated pathways.

TYPE OF ELIGIBLE AVIATION FUEL	PRODUCTION PATHWAY	FEEDSTOCK
Synthetic aviation fuels	FT (PtL)	Biogenic and industrial CO_2 from PSC and hydrogen from electrolysis using renewable electricity
		Atmospheric CO_2 from DAC and hydrogen from electrolysis using renewable electricity
Advanced aviation biofuels	Gasification FT	MSW (biomass fraction, compliant with Annex IX.A)
		Forest Residue
	AtJ	Bioethanol from feedstock listed in Annex IX.A
Recycled carbon aviation fuels	AtJ	Fossil CO_2 from Point Source Capture (PSC), fermantation to ethanol
	FT (PtL)	Fossil CO_2 from Point Source Capture (PSC) and hydrogen from electrolysis using renewable electricity
Renewable hydrogen for aviation	Alkaline electrolysis	Green hydrogen from electrolysis using renewable electricity
Low-carbon hydrogen for aviation	Alkaline electrolysis	Hydrogen from electrolysis using nuclear electricity
Synthetic low-carbon aviation fuels	FT (PtL)	Biogenic and industrial CO_2 from PSC and hydrogen from electrolysis using renewable electricity
		Atmospheric CO_2 from DAC and hydrogen from electrolysis using renewable electricity

Figure 14: European SAF categories, associated production pathways and feedstocks[19].

[19] EASA 2024 Report, State of the EU SAF market in 2023, https://www.easa.europa.eu/en/document-library/general-publications/state-eu-saf-market-2023

2.1.2. Emerging SAF pathways & the ICARUS project

Beyond the established HEFA, Fischer-Tropsch, Alcohol-to-Jet, and Power-to-Liquid pathways, researchers and industry players are further developing new SAF production technologies to enhance sustainability, scalability, and feedstock diversity.

Examples include sun-to-liquid (solar fuels), which use solar thermochemical reactions to convert water and CO_2 directly into synthetic aviation fuels or microbial and algae-based SAF, where bioengineered microorganisms or algae produce hydrocarbons that can be processed into jet fuel.

Within this evolving SAF landscape, the ICARUS project introduces three advanced pathways to improve the efficiency and sustainability of bio-based SAF production (see Figure 15). The project builds upon existing SAF technologies but refines them to optimize feedstock utilization and production processes:

- The **Hydrothermal Liquefaction (HTL)** pathway offers a more energy-efficient approach to converting wet biomass like algae and agricultural residues into biocrude, removing the need for drying, a significant improvement over traditional biofuel processing.
- The **Isobutanol-to-Jet (AtJ)** pathway advances the conventional Alcohol-to-Jet process by shifting from ethanol/methanol to lignocellulosic-derived isobutanol, which allows for better conversion efficiency while avoiding reliance on food crops.
- Finally, the **Fischer-Tropsch (FT)** synthesis pathway from biomass gasification follows the same core principles as traditional G-FT technology but focuses on improving the cost efficiency and scalability of biomass conversion.

With these innovations, ICARUS enhances existing SAF pathways, making them more viable for large-scale deployment while prioritizing feedstock sustainability, process efficiency, and economic feasibility.

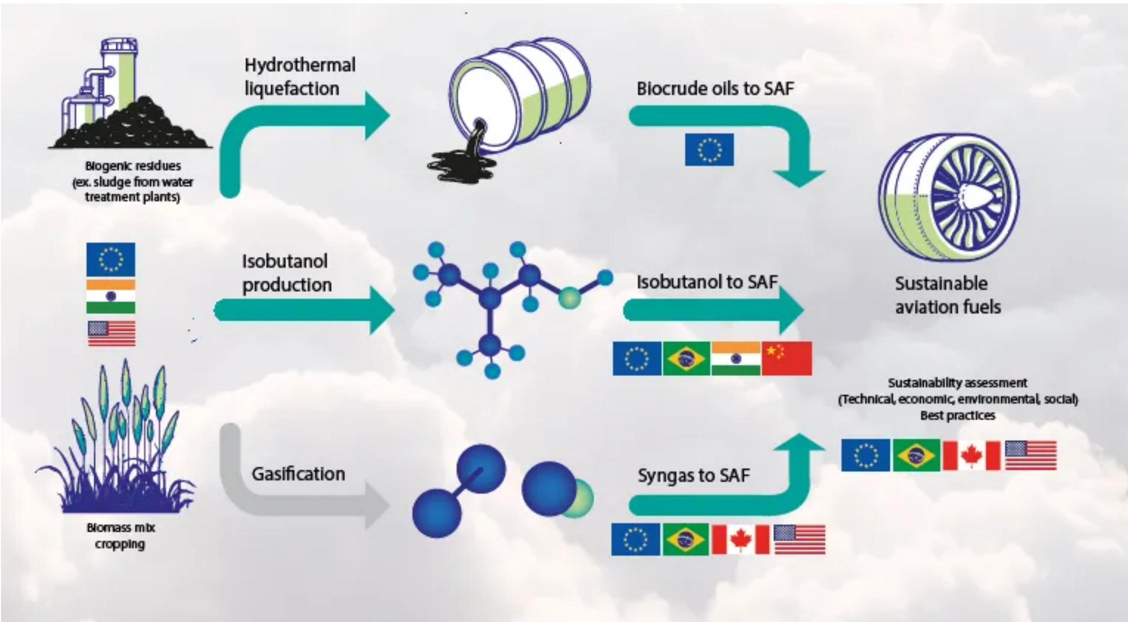

Figure 15: Novel SAF pathways developed within the ICARUS project[20].

[20] https://www.icarus-biojet.eu/

2.2. SAF production costs and pricing

SAF production costs remain a key barrier to widespread adoption, with prices currently ranging from two to five times that of conventional aviation fuel (CAF), depending on the technology pathway and feedstock used[21] (see Figure 16). Several factors contribute to this cost disparity, including high feedstock prices, capital investment requirements, and operating expenditures.

Key cost drivers

- **Feedstock Costs:** Feedstock expenses are the most significant factor, accounting for 20% to 80% of total production costs depending on availability and technology pathway[22].
- **Capital Expenditures (CAPEX):** Costs related to facility construction, processing equipment, and infrastructure investment play a critical role. These are divided into Inside Battery Limits (ISBL), covering core processing units, and Outside Battery Limits (OSBL), which includes auxiliary systems such as feedstock preprocessing and utilities[22].
- **Operating Expenditures (OPEX):** SAF production involves high operational costs, including utilities, chemical inputs, labor, maintenance, and insurance. These expenditures, financial requirements, and logistical considerations add to the overall production burden[23].
- **Process Efficiency & Co-Product Pricing**: The efficiency of conversion technologies directly influences costs, as does the ability to generate valuable co-products such as renewable diesel and naphtha, which can offset production expenses[22].

Pathway/Feedstock	Operational Cost	Capital Cost	Comments
HEFA: Waste Fats/Oils/Greases	**High** Constrained feedstock	**Low** Existing renewable fuel production capacity	Requires incentives, policies to reduce operational costs, linked to high feedstock costs.
Alcohol-to-Jet + FT: Agriculture & Forestry Wastes	**Low/Medium** Abundant waste-based feedstock; low value	**High** New renewable fuel production capacity required	Risk capital required to enable new biorefining ventures. Once capital cost is absorbed, cost of production benefit from lower Feedstock costs.
Fischer-Tropsch: Agriculture & Municipal Solid Waste (MSW)	**Low/Medium** Abundant waste-based feedstock; low value	**High** New renewable fuel production capacity required	In addition to above, higher tipping fee for waste collection can be a further incentive to leverage these feedstocks.
Power-to-Liquid: Industrial Waste CO_2	**Low/Medium** Abundant synthetic carbon source from existing processes	**High** New renewable fuel production capacity required	Requires a concentrated CO_2 source of synthetic carbon, but questions remain over their fossil origin sources and thus use in SAF production.
Power-to-Liquid: Direct Air Capture CO_2	**High** Abundant synthetic carbon source, but requires further technological maturing	**Very High** New renewable fuel production capacity required	The most abundant source of synthetic carbon, but limited today by current technology immaturity; significantly high capital intensity and renewable energy requirements.

Source: IATA Sustainability & Economics

Figure 16: High-level assessment of costs for selected SAF pathway[21].

[21] IATA, SAF Handbook, May 2024, https://www.iata.org/contentassets/d13875e9ed784f75bac90f000760e998/saf-handbook.pdf
[22] EASA 2025 Briefing Note, https://www.easa.europa.eu/en/document-library/general-publications/2024-aviation-fuels-reference-prices-refueleu-aviation
[23] NREL, SAF State-of-Industry Report, https://www.nrel.gov/docs/fy24osti/87802.pdf

Current SAF pricing

In 2022, the average SAF price was approximately **$2,400 per metric ton**, about 2.5 times higher than conventional jet fuel[21].

The latest reference prices from EASA[24] underscore the cost gap between different aviation fuel types:

- **Conventional aviation fuel (CAF):** €816/tonne
- **Aviation biofuels:** €2,768/tonne
- **Synthetic aviation fuels (PtL fuels):** €8,700/tonne

These figures reflect the price advantage of CAF due to established supply chains and economies of scale. Though more expensive, aviation biofuels benefit from active market trading, while synthetic SAF remains at the highest cost level, primarily due to early-stage production and limited infrastructure. Average price estimates from EASA per pathway are shown in Figure 17.

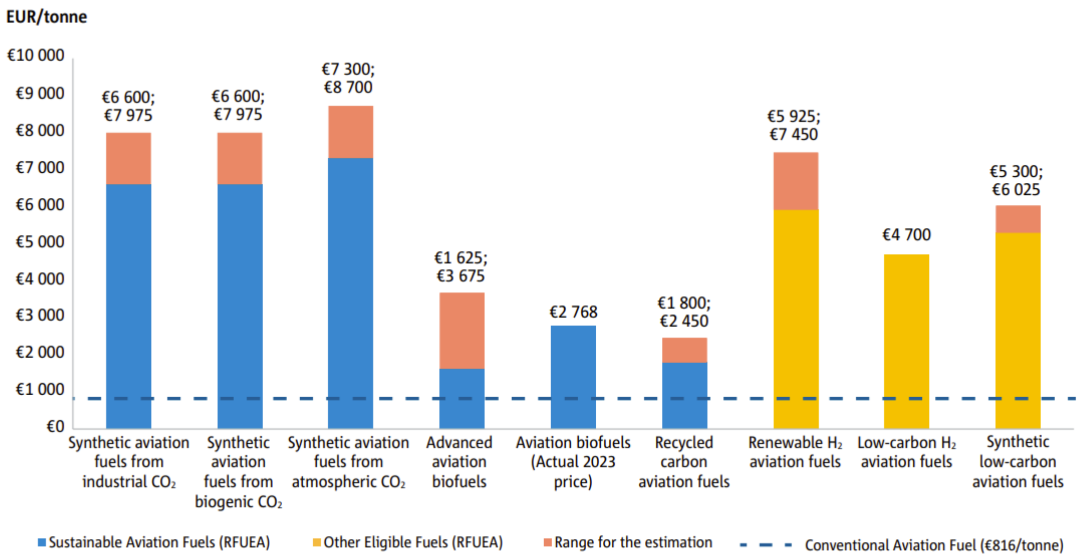

Figure 17: Average price estimates for 2024 by EASA following the SAF terminology established by the ReFuelEU Aviation Regulation ("RFEUA")[25].

To ensure price transparency under ReFuelEU Aviation (RFEUA), EASA employs a dual-method approach:

- **Market-based pricing** for actively traded fuels (CAF and aviation biofuels), relying on price reporting agencies (e.g., Argus, Platts, General Index).
- **Bottom-up production cost estimation** for fuels without established market prices, such as synthetic SAF and advanced biofuels, incorporating feedstock costs, CAPEX, and OPEX.

This hybrid model allows for regulatory enforcement, penalty calculations, and SAF-related incentives under the EU ETS framework.

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[24] EASA 2025, European aviation environmental report 2025, https://www.easa.europa.eu/sites/default/files/eaer-downloads/EASA_EAER_2025_Book_v5.pdf

[25] EASA 2025, European aviation environmental report 2025, https://www.easa.europa.eu/sites/default/files/eaer-downloads/EASA_EAER_2025_Book_v5.pdf

Beyond the EU, SAF price estimates remain highly variable across different sources and methodologies. Some projections indicate SAF prices ranging from $1,500 to over $8,000 per metric ton, depending on production scale and feedstock selection (see example in Figure 18). As the industry scales, SAF costs are expected to decline due to technological improvements, increased feedstock availability, and more substantial policy support.

