



Deliverable 1.7:

SAF Policies 2025 Update

Task 1.5: Policies Overview

WP1: Framework conditions for SAF development in Europe and MIC

March 2025

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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. Different complex strategies and policies are being elaborated with sophisticated multiple regulatory and non-regulatory measures. In the EU, the recent RefuelEU aviation initiative's mandates are ambitious, and the specific targets are very high compared with the market availability of Sustainable Aviation Fuels (SAF). Furthermore, the targets must be achieved in a relatively short time.

This report is an update of the first version of the report dated 30/03/2024, presenting the policy initiatives and actions in the EU and the key Mission Innovation Countries (MIC) Brazil, Canada, China, India, and US. In this updated report, the information was updated wherever possible, and relevant SAF policies of the UK, Japan, Australia, Southeast Asia, Singapore, South-Korea and Africa have been added¹. There is an increasing interest in tackling aviation's GHG emissions in general, and more countries are announcing new initiatives and policies. Therefore, future report updates will add other regions and countries of interest.

The objective of this report is not to make an extensive study of the various policies that have been proposed but to present a comparative analysis of the current policies. More details were incorporated in the report following the first workshop organised with representatives from the EU and MIC in July 2024². Information on the role of airports as the location where SAF is stored before fuelling the planes will also be addressed in the next update of the report. This report is a working document and will be continuously updated.

Figure 1 and Table 3 summarise the various policies and support actions under implementation in the EU, the 5 MIC countries mentioned above, and the additional selected countries and regions covered in this report.

The policies and actions outlined in this report represent a snapshot as of the report date, acknowledging that this space is rapidly evolving and subject to continuous change; for the most up-to-date information, please refer to additional sources such as RMI's global SAF map³, Eurocontrol's SAF map⁴ or ICAO's Aviation Fuel Maps⁵ which provide more frequent updates.

¹ China, USA, UK, Japan, Australia, Southeast Asia, Singapore, South-Korea and Africa are not members of ICARUS.

² ICARUS hybrid workshop on sustainable aviation fuel policies, 9 July 2024, <https://www.icarus-biojet.eu/events-news/project-spotlights/project-spotlights-icarus-hybrid-workshop-on-sustainable-aviation-fuel-saf-policies-9-july-2024-presentations-and-recording-available/>