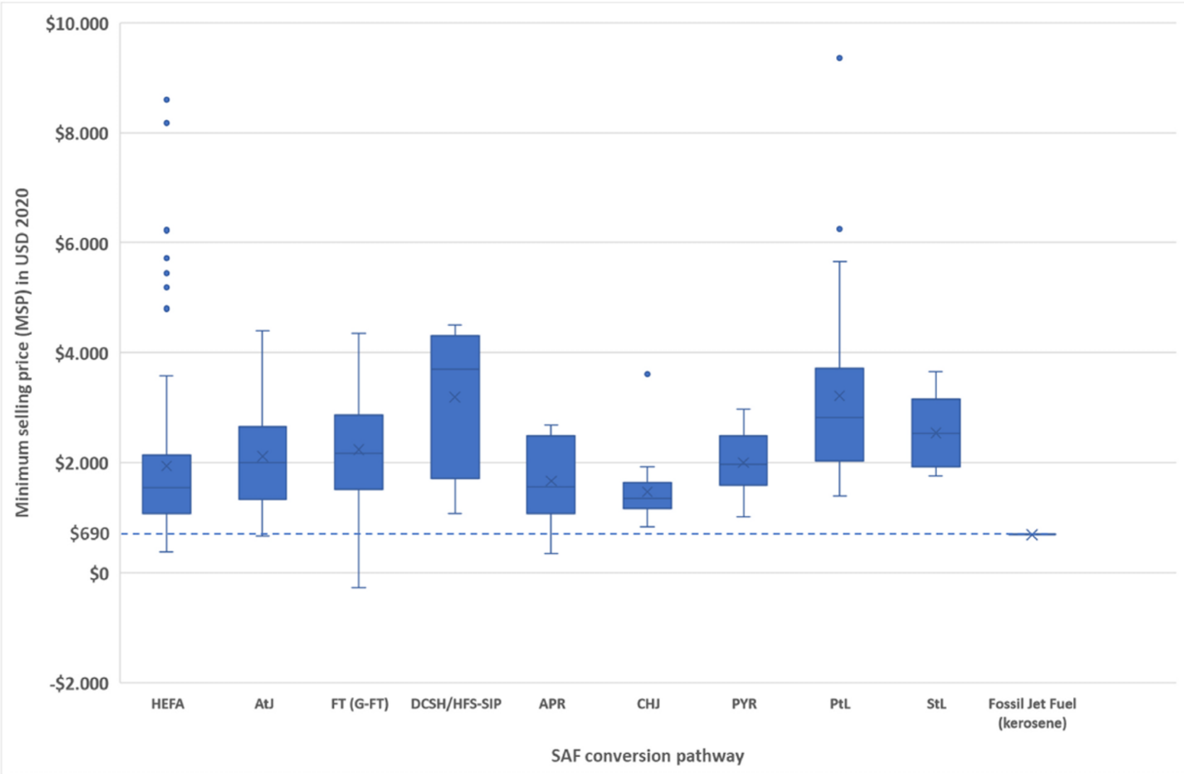

Figure 18: Price ranges for different SAF pathways from literature data[26].

While SAF remains costly today, ongoing policy interventions and commercial advancements will be key to reducing prices and enabling broader market adoption. Achieving cost parity with conventional jet fuel requires policy support, technological advancements, and supply chain improvements.

Strategies to lower SAF costs include expanding feedstock supply and optimizing production processes to enhance yields[23], increasing financial support mechanisms such as government subsidies, tax incentives, and loan guarantees to reduce CAPEX burdens[21], and enhancing economies of scale by scaling up production and improving logistical efficiency.

[26] Braun et. Al (2024), Pathway to net zero: Reviewing sustainable aviation fuels, environmental impacts and pricing, Journal of Air Transport Management (https://doi.org/10.1016/j.jairtraman.2024.102580)

2.3. SAF demand and supply

The European perspective

For Europe, EASA recently conducted a capacity estimate to assess the region's ability to meet the minimum SAF blending targets set under ReFuelEU Aviation (RFEUA)[27](see Figure 19). The analysis evaluates operational and announced production facilities across EU Member States, applying a maturity assessment to determine the likelihood of these facilities becoming operational by 2030.

The assessment projects that, under a realistic scenario, **3.2 million tonnes (MT) of SAF** could be produced in the EU by 2030. This volume would meet the 6% SAF mandate, which is estimated to require 2.8 MT of SAF based on projected jet fuel consumption. However, achieving longer-term targets beyond 2030 will require further expansion. An optimistic scenario suggests a pipeline of 5.5 MT of SAF capacity, which includes facilities that have been announced but have not yet reached final investment decision (FID). Notably, the development of synthetic aviation fuels remains uncertain, as no announced facilities had reached FID at the time of assessment. EASA concludes that while current SAF production estimates align with short-term regulatory targets, continued investment and policy support will be critical to ensure compliance with progressively higher SAF blending mandates in the coming decades.

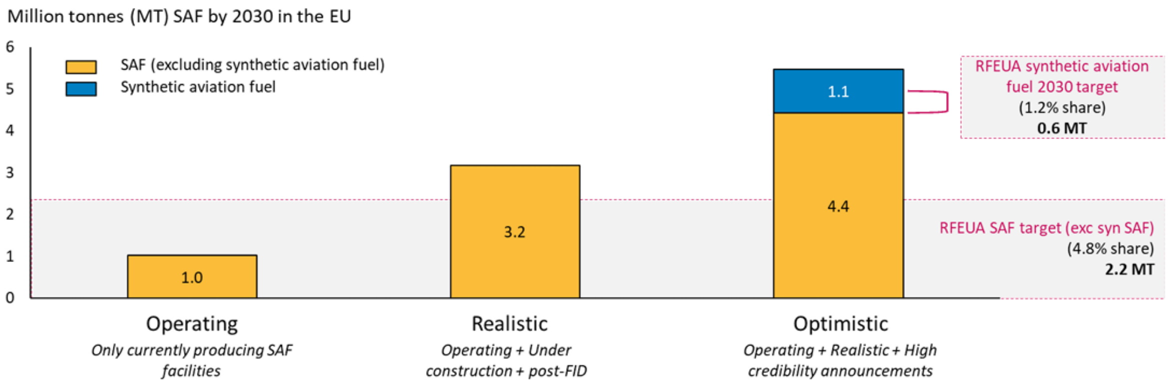

Figure 19: Annual SAF production volumes estimated by EASA for 2030[27]. Within RFEUA, synthetic fuel is defined as fuels produced from renewable sources other than biomass, such as renewable energy.

SkyNRG makes similar predictions, estimating a total SAF supply of 3.8 MT by 2030, primarily driven by HEFA pathways, which will account for the majority of production (see Figure 20). This projected supply is expected to meet mandated SAF demand targets 2030, provided that at least 73% of announced production capacity is realized. However, unannounced co-processing activities may influence the actual supply structure, which remain a variable factor in SAF market developments.

While HEFA is expected to dominate, volumes from advanced bio-SAF and e-SAF will remain limited in the near term. By 2030, the first-of-its-kind facilities for advanced bio-SAF and e-SAF are expected to be operational, demonstrating commercial feasibility. However, their contribution to overall SAF production will likely be marginal compared to HEFA-based SAF, given the technical, financial, and regulatory challenges associated with scaling up these next-generation pathways.

[27] EASA 2024 Report, State of the EU SAF market in 2023, https://www.easa.europa.eu/en/document-library/general-publications/state-eu-saf-market-2023.

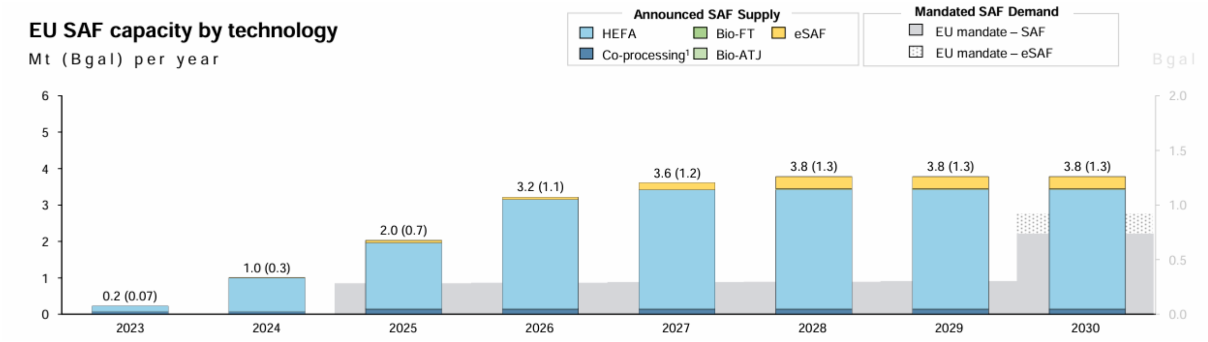

Figure 20: Projected SAF supply and demand in Europe until 2030[28].

When it comes to PtX-based SAF (e-SAF), Project SkyPower[29] has identified significant challenges in financing large-scale e-SAF plants, primarily due to substantial investment requirements, high risks, and a lack of off-take agreements. To address these issues, the project proposes the creation of a government-backed market intermediary[30] that would de-risk investments by bridging long-term supply contracts with short-term airline demand. While the project's duration has been extended to meet its objectives, its future is uncertain following Breakthrough Energy's recent decision to reduce its climate policy advocacy efforts, including layoffs in its U.S. and European teams[31].

The Global perspective

Beyond Europe, multiple reports predict a critical global SAF supply gap, with significant regional variations in production capacity and development timelines. North America is set to dominate SAF production, accounting for 40% of expected SAF capacity by **2030**, primarily due to larger average plant sizes and a distinct feedstock focus, favouring agricultural residues, waste oils, and emerging technologies (see Figure 21).

Meanwhile, Asia-Pacific is rapidly expanding its SAF capacity, benefiting from shorter project lead times than other regions. Investments in both HEFA and emerging e-SAF technologies are increasing, positioning the region as a key contributor to global SAF supply growth. As 2030 approaches, Latin America (LATAM) is also expected to emerge as a significant SAF production hub, leveraging its abundant biomass resources and favourable climate conditions for feedstock cultivation. While production capacity in LATAM remains in earlier stages of development compared to North America and Asia-Pacific, ongoing infrastructure investments and policy support are expected to accelerate its role in global SAF markets.

[28] SkyNRG, 2024 SAF Market Outlook, Presentation at ALIGHT Bold Vision Workshop, October 2024
[29] https://project-skypower.org/
[30] https://www.safinvestor.com/opinion/147233/esaf/
[31] https://www.bloomberg.com/news/articles/2025-03-12/bill-gates-climate-group-lays-off-us-and-europe-policy-teams?utm_source=chatgpt.com

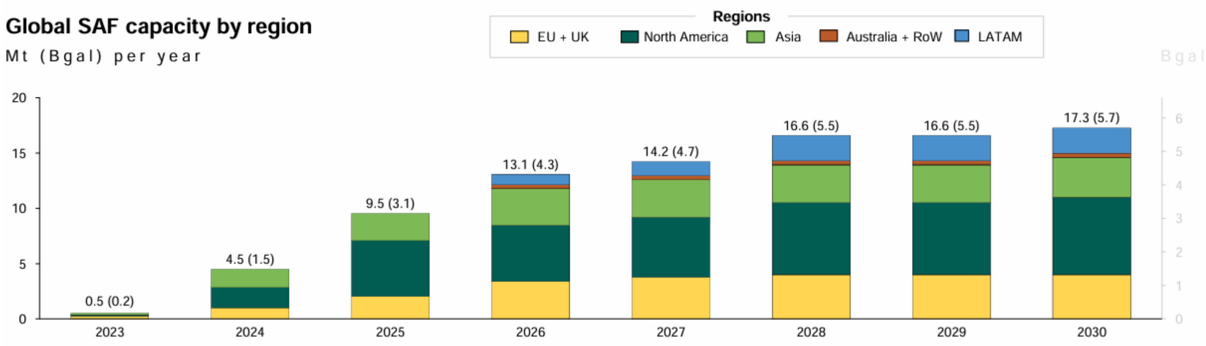

Figure 21: Projected global SAF capacity by region until 2030[32].

To meet the 10% SAF target globally (**requiring 40–50 Mt by 2030**), currently announced production covers only 30–40% of this demand, leaving a 25–35 Mt shortfall (see Figure 22). The primary challenges include technology risks, uncertain market conditions, and financial barriers, which deter fuel producers from scaling up production.

While Europe benefits from regulatory certainty under ReFuelEU, inconsistent global policies and a lack of price transparency slow SAF adoption in other regions. Without stronger policy frameworks, financial incentives, and investment certainty, bridging this gap will remain a significant challenge for the aviation sector.

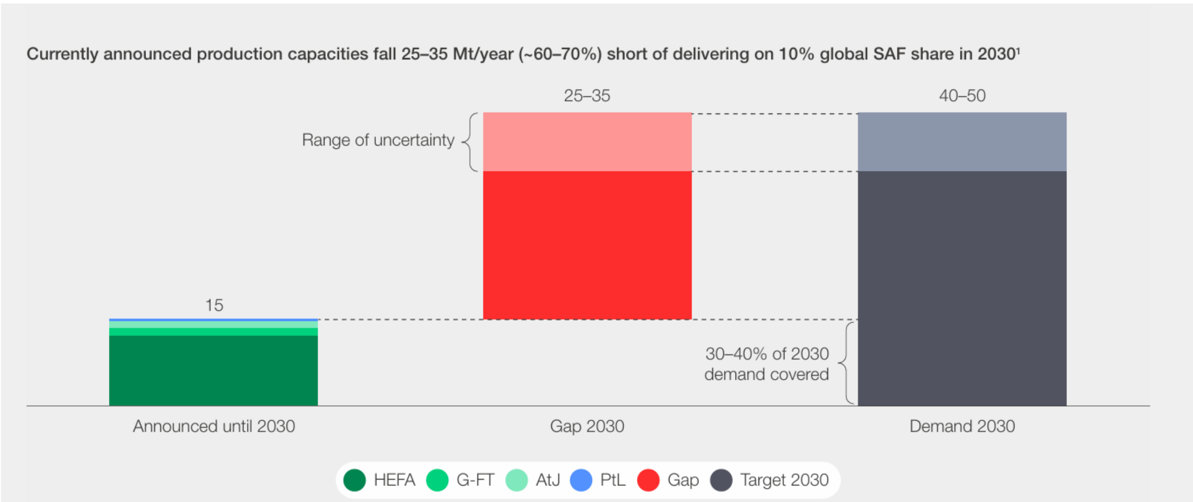

Figure 22: SAF production gap estimated by the WEF[33].

While current SAF expansion relies primarily on HEFA production, feedstock constraints will limit its long-term scalability, even as new bio-oil supply chains develop. To achieve net-zero aviation emissions by **2050**, a rapid scale-up of advanced bio-SAF and e-SAF will be required, particularly after 2035, when HEFA alone will no longer be sufficient. Meeting this demand will be challenging due to feedstock availability, high production costs, and infrastructure requirements. The first significant volumes of advanced bio-SAF and e-SAF will not materialize without strong policy support, as producers need clear regulatory frameworks, financial backing, and risk-sharing mechanisms to scale up operations.

[32] SkyNRG, 2024 SAF Market Outlook, Presentation at ALIGHT Bold Vision Workshop, October 2024
[33] World Economic Forum, Scaling up SAF Supply, March 2024, https://www3.weforum.org/docs/WEF_Scaling_Sustainable_Aviation_Fuel_Supply_2024.pdf

The ability to scale novel SAF pathways is contingent on securing sufficient feedstocks, particularly for e-SAF, which requires large-scale renewable electricity and green hydrogen production. Expanding these technologies will demand significant investments, continued innovation, and collaboration across industries to ensure a sustainable and cost-effective transition.

Figure 23 illustrates the projected SAF supply until 2050, highlighting the increasing role of advanced biofuels and e-SAF in achieving aviation decarbonization goals. This transition will require substantial infrastructure development and supportive policies to enable the scale-up necessary for a net-zero future.

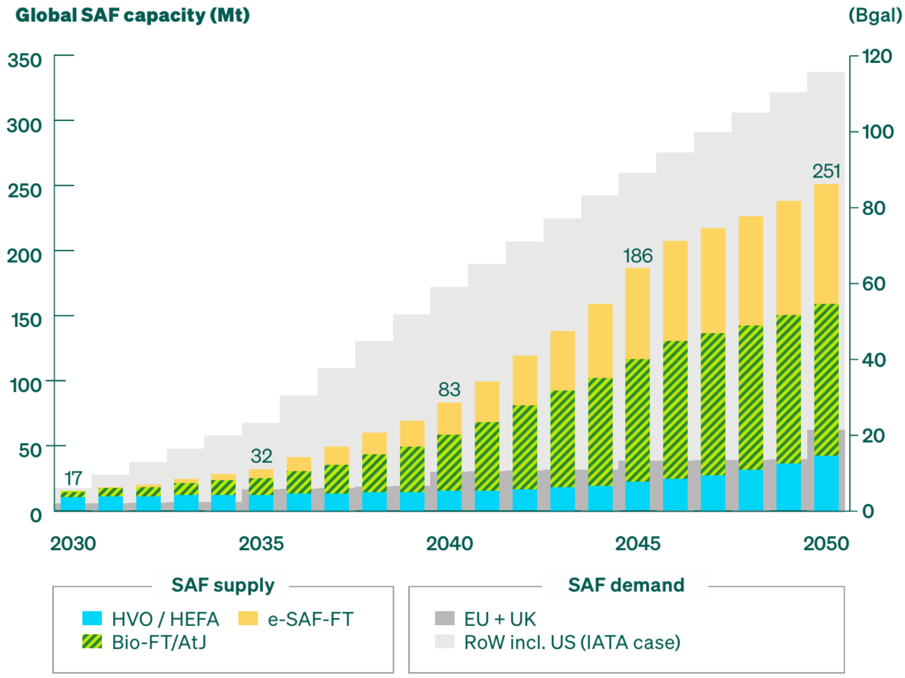

Figure 23: Projected global SAF supply by pathway (colored bars) and demand by region (grey bars)[34].

Figure 23 excludes the potential contribution of biomass gasification combined with Fischer-Tropsch synthesis. It is highly unlikely that biomass gasification for FT will be commercial by 2030; however, technical reliability is expected to be achieved by 2035.

2.4. Airline commitments

Major airlines have signed long-term offtake agreements with SAF suppliers aiming to support the young industry and simultaneously be protagonists in this new era of aviation. As of 2024, more than 50 airlines globally had committed to SAF targets, either as individual commitments or through their respective airline alliances. Airlines, operators, and corporate partners currently have around $45 billion in forward purchase agreements for SAF, an increase from $6 billion pre-Covid[35]. Figure 24 shows the number of agreements by major airlines has increased considerably since 2025 and will remain strong till 2023. Southwest Airlines is the only major airline that has offtake agreements till 2048.

[34] SkyNRG, Sustainable Aviation Fuel Market Outlook, June 2024 Update, https://www.efuel-alliance.eu/fileadmin/Downloads/SAF-Market-Outlook-2024-Summary.pdf
[35] https://www.icao.int/Meetings/CAAF3/Documents/CAAF.3.WP.034.2.en.pdf

The majority of airline targets aspire to achieve 5%-10% of their overall jet fuel requirements through SAF by 2030. While airlines and logistics service providers showed an average willingness to pay almost three times the current price of fossil jet fuel, because airlines usually operate on thin margins, this “green premium” is almost always passed on to corporate customers to maintain financial viability. Non-airline corporate purchasers with a high willingness to pay often have in-value chain emissions reduction goals and can contribute to the SAF market via SAF certificates. This will play a crucial role in the market, particularly in the near term, as suppliers benefit from the ability to sell to highly motivated and credit-worthy corporate buyers[36].

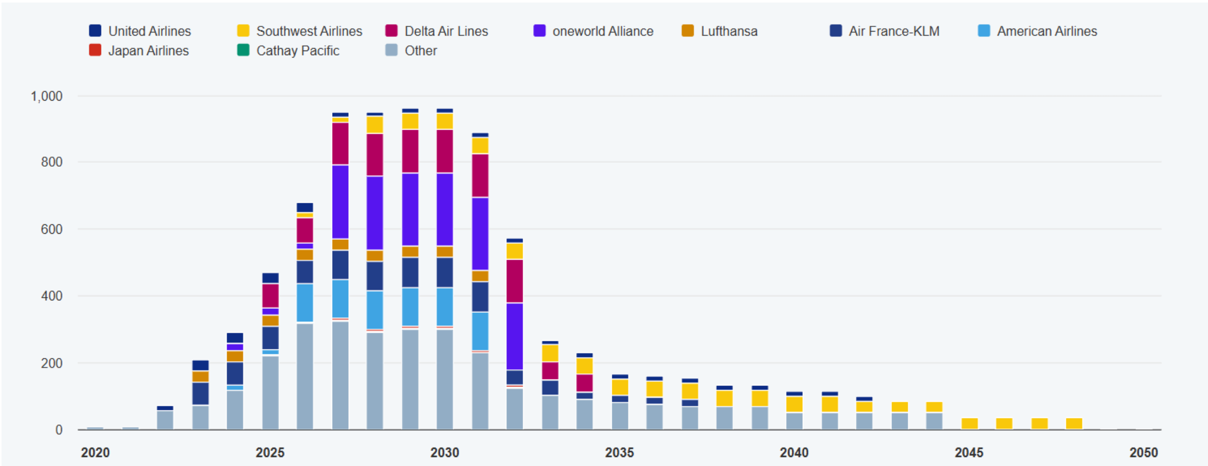

Figure 24: SAF offtake agreements by major airlines, MGal/yr[36].

Airlines and logistic service providers showed an average willingness to pay $6 per gallon for SAF — almost three times the current price of fossil jet fuel, which sits at $2.29 per gallon at the time of writing[37] as shown in Figure 25. This willingness to pay a significant premium for SAF reflects airlines' commitment to sustainable practices, even when it comes at a higher cost[38]. The implications for airlines and corporate willingness to pay much higher premiums are significant for the development of the market since it provides confidence to SAF producers and technology developers of long-term market demand. Furthermore, long-term offtake agreements are paramount for investors to invest in the construction of new SAF facilities.

[36] https://saf.rmi.org/
[37] https://www.airlines.org/dataset/argus-us-jet-fuel-index/
[38] https://rmi.org/unraveling-willingness-to-pay-for-sustainable-aviation-fuel/

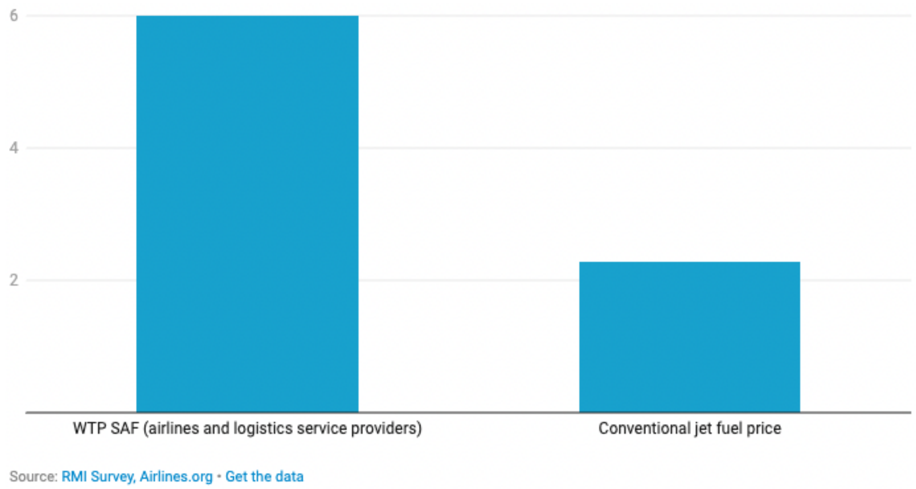

Figure 25: Conventional jet fuel price vs Airlines SAF WTP ($/gal)[38].

2.5. SAF supply at airports

The main task of airports is to provide infrastructure and facilitate the safe and efficient movement of people and goods. Most airports are not involved in fuel purchase; it is up to the airlines and the fuel suppliers. This makes it complicated for airports to play a significant role in the uptake of SAF. However, airports can play a significant role by agreeing to sign long-term offtake agreements and several other measures, such as the airports providing SAF incentive schemes, financial support for SAF plants, raising awareness with regulators and organising and/or supporting awareness campaigns targeted at passengers[39]. It is of critical importance that airports do not enforce local fees, taxes, or charges on SAF, which would create barriers to the market uptake of SAF.

A continuously growing number of airports aim for continuous SAF deliveries rather than in batches, indicating that airports have started to identify themselves as a key element in the SAF logistics value chain, as indicated in Figure 26[36]. In 2014, only one airport (Geneva[40]) agreed to batch deliveries, while by 2024, the number of airports operating on batch deliveries had increased to 46. However, those operating on ongoing deliveries had surpassed them to 81. The policy recognition of the role of airports in decarbonizing transport is strongly reflected in the EU REFUA legislation, with airports being treated with the same significance as fuel providers and airlines. Under REFUA large airports will have to pay penalties if they fail to meet annual targets[41].