³ <https://saf.rmi.org/>

⁴ <https://www.eurocontrol.int/shared/saf/>

⁵ <https://www.icao.int/environmental-protection/GFAAF/Pages/Maps.aspx>

SAF Policy Map

Feb 2025

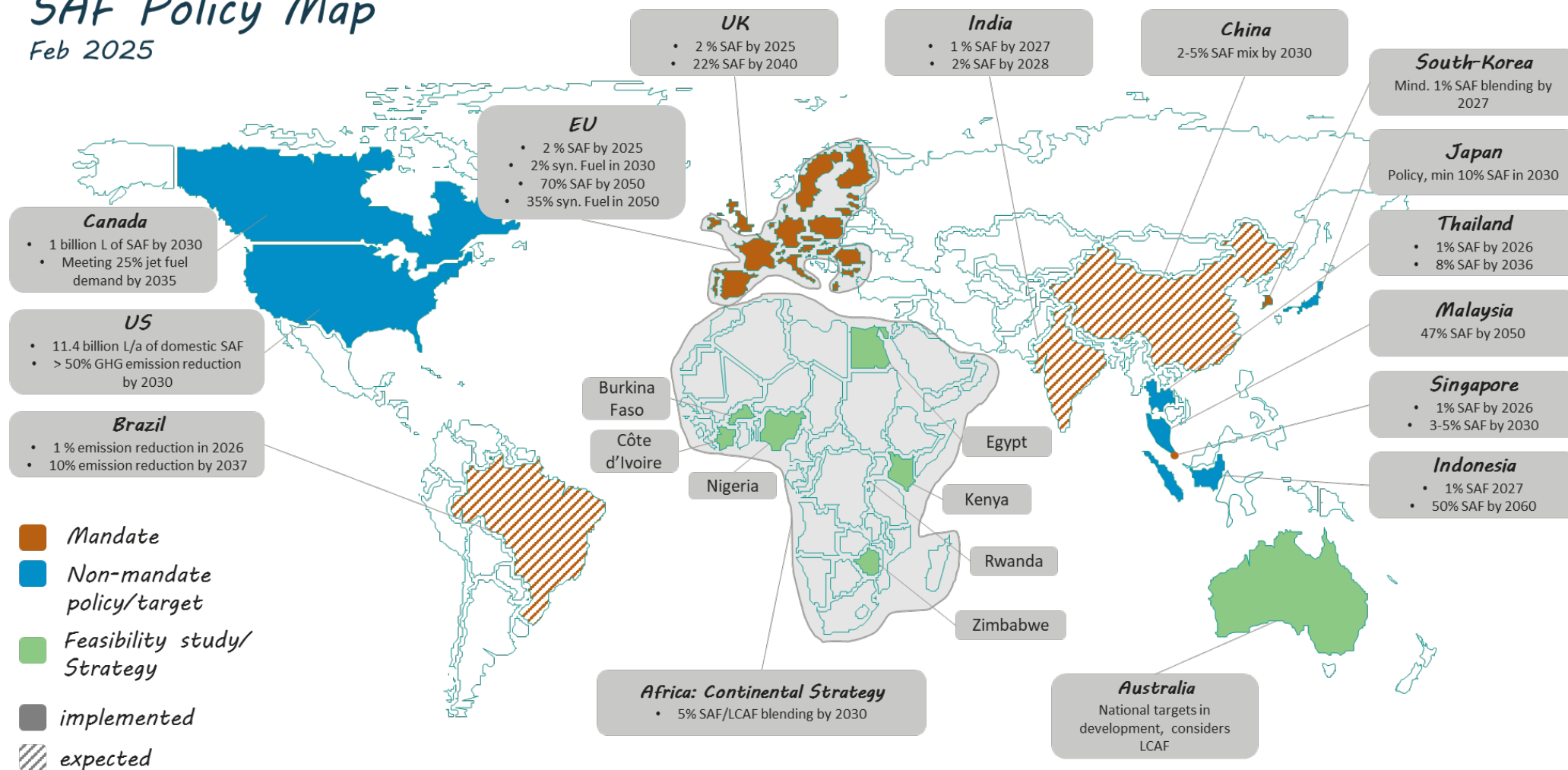


Figure 1: SAF Policy Map summarizing findings of the updated policy report.

Table 3: SAF Policies and support actions in selected regions/countries covered in this report.

<i>Region/ Country</i>	<i>Key initiatives</i>	<i>Type</i>	<i>Comments</i>
Global	CORSIA	Non-Mandate Policy (Target)	- CORSIA sets specific carbon neutrality targets for international aviation growth post-2020. - Airlines must monitor, report, and offset their emissions beyond a baseline level, using eligible carbon credits. - See Chapter 3
Africa	Continental SAF strategy	Non-Mandate Policy (Target)	- Ongoing approval of “Continental Strategy for Accelerating the Development and Deployment of SAF and Low Carbon Aviation Fuels (LCAF)” (2024-2050) - SAF/LCAF blending targets of 5% by 2030
Australia	National strategy for SAF	Strategy	- National strategy issues in 2024 - No targets have been proposed yet. - Policy looks closely to LCAF
Brazil	Policy on forthcoming mandate	Mandate (expected)	- Fuel of the Future Law was established in 2024. - Airlines will be required to reduce GHG emissions from domestic flights by utilizing SAF. - Forthcoming mandate set for 2027 aiming to reduce Brazil’s aviation emissions by 1% of the sector’s total emissions in 2026, increasing to 10% by 2037.
Canada	Policy on targets	Non-Mandate Policy (Target)	- 1 billion litres of SAF by 2030. - By 2035, Canada should be ready to produce SAF to meet 25 percent of total jet fuel demand.
China	Policy on forthcoming mandate	Mandate (expected)	- Original planning cumulatively consuming 50,000 tons of SAF by 2025. - Mandate of 2%-5% of fuel mix by 2030 is expected in 2025 - No reference yet to sustainability certification. - No relationship to ASTM, thus need to develop own standards.
EU	ReFuelEU Aviation Regulation	Mandates & Legislation	- Complex legislation in relation to feedstocks. - Mandate targets very ambitious and in short time: 2% SAF in 2025 up to 70% in 2050 and 2% synthetic fuel in 2030 rising to 35% in 2050. - High minimum GHG savings targets. - Obligation is upon the fuel suppliers. - Mandate targets also on eSAF; nuclear included.
India	Policy on forthcoming mandate	Mandate (expected)	- Use of 1% SAF for international flights by 2027 doubling to 2% by 2028. - The policy also aims to support farmers and rural job creation.