In short, airports are a major partner of any SAF ecosystem and should join airlines and industry partners in advocating with governments for policies to encourage SAF production incentives, and market uptake while avoiding new taxes[42].

[39] https://rsb.org/wp-content/uploads/2023/01/SAP-2022-SAF-Guidance-for-Airports.pdf
[40] https://rmi.org/press-release/press-release-geneva-airport-is-first-to-advance-carbon-war-room-skynrg-airport-approach/
[41] EU Airports with passenger traffic ≥800,000 passengers or freight traffic ≥100,000 tons per year must provide storage facilities and make SAF refuelling possible (small remote airports have exemptions). Ideally, they should also establish alternative ground power supply (e.g., electricity, hydrogen).
Minimum fines for Airports: 2 x the annual average price of aviation fuel per tonne, multiplied by the total yearly non-tanked quantity.
[42] https://www.iata.org/contentassets/fa95ede4dee24322939d396382f2f82d/iata-saf---position-paper-v4.3.pdf

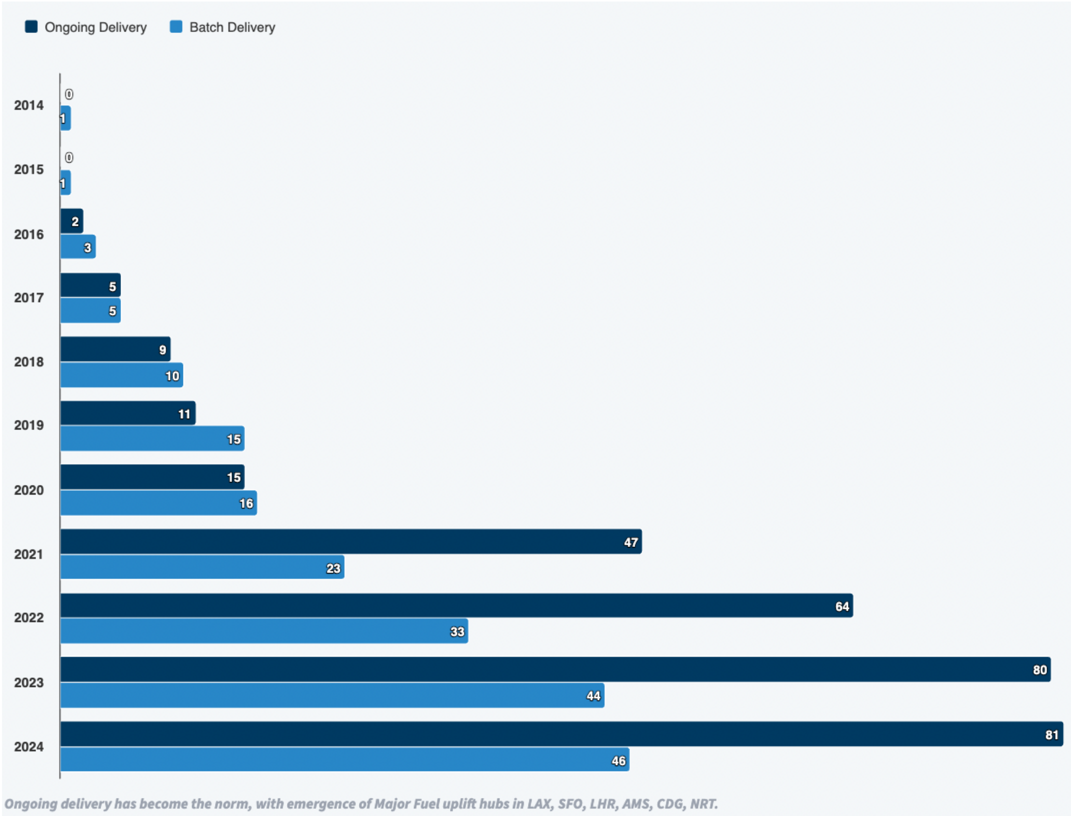

Figure 26: SAF supply at airports[36].

2.6. Global feedstock trade flows and trade corridors

The expansion of SAF markets is shaped not only by technological readiness and policy mandates, but also by the uneven global distribution of feedstock resources and regional production capacities. As demand for SAF grows—especially in regions with limited domestic resources—international trade in feedstocks and finished SAF products has emerged as a critical element in the development of the global SAF supply chain.

Feedstocks such as used cooking oil (UCO), tallow, energy crops, waste lipids, and ethanol are not uniformly distributed across regions. Countries in the Asia-Pacific, South America, and parts of Africa show significantly higher feedstock potential compared to Europe or Japan, where arable land and waste streams are more limited (see Figure 27)[43]. This disparity has catalysed the development of global supply chains to ensure SAF production can meet rising demand in line with policy mandates such as the EU's ReFuelEU Aviation Regulation or Japan's blending targets.

[43] https://aviationbenefits.org/media/167417/w2050_v2021_27sept_full.pdf

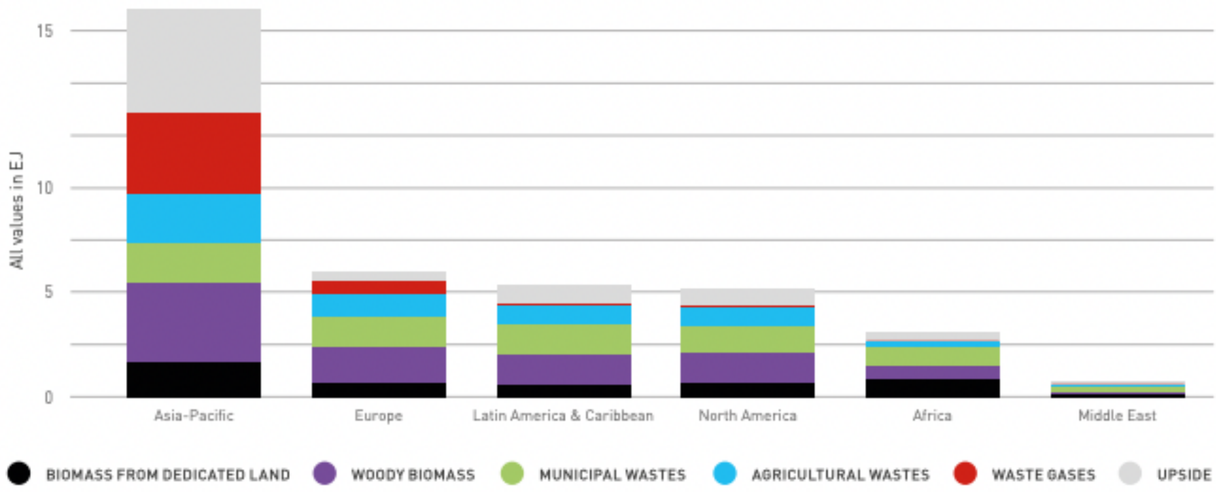

Figure 27: feedstock availability by region in exajoules (EJ)[43].

Over the past decade, the trade in SAF-relevant feedstocks has intensified. UCO, for instance, is a critical input for HEFA (Hydroprocessed Esters and Fatty Acids) SAF—the only fully commercialized SAF pathway today. Most European HEFA production facilities are currently importing large volumes of UCO from China and other countries in Southeast Asia, where supply chains are well-established. HEFA production has been expanding on a global scale, and all HEFA plants in the EU are importing significant UCO quantities from the Far East and China, as shown in Figure 28. However, policy developments may affect UCO trade flows, as higher quantities of UCO will be used locally for HVO and SAF production to meet national targets[44], or produce HEFA SAF locally and export it to the EU and elsewhere at a premium price.

China has announced plans for a 5% SAF blend by 2030, and with the huge expansion in new airports[45] and corresponding aircraft fleets, it is expected to halt UCO and SAF exports to fulfill its national demand. India is likely to follow a similar trajectory and absorb significant feedstock volumes for domestic SAF production, driven by its own rapid airport and fleet expansion[46].

[44] https://www.bangkokpost.com/business/general/2883867/bangchak-buys-used-cooking-oil-for-jet-fuel
[45] The total number of national civil airports will reach about 400 by 2035, up from 241 in 2020, which means that during the next 15 years, China will add more than 150 airports, at an average of 10 new airports each year.
https://www.globaltimes.cn/page/202201/1245192.shtml#:~:text=According%20to%20the%20map%20released,10%20new%20airports%20each%20year.
[46] India plans to build 71 new airports;
https://tvbrics.com/en/news/india-plans-to-build-71-new-airports/
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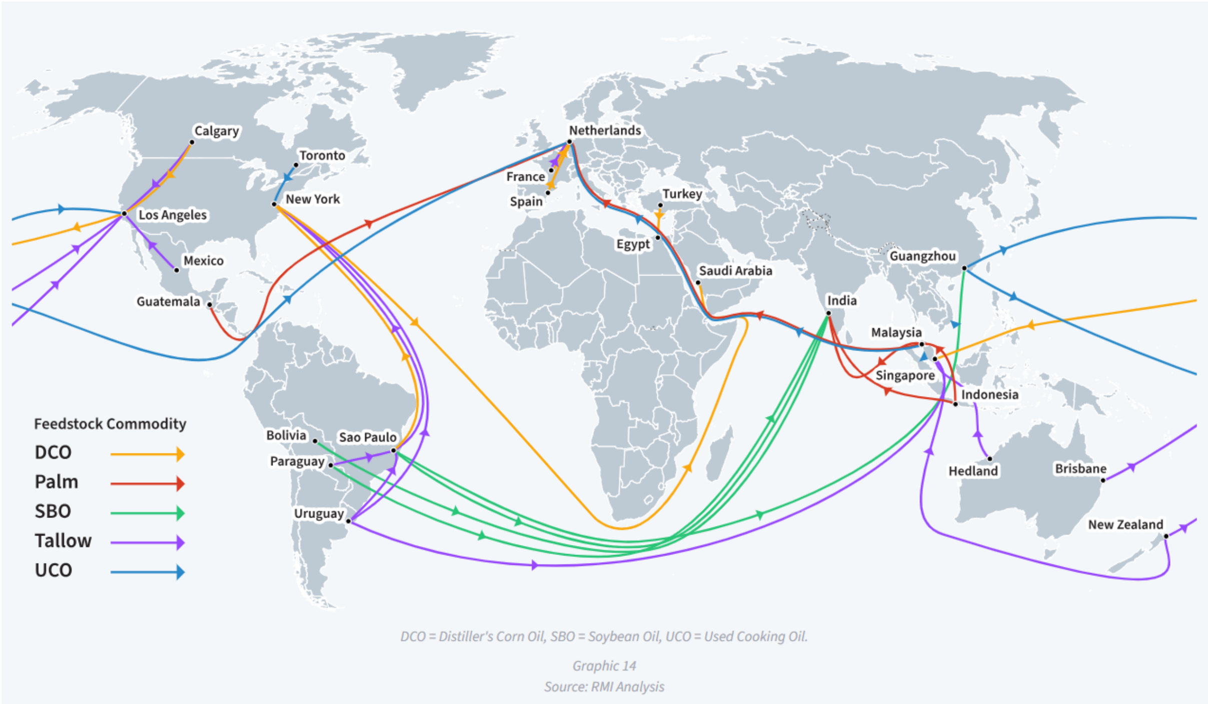

Figure 28: Global feedstock trade flows[47] .

As a result, Europe's SAF supply chain may face growing constraints. While the EU has invested in local SAF production, especially Power-to-Liquid (PtL) capacity, it is unlikely to be self-sufficient by 2030. According to current forecasts, Europe will need to import significant volumes of SAF or its feedstocks to meet the ReFuelEU blending mandates—2% by 2025, rising to 6% by 2030, and higher thereafter.

This evolving situation has led to the emergence of international SAF trade corridors[48]. These corridors connect regions with feedstock surpluses and lower production costs to those with strong policy-driven demand but limited domestic resources. Today's most developed corridor is from Southeast Asia to Europe, centered around Singapore's HEFA production and driven by the EU's regulatory market pull. Singapore-based SAF producers already export to EU airlines and fuel suppliers under long-term contracts.

A second prominent corridor is from South America to North America, where countries like Brazil—with ample sugarcane-based ethanol—are well-positioned to support the U.S. market. The U.S. incentivizes SAF through mechanisms such as Renewable Identification Numbers (RINs), California's Low Carbon Fuel Standard (LCFS), and federal tax credits, which help close the price gap between SAF and fossil jet fuel. Another emerging corridor connects China and Southeast Asia with Japan, where a 10% SAF blending target by 2030 is expected to stimulate SAF imports from nearby feedstock-rich regions. However, this corridor remains volatile, as China's shift to meet its own targets may reduce its availability as an exporter.