<i>Region/ County</i>	<i>Key initiatives</i>	<i>Type</i>	<i>Comments</i>
Indonesia	National blending targets	Non-Mandate Policy (Target)	- National SAF roadmap: 1% SAF blending target by 2027 increasing to 30% in 2050 and 50% in 2060.
Japan	Short-term goal for biofuel uses in aviation	Non-Mandate Policy (Target)	- Legally set a target supply volume for 2030. It will be at least 10% of SAF consumption (equivalent to 1.71 million kl)
Malaysia	National blending targets	Non-Mandate Policy (Target)	- Sustainable Aviation Energy Task Force was created in 2022 - Ambitious SAF blending target of 47% by 2050
Singapore	Short-term goal for biofuel uses in aviation	Target	- All flights from Singapore should blend 1% SAF from 2026 increasing to 3-5% by 2030.
South Korea	SAF Mandate	Mandate	- Min. 1% SAF blend by 2027 for international departing flights - SAF expansion strategy announced
Thailand	National blending targets	Non-Mandate Policy (Target)	- SAF integrated into National Energy plan. - SAF blending targets of 1% by 2026 and 8% by 2036.
UK	SAF Mandate	Mandates & Legislation	- 2% SAF beginning in 2025 ramping up to 10% in 2030 and 22% by 2040. HEFA SAF will be allowed to contribute up to 100% of SAF demand in 2025 and 2026, decreasing to 71% in 2030 and 35% in 2040. E-SAF will be introduced starting in 2028 at 0.2%, increasing to 3.5% of total jet fuel demand in 2040. Both obligations will include a buy-out mechanism
USA	Sustainable Aviation Fuel tax credit, legislation	Production Target	- Expand production to achieve 3 billion gallons (11.4 billion litres) per year of domestic SAF production that achieve a minimum of a 50% reduction in life cycle GHG emission compared to conventional fuel by 2030. - Strong support for new types of feedstock development. - Loan guarantees.

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1 Introduction

Green House Gas emissions of the aviation sector, although relatively significantly lower than those from road transport, are expected to increase faster in the future. This has brought sustainable aviation fuels (SAF), as the most effective measure to reduce the GHG emission of aviation, to the forefront of the 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

Although the primary objective of the ICARUS project is to develop three value chains for SAF production, the project also aims to carry out an extensive analysis of the status of the various policies either in implementation or under development in the EU, Mission Innovation countries, and even further, such as in Africa and the Far East.

Introducing new fuels in a global market such as aviation is a very complex operation. In addition to European or national issues and interests, international concerns and measures must be taken into consideration. This report aims to present and compare the various policies that have been adopted or are in development globally, focusing on the EU and some key Mission Innovation countries such as Brazil, Canada, India, the UK and the US. The aim is to give the reader a realistic picture of the international activities in SAF policy developments, their similarities and the key differences among the various efforts.

Aviation is a global industry using a well-defined fuel with recognised quality specifications. Since planes must be able to refuel anywhere, fuel quality must be ensured globally. ASTM defines the quality specifications of kerosene, and it is the same organisation that develops the quality specifications for SAF. Details on the SAF value chain specifications have been published in numerous reports and articles, even from ICARUS⁶, and therefore are considered out of the scope of this report on policy-related issues.

1.2. SAF terminologies worldwide

Policymakers worldwide use multiple terms to describe Sustainable Aviation Fuels (SAF), reflecting different technological approaches and regulatory frameworks. The most commonly used terms in policy documents are SAF (Sustainable Aviation Fuel) and LCAF (Low-Carbon Aviation Fuel), with SAF being the dominant term globally. These terms typically refer to bio-based SAF, which is produced from renewable feedstocks such as waste oils, agricultural residues, and forestry by-products. LCAF enables emissions reduction in the production phase of the fuel lifecycle such as carbon capture and sequestration (CCS), renewable and low carbon intensity hydrogen, and renewable and low carbon intensity electricity. Further, LCAF producers and their crude suppliers can use additional mitigation measures, such as methane emission management (venting, flaring and fugitives - VFF) and use of newly developed crudes⁷.

In short, SAF enables emissions reduction in the combustion phase of the fuel lifecycle. LCAF enables emissions reduction in the production phase of the fuel lifecycle

⁶ See table 2, in Recent developments in the catalytic conversion of syngas to SAF, Deliverable D1.4, <https://www.icarus-biojet.eu/project-outputs/public-deliverables/ICARUSD14-2-.pdf>

⁷ ICAO Environment, Lower Carbon Aviation Fuels, <https://www.icao.int/environmental-protection/Pages/LCAF.aspx>

However, as aviation decarbonization advances, additional terminologies are emerging to describe fuels that are produced using renewable electricity. These fuels, often called eFuels, RFNBOs (Renewable Fuels of Non Biological Origin), or PtX (Power to X; X=Liquid or Gas) Fuels, rely on electrolysis-based hydrogen production from renewable electricity and carbon to synthesize hydrocarbons. Table 4 below highlights some of the key terms used across different countries and regions. While not exhaustive, it provides a snapshot of the evolving terminology as fuel production technologies continue to advance.