[47] https://saf.rmi.org/
[48] SkyNRG, SAF Market Outlook, June 2024 Update, https://skynrg.com/wp-content/uploads/2024/06/SAF-Market-Outlook-2024-Summary.pdf

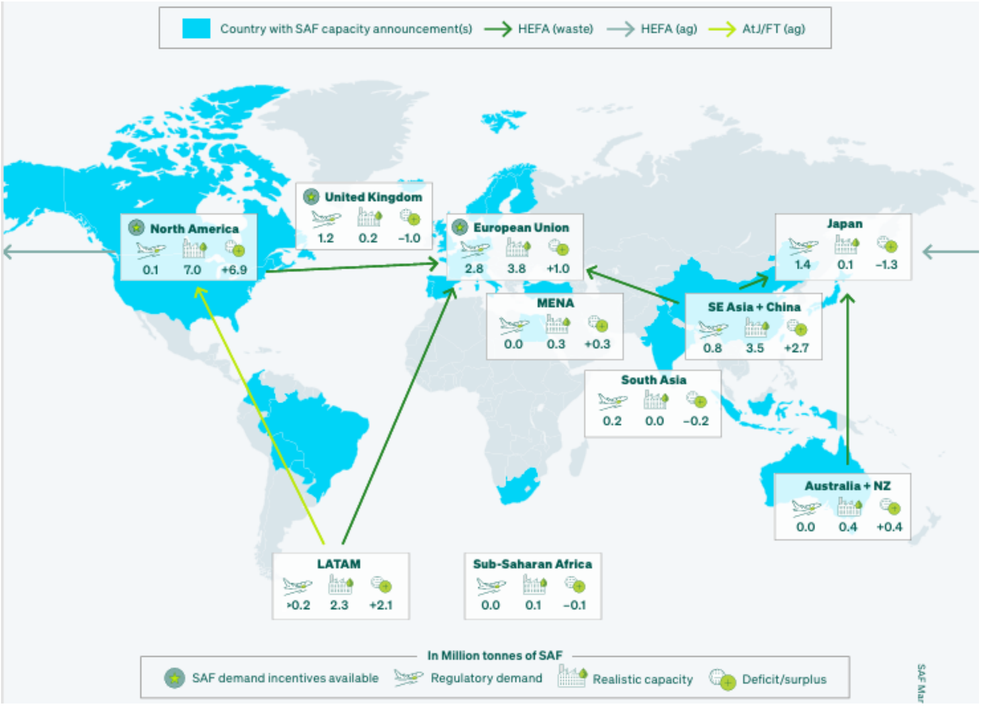

Figure 29: Expected global SAF corridors by 2030[48]Error! Bookmark not defined..

These international trade flows are not only shaped by feedstock availability and technology—but also by regulatory risks and geopolitical developments. For example, potential EU or UK policies introducing sustainability criteria, tariffs, or origin-based restrictions could hinder SAF imports from non-European countries. Similarly, rising competition for feedstocks from other sectors (e.g., maritime fuels, heavy-duty transport, and chemical industries) could limit availability for aviation.

Furthermore, policy developments to significantly increase biodiesel blending in diesel up to 40% in Indonesia and lower blends in other Far East countries will divert resources from the SAF value chain. Given current projections for local production, the European Union may need to import fuels, especially Power-to-Liquid (PtL) fuels, to meet the sub-mandate within the ReFuelEU legislation.

The emergence of China as a global UCO, HVO and SAF global player

China is emerging as a major player in SAF production and consumption due to abundant feedstocks, low production costs and rapid renewable energy growth. Considering the rapid growth of the aviation sector in China it is expected that China could become a global leader in SAF. The 14th Five-Year Plan (2021-25) targets the Chinese civil aviation industry to consume 50,000 tons annually by 2025[49]. To date, there are around 400,000 tons per year of production capacity already in operation (over 90% for export), with a further 3.9 million tons per year announced

China is a major exporter of sustainable feedstocks that can be used for SAF production, such as UCO. Major buyers include the Netherlands, Spain, Italy, the UK, and, more recently, the US, following incentives from the 2022 Inflation Reduction Act, as shown in Figure 30.

[49] https://www.weforum.org/stories/2024/12/could-cooking-oil-from-china-disrupt-civil-aviation-with-sustainable-fuel/

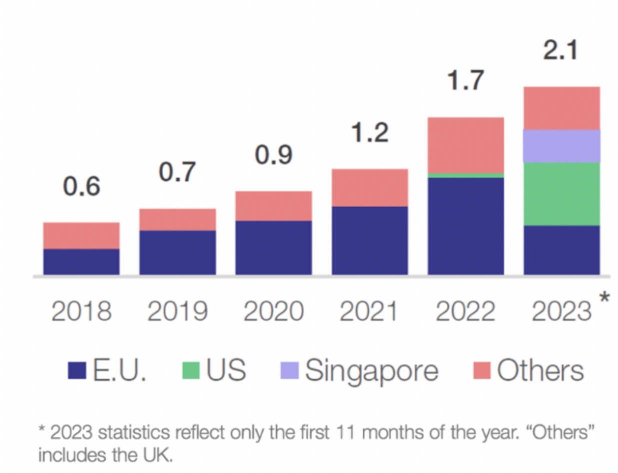

Figure 30: Exported UCO from China in Mt[50].

China has abundant UCO potential (over five million tons per year). Currently, most UCO in China is exported or used for biodiesel production, which is also driven by overseas demand (see Figure 31). Overall, the country has the potential to produce enough SAF to cover domestic demand. Used cooking oil (UCO) is a significant source of biodiesel feedstock in China and is expected to be the primary feedstock for SAF in the next decade.

Should China decide to prioritise SAF production for its own use, the export shown in Figure 31 could dry up almost completely, creating SAF market disturbances in the EU and US.

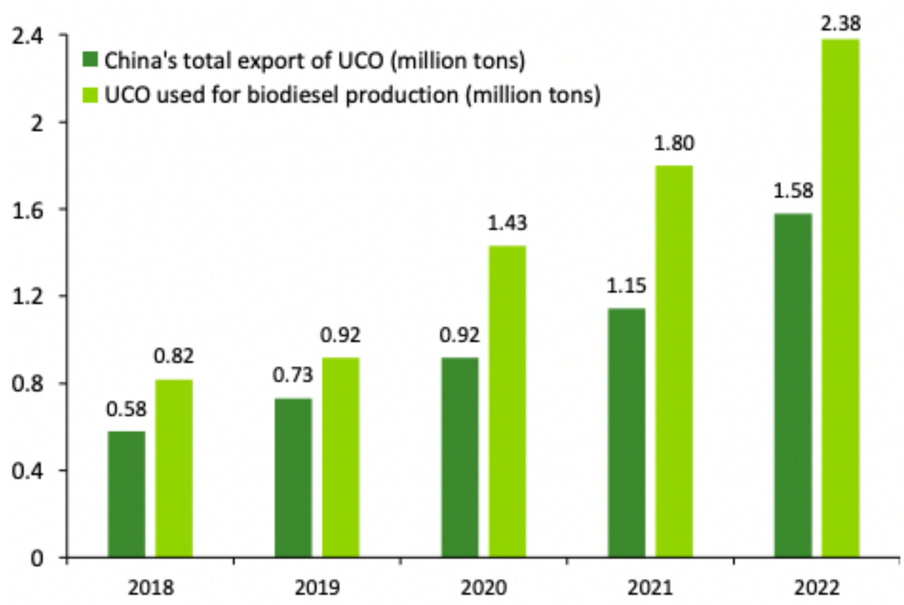

Figure 31: China's Used cooking oil potential[51].

[50] https://www.icao.int/Meetings/CAAF3/Documents/CAAF.3.WP.034.2.en.pdf
[51] https://www.weforum.org/stories/2024/12/could-cooking-oil-from-china-disrupt-civil-aviation-with-sustainable-fuel/

2.7. SAF projects worldwide

A company perspective

For 2023, the SAF - State of the Industry report[52] identified over 100 companies engaged in SAF development (see Figure 32). Based on their supply commitments, leading producers identified in the report include Gevo, Fulcrum BioEnergy, Alder Renewables, Shell Aviation, and Neste. Additionally, the report lists numerous emerging companies, such as Twelve, Air Company, Synhelion, Dimensional Energy, SkyNRG, LanzaJet and Velocys, which are developing innovative SAF technologies. The SAF industry is evolving rapidly, driven by technological advancements, shifting market dynamics, and new investments. Some companies reduce workforce and costs in response to financial challenges, while others secure large-scale funding to advance SAF technology. At the same time, expansion efforts are underway to scale production capacity globally (see also Figure 40), including new facilities and commercial-scale SAF plants. Examples include workforce reductions following stock declines[53], major funding rounds to scale both, bio-based[54] and synthetic[55], SAF technology, and efforts to expand production through new SAF facilities[56,57].

Figure 32: Overview of 100 companies working on SAF per pathway according to SimpliFlying in 2023

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[52] SimpliFlying, Sustainable Aviation Fuels Powerlist 2023, https://simpliflying.com/reports/sustainable-aviation-fuels-powerlist-2023/
[53] https://www.reuters.com/business/energy/finlands-neste-cut-around-600-jobs-2025-02-13/
[54] https://investors.gevo.com/news-releases/news-release-details/gevo-secures-conditional-commitment-us-department-energy-loan
[55] https://thefinancialanalyst.net/2024/09/20/twelve-raises-645-million-to-boost-sustainable-aviation-fuel-production/
[56] https://www.energy.gov/eere/bioenergy/articles/first-ethanol-alcohol-jet-sustainable-aviation-fuel-production-facility
[57] https://flite.eu/

The European perspective

EASA recently provided a comprehensive summary of existing and planned European SAF projects, detailing production capacity, technology pathways, and feedstocks across EU Member States and EFTA countries[58]. According to the assessment, **62 SAF production projects** have been identified across the EU and the European Free Trade Association (EFTA), with notable concentrations in countries such as France, Spain, Germany, the Netherlands, and Sweden. Countries are emerging as key SAF production hubs, driven by favourable policies, investments, and existing refining infrastructure.

The report includes detailed country-specific insights, highlighting the current state of SAF production, ongoing developments, and national policy initiatives (see example for Germany in Figure 33).

The report demonstrates that the fate of SAF production efforts remains uneven across Europe, with some countries taking the lead while others have limited or no active projects. For instance, Belgium, Bulgaria, Croatia, Cyprus, Estonia, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Malta, Slovakia, and Slovenia currently have no announced SAF facilities. This underscores the need for continued policy support, financial incentives, and cross-border cooperation to scale up SAF production and align with ReFuelEU Aviation targets in the coming years.

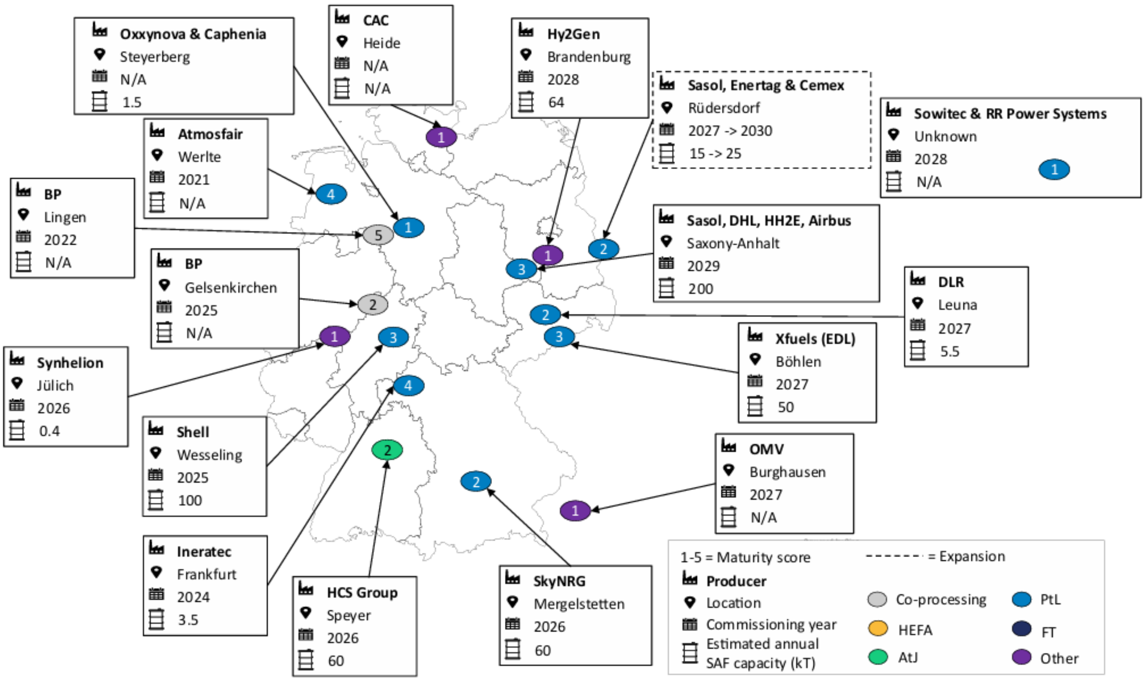


Figure 33: Example of SAF project map for Germany[58].

[58] EASA 2024 Report, State of the EU SAF market in 2023, https://www.easa.europa.eu/en/document-library/general-publications/state-eu-saf-market-2023

The SAF project realisation gap

Despite growing commitments to SAF production, the industry is not on track to meet its net-zero targets. According to a recent study by the University of Hasselt[59], which collected and analyzed SAF project announcements, only 25.6% of the global SAF capacity expected to be on the market by now has materialized, resulting in a realisation gap of 6.19 million tonnes (Mt) in 2024 (see Figure 34).

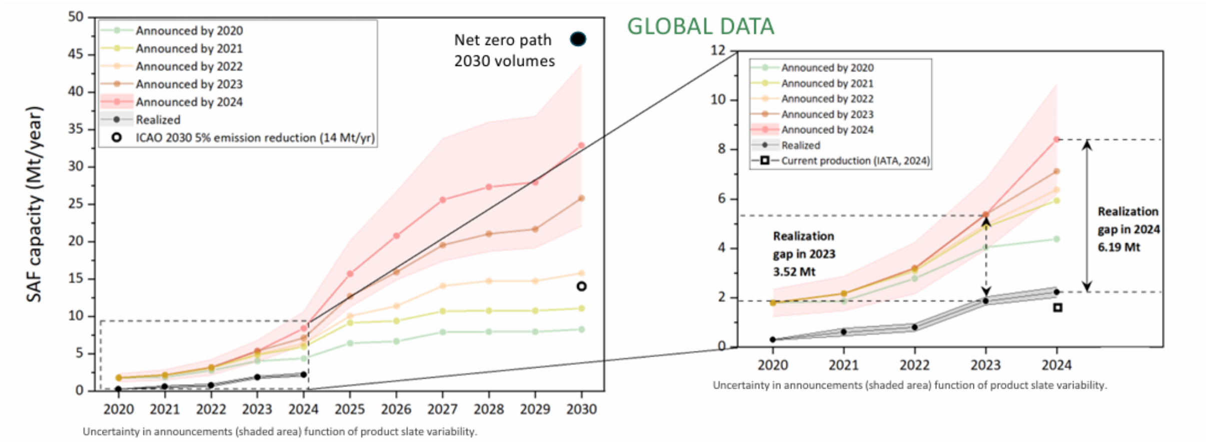


Figure 34: SAF project realisation gap until 2030 based on SAF announcements[60].

In 2024, a significant share of the expected SAF capacity did not materialize as planned, with many projects facing delays (45%), failing (29%), and only 26% reaching successful completion (see Figure 35).

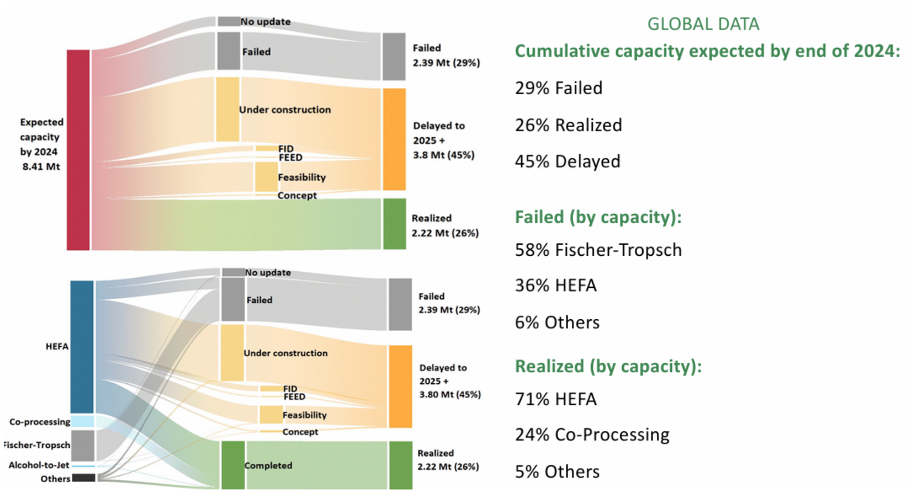


Figure 35: State of SAF projects in 2024[60].

The realization gap varies significantly across different SAF production pathways, with some technologies facing greater challenges than others. Fischer-Tropsch (FT) technology has struggled the most, with 58% of its projected capacity failing to materialize, highlighting the difficulties associated with scaling this pathway. HEFA has proven to be the most mature and scalable SAF production method, with 71% of announced projects successfully completed.

[59] Martulli, Alessandro; Malina, Robert (2025). Sustainable aviation fuels (SAF) projects realization gap and state. figshare. Figure. https://doi.org/10.6084/m9.figshare.28659074.v1
[60] Figure used is from https://doi.org/10.6084/m9.figshare.28659074.v1, under CC BY 4.0 licence.

3 Barriers to deployment, trading and investment

3.1 Policy stability and regulatory gaps

Although SAF is considered technically feasible with several value chains close to commercialisation, as long as SAF faces barriers to deployment, such as cost-effective production policy, support will be fundamental to facilitate SAF market uptake. Different countries have different climates, agricultural and forestry resources, economic structures and regulatory frameworks. Therefore, there is no path to successful SAF policy, even within the EU[61]. A competitive and sustainable aviation sector requires clear political recognition and a supportive regulatory framework. In the EU and globally, the priority now is to accelerate investment in SAF production and close the price gap. For the EU, boosting investment in next-generation SAF – such as eSAF and power-to-liquid (PtL) fuels – is critical to meeting the 2030 mandates under ReFuelEU[62].

However, what has been critical in all approaches is the creation of a comprehensive ecosystem where all stakeholders, including SAF producers, the aviation industry, the research community, resource providers, policy and decision-makers, financers, et al., work together to facilitate technology reliability, economic viability and market stability for SAF. The most critical factor for the strong ecosystem is policy long-term stability, which creates a conducive environment for investors.

SAF policy stability in the EU[63]

The ReFuelEU Aviation Regulation[64] (RFEUA) was issued on 31.10.2023; however, the European Commission issued a Communication on 28.2.25 on the interpretation and implementation of certain legal provisions of the RFEUA[65]. Indeed, RFEUA had left several issues not adequately addressed, creating uncertainty amongst the stakeholders and investors. The Communication clarified issues related to the following topics:

1. The scope of REFUA
2. The eligible aviation fuels
3. The reporting obligations
4. Obligations to supply minimum shares
5. Enforcement of FEFUA, and,
6. Flight emissions label.

It is obvious that unless the above 6 topics were clearly specified in the legislation and well understood by the stakeholders and investors little progress could be realised in new SAF plants and especially those for eSAF which are critically needed.

The REFUA Regulation is strongly based on the Renewable Energy Directive (RED). RED was first issued in 2009 to deliver 20% share of RES in EU final consumption by 2020. It was recast in 2018, aiming to deliver a 32% share by 2030. RED was further revised in 2021 by issuing the “Fit for 55” package. On October 2023, the Council adopted the revised RED III. On 17.5.2024, the Commission issued Delegated

[61] https://www.icao.int/environmental-protection/Documents/SAF/Guidance%20on%20SAF%20policies%20-%20Version%203.pdf
[62] https://www.europarl.europa.eu/doceo/document/E-10-2025-000740_EN.html
[63] For a detailed description of EU SAF policies please see ICARUS Deliverable 1.7: SAF Policies 2025 Update
[64] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202302405
[65] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C_202501368

Directive 2024/1405, amending Annex IX of RED III[66] regarding approved biofuel feedstocks. This sequence of revisions and delegated acts show that the RED is a "*living legislation*" or "*legislation in transition*". Especially amending Annex IX can only be done via delegated Acts which is a complex and time-consuming process.

The RED III includes several sub-targets and incentives to promote the deployment of renewable fuels of nonbiological origin (RFNBOs), including hydrogen and e-fuels produced via electrolysis using renewable electricity. In particular, any renewable fuel used towards REFUA may also be used towards the overall target and sub-targets, where relevant. The Directive includes a 1% minimum share of RFNBOs in transport by 2030. Further, the RED III introduced a 2x multiplier for RFNBOs towards the overall policy target to facilitate the uptake of SAF (and such fuel used in maritime transport).

Member States may also opt to count recycled carbon fuels (RCFs), which include fuels produced from industrial flue gases and waste plastics, towards their transport target. Another delegated act published in 2023[67] sets the GHG reduction requirement for RCFs at 70% below the fossil comparator, the same as for RFNBOs. It also provides detailed information on how producers should calculate GHG emissions from RFNBOs and RCFs[68].

Furthermore, another key regulatory framework linked to the aviation sector is the European Emissions Trading System (EU ETS), a cap-and-trade system to incentivise CO_2 reduction within sectors such as power and manufacturing. It was decided to include aviation activities within the EU ETS in 2008, and the system has been applied to aviation activities since 2012[69]. In July 2021, the European Commission adopted the 'Fit for 55' Legislative Package, which included proposed amendments to the EU ETS Directive for aviation activities, which entered into force on 5 June 2023. The main changes to the aviation ETS are applicable from 2024 onwards. It included the creation of a new incentive scheme for SAF during the period from 2024 to 2030; a maximum of 20 million ETS allowances will be allocated to aircraft operators for the uplifting of SAF to cover part or all of the price difference between SAF and fossil kerosene, depending on the type of SAF used.

In general, the REFUA and RED III were stable at the time of writing this report (March 2025); however, the Commission may issue further revisions and communications in the future.

SAF policy stability in the US[70]

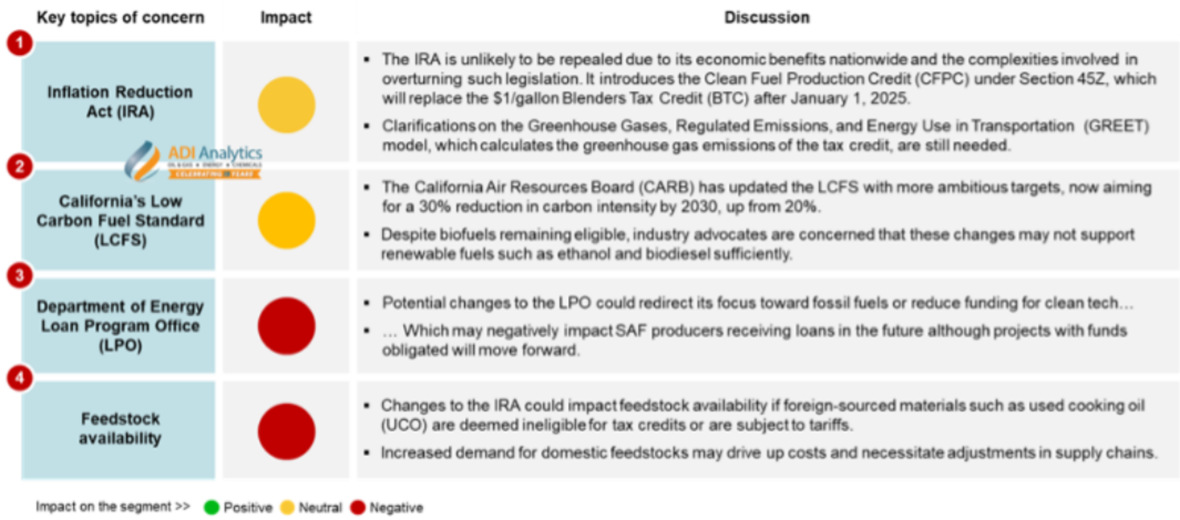
The Trump administration aims to boost oil and gas production and has taken a conservative approach towards climate change. Such policies may seriously affect SAF deployment in the US. Furthermore, the tariffs introduced may discourage biofuel feedstock imports, which could lower the availability of renewable fuels in 2025. SAF stakeholders have four primary concerns, as illustrated in Figure 36:

- the future of the Inflation Reduction Act (IRA),
- the fate of California's Low Carbon Fuel Standard (LCFS),
- the priorities at the U.S. Department of Energy's Loan Program Office (LPO), and,
- feedstock availability[71].