Table 4: Explanations of selected terms in the SAF policy space.

<i>Terminology</i>	<i>Explanation</i>	<i>Countries/Regions</i>
SAF (Sustainable Aviation Fuel)	A broad term referring to aviation fuels derived from renewable or waste-based sources that reduce lifecycle carbon emissions	Global (Used by all regions, including the EU, UK, USA, Canada, Brazil, China, India, Japan, Southeast Asia, South Korea, Australia, South Africa, Ethiopia)
LCAF (Low-Carbon Aviation Fuel)	A common term used in the CORSIA environment and national policies, e.g. in the USA, Canada and Africa (South Africa, Ethiopia) to refer to fuels that have lower carbon emissions than conventional jet fuels (-10% in the CORSIA context). LCAF are mostly fossil fuels with reduced GHG emissions achieved during the fuel production process.	USA, Canada, Africa (Explicitly referenced in policy documents)
RFNBOs (Renewable Fuels of Non-Biological Origin)	A term specific to the EU , describing synthetic fuels such as those made from renewable electricity and CO ₂ (defined under RED II & RED III) including ammonia	European Union (EU) (Defined under Renewable Energy Directive RED II & RED III). Equivalent term to eFuels.
eFuels (Electrofuels)	A common term in the EU, USA, UK and international energy policy , referring to synthetic fuels produced using renewable electricity, water, and CO ₂ .	EU, United States, UK, UN/IEA/IRENA (U.S. policies often refer to eFuels ; international agencies also adopt the term)
Synthetic Fuels (Synfuels)	A broader term used in the EU, USA, UK, and globally to describe fuels made via the synthesis process (CO + H ₂) for Fischer-Tropsch.	EU, USA, UK, Global (Broad technical term used to describe non-fossil fuel-based aviation fuels, including non-biological renewable fuels)
Power-to-X (PtX) Fuels	Used in China, Japan, UK, EU, and international organizations , referring to hydrogen-based synthetic fuels that can be converted into liquids (PtL) or gases (PtG).	China, Japan, UN/IEA/IRENA, UK, EU (Commonly seen in hydrogen strategy documents)

2 Overview of common SAF policy approaches

A range of policy measures is necessary to accelerate the deployment of SAF, as it remains significantly more expensive than fossil-based alternatives. While technological advancements and market uptake can help SAF overcome the ‘valley of death,’ policy interventions are essential to close the price gap and create a viable market.

The most common SAF policy approaches can be grouped into three main categories: subsidies, mandates, and direct financing and investment tools. Subsidies help lower production costs, while mandates create demand by requiring fuel suppliers or airlines to blend SAF into their fuel mix. Additionally, direct financing mechanisms—such as funding through public financial institutions (PFIs)—support the construction of new SAF facilities and the conversion of existing refineries.

Beyond these core policy tools, governments also promote SAF through research and infrastructure funding, as seen in programs like Horizon Europe, the Connecting Europe Facility, and the Innovation Fund in the EU, as well as similar initiatives in the US and other regions. However, given the international nature of aviation, a more comprehensive approach—including broader economic incentives like carbon pricing—may be needed to ensure the long-term financial viability of SAF.

2.1. Subsidies

USA is the main example of the approach of direct subsidies to SAF production when it comes to the size and significance of this type of support. Most importantly, the Inflation Reduction Act (IRA) (see section 4.8.4) from 2022 establishes a direct subsidy in the form of tax credits per gallon of SAF that recently has been allowed to be in the form of direct payment. In addition of this, many US states such as California through its Low-Carbon Fuel Standard have set state-level subsidy schemes that provide additional benefits to the SAF produced or consumed domestically.

On 6 February 2025, the European Union unveiled the revised EU ETS framework to support the use of this instrument. The framework aims to cover the price difference between SAF and conventional fuels⁸, following the agreement to phase out free allowances to the aviation sector.

According to IATA, the USA and the EU lead the scene in terms of the scale of subsidies to promote aviation decarbonization, followed by Brazil and Japan⁹.

According to IATA, public funding for SAF is greater in the USA and the EU, followed by Brazil and Japan¹⁰.