[66] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202401405
[67] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R1185
[68] https://theicct.org/wp-content/uploads/2023/07/fuels-fit-for-55-red-iii-jul23.pdf
[69] https://www.easa.europa.eu/sites/default/files/eaer-downloads/EASA_EAER_2025_Book_v5.pdf
[70] For a detailed description of US SAF policies please see ICARUS Deliverable 1.7: SAF Policies 2025 Update
[71] ADI Analytics: https://adi-analytics.com/2024/11/20/policy-shifts-in-trumps-second-term-could-threaten-u-s-saf-and-biofuel-progress/

Sudden shifts in trade policy create significant challenges for businesses. This unpredictability complicates both short- and long-term planning and can lead to broader consequences with practically immediate effects. For example, Canadian canola and imported grease were quickly reassessed as less economically viable feedstocks for the US market under the revised RFS2 mandate[72].

It is still too early to have a clear view of the policy changes and the effects of tariffs on the SAF deployment in the US, as these are affected almost daily by new announcements, measures, and countermeasures by the US's trade partners.



Key topics of concern	Impact	Discussion
1 Inflation Reduction Act (IRA)		• The IRA is unlikely to be repealed due to its economic benefits nationwide and the complexities involved in overturning such legislation. It introduces the Clean Fuel Production Credit (CFPC) under Section 45Z, which will replace the $1/gallon Blenders Tax Credit (BTC) after January 1, 2025. • Clarifications on the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model, which calculates the greenhouse gas emissions of the tax credit, are still needed.
2 California's Low Carbon Fuel Standard (LCFS)		• The California Air Resources Board (CARB) has updated the LCFS with more ambitious targets, now aiming for a 30% reduction in carbon intensity by 2030, up from 20%. • Despite biofuels remaining eligible, industry advocates are concerned that these changes may not support renewable fuels such as ethanol and biodiesel sufficiently.
3 Department of Energy Loan Program Office (LPO)		• Potential changes to the LPO could redirect its focus toward fossil fuels or reduce funding for clean tech… • … Which may negatively impact SAF producers receiving loans in the future although projects with funds obligated will move forward.
4 Feedstock availability		• Changes to the IRA could impact feedstock availability if foreign-sourced materials such as used cooking oil (UCO) are deemed ineligible for tax credits or are subject to tariffs. • Increased demand for domestic feedstocks may drive up costs and necessitate adjustments in supply chains.

Figure 36: Key concerns on biofuels in the second Trump Administration[73]

[72] https://www.resourcewise.com/environmental-blog/to-tariff-or-not-to-tariff-unstable-biofuels-market-brings-challenges
[73] https://adi-analytics.com/2024/11/20/policy-shifts-in-trumps-second-term-could-threaten-u-s-saf-and-biofuel-progress/

3.2 Legislative SAF trade barriers

Trade barriers due to legislative differences may significantly restrict SAF trade. The US allows food vegetable oils to produce HVO, as shown in Figure 37. It is important to note that most US HVO production and, subsequently, HEFA-SAF fuels are not allowed in the EU market since they do not meet the RED III sustainability criteria and Annex IX B feedstock list.[74]

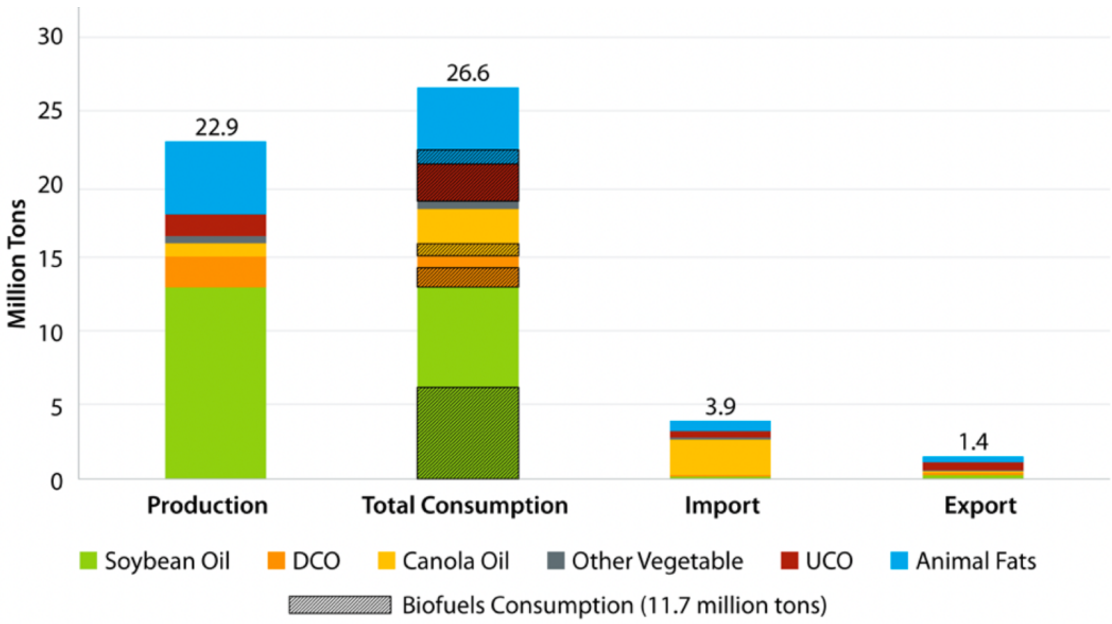


Figure 37: HVO feedstock supply and demand in the U.S. (2022)[75]

The same applies to exporting SAF EtJ from Brazil to the EU unless it can be certified that the ethanol was produced from cellulosic feedstocks, not sugars.

The EU has the most stringent SAF sustainability criteria, which will significantly limit SAF imports. Therefore, the development of the value chains undertaken in ICARUS is critical for the EU to meet its aviation decarbonisation targets.

[74] See https://eur-lex.europa.eu/eli/dir/2023/2413/oj
[75] NREL, July 2024, Sustainable Aviation Fuel State-of-Industry Report: Hydroprocessed Esters and Fatty Acids Pathway, https://www.nrel.gov/docs/fy24osti/87803.pdf

3.3 SAF financing

Different technological pathways for SAF production bring unique CAPEX requirements and scalability challenges, influenced by appropriate legislative structure, feedstock availability and technological maturity (see Chapter 2). The four principal production technologies HEFA, AtJ, G-FT and PtL vary significantly in cost, maturity and capital requirements. Numerous financial levers can be used to mobilise investments (such as Research and innovation grants, Private equity investment, etc.); however, a detailed description of these is out of the scope of this report. The World Economic Forum has discussed the 10 most critical financial levels in great detail[76].

Figure 38 shows the SAF capacity ramp-up needed between 2024 and 2030 to meet the mandated and targeted SAF production. The total 2030 SAF demand is estimated at about 17 Mt from which 4.4 MT was installed capacity in 2024, 1.3 MT is expected to be achieved by capacity expansion of existing facilities, and 5.6 MT is confirmed capacity from projects that have reached Final Investment Decision (FID). This leaves a gap of 5.8 MT that needs to be installed globally to get the 2030 demand.

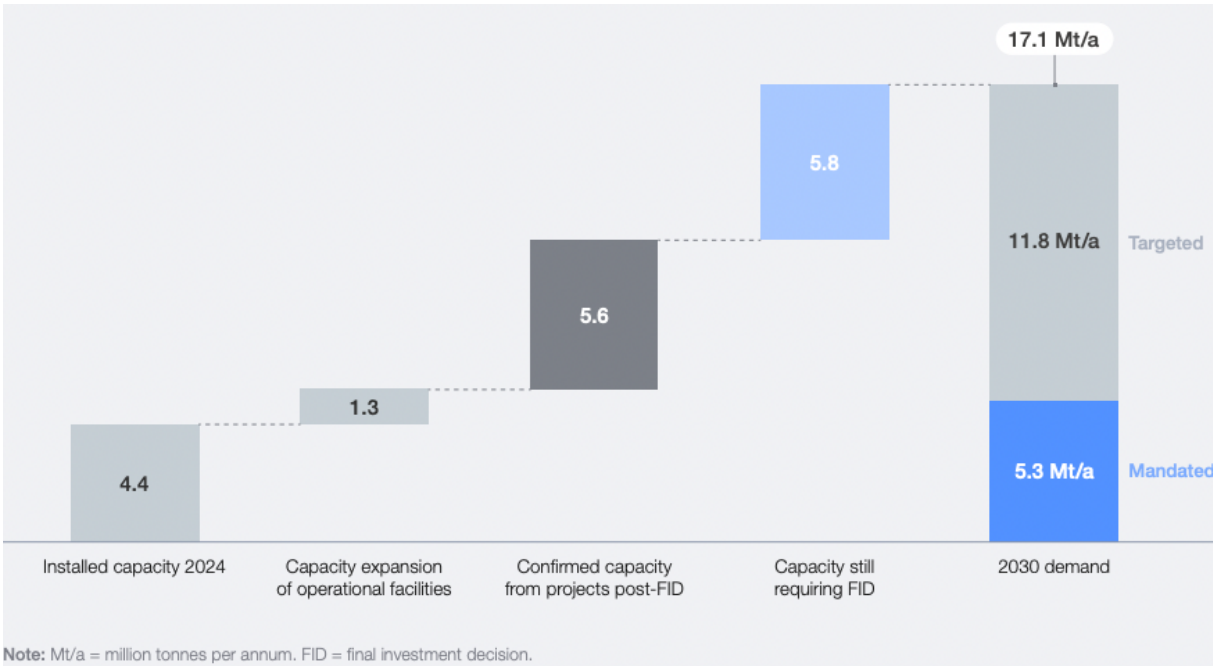


Figure 38: Overview of SAF capacity ramp-up needed between 2024 and 2030[77].

In Europe, in particular, current installed capacity accounts for 1.7 Mt of annual SAF production. This is only one-third of the 5.1 Mt of expected mandated demand driven by REFUA and the UK. As a result, Europe will need to either significantly expand local capacity or rely heavily on imports, most likely from the Americas or Asia.

As shown in Figure 39, each SAF value chain has specific CAPEX requirements due to the technology complexity, operational reliability, feedstock availability, and required infrastructure. Due to the maturity of HEFA production, its CAPEX is the lowest, followed by that of AtJ, G-FT, and finally PtL[78].

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[76] https://reports.weforum.org/docs/WEF_Financing_Sustainable_Aviation_Fuels_2025.pdf

[77] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202302405

[78] Note: There are several other value chains such as SAF from algal lipids, hydrothermal liquefaction of waste streams such as sewage sludge and coprocessing of pyrolysis oils; however, these are still at the very early stages of development, and they are not expected to have any serious contribution before 2035.

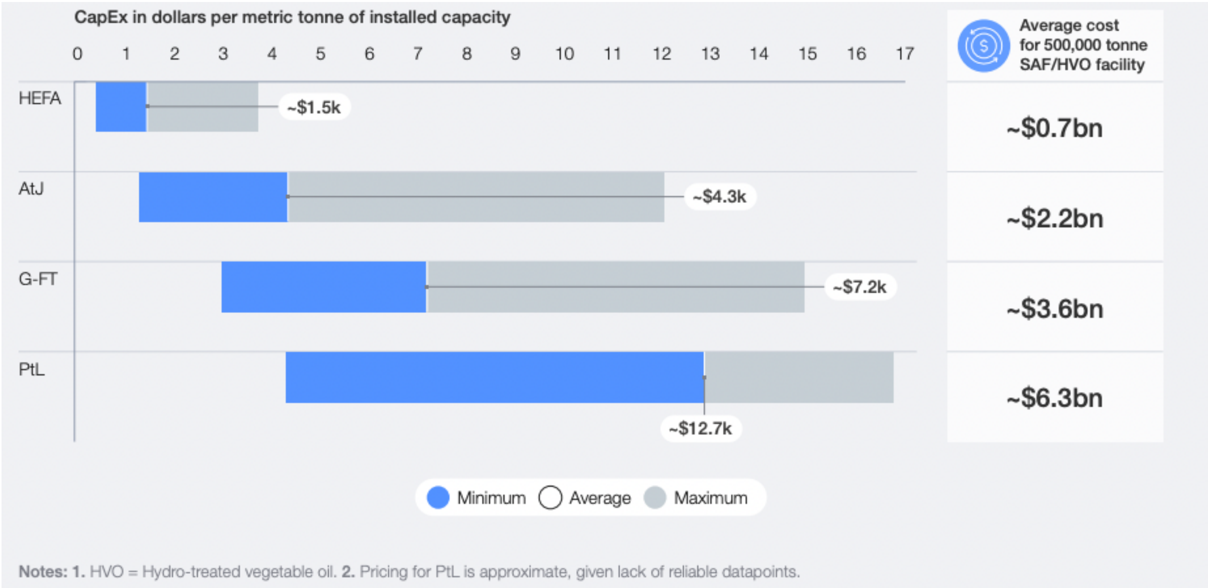


Figure 39: Overview of CAPEX requirements for greenfield SAF refinery by pathway ($/tonne)[77].

Multiplying the total required capacity of 5.8 Mt (Figure 38) with the average investment costs (Figure 39), the total estimated CAPEX commitment required to fulfil the demand for SAF by 2030 ranges between $19 billion and $45 billion. This range of investment in such a relatively very short time scale is huge, and in addition to a well-functioning ecosystem, innovative financial tools are needed to facilitate the bankability of SAF projects. Traditional financial tools consider such projects very risky and traditional financers shy away from SAF projects.

Key initiatives to financially support SAF procurement

There have been some notable initiatives to establish financial mechanisms to support SAF production. Some of these are briefly described below.

- **ICAO Finvest Hub:** The International Civil Aviation Organization (ICAO) has been working to establish the ICAO Finvest Hub as a platform to facilitate dedicated pathways for funding sustainable aviation fuel production facilities, clean energy infrastructure, and other aviation decarbonization initiatives. Finvest Hub aims to connect aviation sustainability projects with investors worldwide directly[79].
- **Sustainable Aviation Fuel Financing Alliance (SAFFA):** Airbus, the Air France-KLM Group, Associated Energy Group, LLC, BNP Paribas, Burnham Sterling, Mitsubishi HC Capital Inc. and Qantas Airways Limited co-invested in a Sustainable Aviation Fuel (SAF) financing fund to accelerate the production of SAF. The corporate partners worked with investment manager Burnham Sterling Asset Management to establish the Sustainable Aviation Fuel Financing Alliance (SAFFA) investment fund in which Airbus is the Anchor Investor. The commitment from the seven partners is amounting to an aggregate of approx. US$200 million. Each partner brings experience and financial expertise to the fund with the ambition to accelerate the availability of SAF by investing mainly in technologically mature SAF-producing projects using,

[79] https://www.icao.int/Newsroom/Pages/ICAO-establishes-global-platform-to-secure-financing-for-aviation-sustainability-projects.aspx

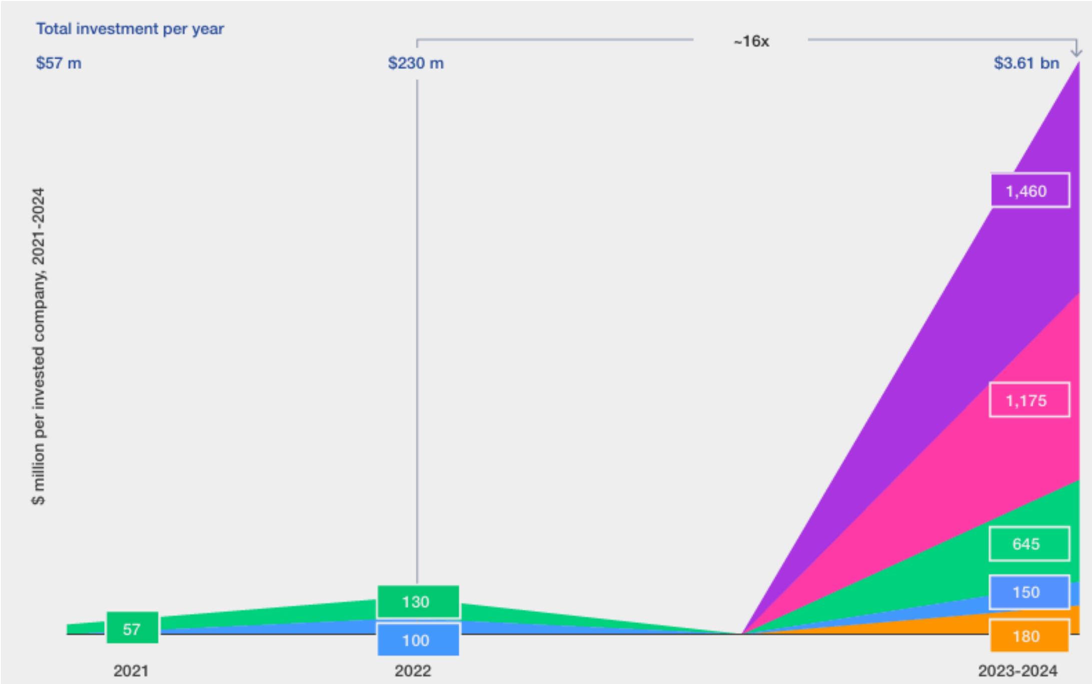
for instance, waste-based feedstocks. Investments will be diversified across various SAF production pathways and by region[80].

- **First Movers Coalition – Aviation**: a global initiative launched by the World Economic Forum and former U.S. Special Presidential Envoy for Climate, John Kerry. The FMC advances the most critical, emerging climate technologies by leveraging members' collective purchasing power[81]. By translating member commitments into the world's most significant, credible demand signal, the FMC accelerates the adoption of emerging climate technologies to decarbonize the world's heavy-emitting sectors. FMC includes a strong aviation community taking decisive action towards combating aviation emissions by embracing emissions reduction technologies, including (SAF). FMC has been advancing the corporate buyer perspective with the involvement of the private sector, which is considered crucial in promoting the adoption of SAF. It promotes the "insetting" which allows the passengers to buy directly SAF when making their booking instead of offsetting which focuses on emissions reduction or prevention through initiatives like tree planting. Complementing the First Movers Coalition, the **Clean Skies for Tomorrow initiative**—also led by the World Economic Forum—brings together public and private stakeholders to develop policy roadmaps and financing strategies aimed at scaling the production and use of sustainable aviation fuels globally.
- **EU Initiatives**: The **Mission Innovation Clean Aviation Mission**[82], supported by several EU Member States and the European Commission, aims to accelerate the development and deployment of clean aviation technologies, including SAF, with a focus on achieving net-zero aviation by 2050. The **EU Innovation Fund** – Clean Tech Projects [83]provides substantial financial support to first-of-a-kind SAF projects through grants and competitive calls, helping to de-risk investments and scale up production. In addition, the **Project SkyPower**[84] initiative has proposed the creation of a government-backed **market intermediary** to bridge the financing gap for e-SAF by offering long-term purchase agreements to producers and short-term contracts to airlines—thereby improving bankability and investment certainty for new projects.

Private sector investments in SAF procurement

Investment in new HEFA capacity has continued throughout 2024 without any problems in raising the necessary investment since HEFA is considered a mature and reliable technology. On the other hand, numerous projects with new and innovative technologies for constructing FOAK plants in Europe and the US were paused or dropped during 2024 amid technical challenges. Similarly, some power-to-liquid projects were scrapped amid a lack of demand or limited returns. Meanwhile, a couple of advanced low-carbon fuel projects went bust, and some energy players exited the SAF production market to focus on potentially more profitable activities such as supply and resale[85]. Despite these problems financing new facilities, several SAF producers have successfully raised capital, as shown in Figure 40. In 2021, only Twelve could raise investments, while in 2020, Twelve was joined by Lanzajet. However, in 2023 and 2024, GAVO, Infinium, and SkyNRG joined the club. In 2021, the total SAF investment was $230 m, which increased 16 times in 2023 – 2024 to $3.61 bn. This is encouraging for SAF deployment, indicating that investors are starting to feel confident about the progress achieved by some SAF producers.

[80] https://www.airbus.com/en/newsroom/press-releases/2024-07-airbus-and-partners-invest-in-sustainable-aviation-fuel-financing
[81] https://www.weforum.org/publications/sustainable-aviation-fuels-offtake-manual/
[82] https://mission-innovation.net/missions/clean-aviation/
[83] https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund_en
[84] https://project-skypower.org/
[85] https://reports.weforum.org/docs/WEF_Global_Aviation_Sustainability_Outlook_2025.pdf



Company	Object	Value	Financier
Gevo $1.46 bn	Net-zero 1 project (South Dakota)	$1.46 bn loan guarantee	U.S. Department of Energy (2024)
Infinium *up to* $1.175 bn	Infinium's Project Roadrunner in West Texas	$75 m	Breakthrough Energy Catalyst (2023)
		More than $200 m	Brookfield Asset Management (2024)
	Other eFuels projects	*Up to* $850 m	Brookfield Asset Management (2024)
Twelve $832 m	Series A	$75 m	Capricorn Technology Impact Fund & others (2021)
	Series B	$130 m	DCVC & others (2022)
	Project equity: 'Airplants' to produce e-fuel	$400 m	TGP Rise Climate (2024)
	Series C	$200 m	TGP & others (2024)
	Credit facilities	$45 m	Fundamental Renewables & SMBC (2024)
LanzaJet $250 m	Freedom Pines Fuels	$50 m	Microsoft's Climate Fund (2022)
	Credit facilities	$50 m	Breakthrough Energy Catalyst (2022)
	SAF production in US	$30 m	Southwest Airlines (2024)
	SAF integration into airport operation	$20 m	Groupe ADP (2024)
	Growth equity funding	$100 m	MUFG (2024)
SkyNRG *up to* ~$180 m	Support facilities development	Up to €175 m	Macquarie Asset Management (2023)

Figure 40: Recent SAF investments by different companies[86]

[86] World Economic Forum, Global Aviation Sustainability Outlook 2025, March 2025, https://reports.weforum.org/docs/WEF_Global_Aviation_Sustainability_Outlook_2025.pdf

Fossil fuels still get significantly more subsidies than renewables

Currently, most countries still subsidize fossil fuel production to a greater extent than renewable energy[87] (see Figure 41). This is at odds with declared policy agendas, given that nearly 200 countries committed to eliminating harmful fossil fuel subsidies at the COP26 in Glasgow in 2021. It is also counterproductive as it will reduce the positive effect of any fiscal support in favour of SAF and other renewable energies, which already receive a minority share of total subsidies (the European Union as a whole spends more money on renewable energies than on the fossil kind, but in 15 member-states the opposite remains true, according to the European Court of Auditors[88]. According to research by the International Institute for Sustainable Development, G20 governments are spending three times as much on fossil fuels as renewables[89].

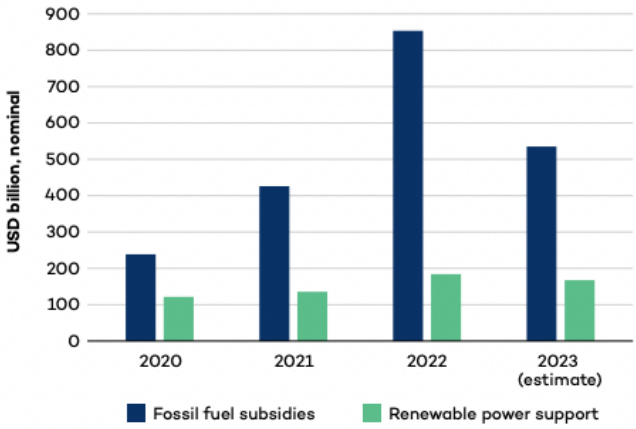


Figure 41: Comparison of G20 renewable power support with fossil fuel subsidies 2020-2023[90].

As long as fossil energy gets higher subsidies than renewable energy, renewables in general and SAF in particular will have an uphill battle to complete in the energy markets without direct fiscal support.

[87] https://www.iata.org/contentassets/d13875e9ed784f75bac90f000760e998/saf-policy-2023.pdf
[88] https://www.eca.europa.eu/Lists/ECADocuments/RW22_01/RW_Energy_taxation_EN.pdf
[89] https://www.iisd.org/articles/press-release/g20-spending-three-times-fossil-fuels-renewables
[90] https://www2.deloitte.com/content/dam/Deloitte/cn/Documents/energy-resources/deloitte-cn-saf-en-230922.pdf

4 Conclusions

The SAF market is at the very early stages of development and is a rather complex matrix of policy initiatives, sustainable feedstock availability, technology reliability, costs and financing mechanisms. The international aspects of SAF have resulted in global trade that can easily be disturbed with changes in local/national SAF or feedstock policies.

HEFA remains the main commercially available SAF, and it is traded globally, however, the availability of fatty acid feedstocks, such as used cooking oils (UCO) and other waste lipid streams, are of limited global supply and originate mostly in China and the Far East with Europe as the main importer of these resources. At the same time these resources are also used for increased biodiesel production in these countries indicating higher demand for biodiesel production.

In the EU the demand for SAF is strong due to REFUA Regulation, however, additional production is needed to ensure that the 2030 targets will be met. Dedicated financial instruments are needed to support the development of new SAF value chains and especially the construction of FOAK plants.

Imports of SAF from the US and Brazil have limited potential since in these countries SAF is mainly produced from food-based resources (vegetable oils and sugar respectively) making them ineligible for the EU market.

Airlines and airports have taken important initiatives to procure SDAF supplies and there is encouraging expectations since technology developers and SAF producers have been recently successful in securing investments in their operations for new SAF production.

The value chains developed under the ICARUS project could play a significant role in the SAF market development when they will reach the commercialisation stage.