⁸ https://climate.ec.europa.eu/news-your-voice/news/adoption-eu-rules-ets-support-system-accelerate-use-sustainable-aviation-fuels-2025-02-06_en#:~:text=On%206%20February%202025%2C%20the%20Commission%20adopted%20a,speed%20up%20the%20use%20of%20sustainable%20aviation%20fuels.

⁹ <https://www.iata.org/en/iata-repository/publications/economic-reports/saf-progress-slowed-by-inconsistent-public-funding/>

¹⁰ <https://www.iata.org/en/iata-repository/publications/economic-reports/saf-progress-slowed-by-inconsistent-public-funding/>

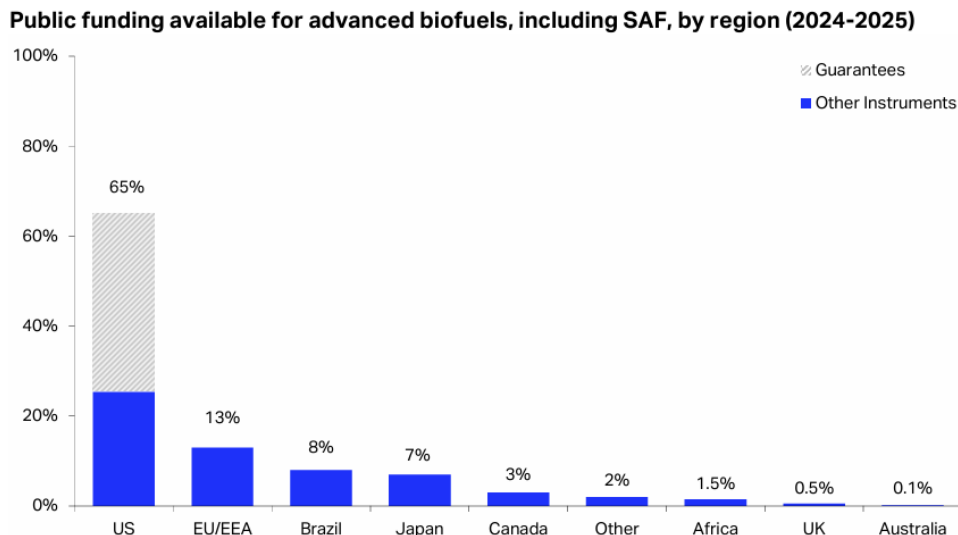


Figure 2: Public funding available for advanced biofuels, including SAF, by region (2024-2025)⁹.

2.2. Mandates

Another main approach for SAF policy is establishing by law a mandatory blending target of SAF into the overall fuel mix consumed by the aviation industry. Following the EU Climate Law from 2019 which enshrined the net-zero target by 2050 for the EU, the European Commission proposed a legislative package referred as the “Fit for 55” aimed at bringing down emissions by 55% by 2030. The Refuel EU Regulation entered into force in 2023 and established the following mandatory and increasing percentages of SAF that must be blended into the aviation fuel mix for aircraft operating within the EU. Specifically, it mandates that airlines must gradually increase their use of SAF in the fuel mix over time.

The key provision of the regulation is the obligation for aviation fuel suppliers to ensure that all fuel made available to aircraft operators at EU airports contains **a minimum share of SAF from 2025** and, from 2030, **a minimum share of synthetic fuels**, with both shares increasing progressively until 2050. Fuel suppliers will have to incorporate 2% SAF in 2025, 6% in 2030 and 70% in 2050. From 2030, 1,2% of fuels must also be synthetic fuels, rising to 35% in 2050¹¹.

The ReFuelEU-Aviation rapid market uptake of SAF is indicated (see Figure 3). What is important to note is that the ReFuelEU the obligation to meet the targets and comply with the regulation is for the fuel suppliers and neither the member states, nor the airlines. Furthermore, the fuel suppliers may market SAF in other countries in a global scale. Therefore, national mandates that surpass the ReFuelEU targets are not allowed, and national measures adopted by the Netherlands¹² and Germany¹³ need to be repealed.

¹¹ <https://www.consilium.europa.eu/en/press/press-releases/2023/10/09/refueleu-aviation-initiative-council-adopts-new-law-to-decarbonise-the-aviation-sector/>

¹² 14 % of aviation fuel must be sustainable by 2030 whilst by 2050, the fossil kerosene requirements of the aviation sector must be fully replaced by sustainable alternatives.
<https://www.government.nl/latest/news/2020/03/04/minister-van-nieuwenhuizen-imposes-use-of-cleaner-fuel-in-aviation-sector>

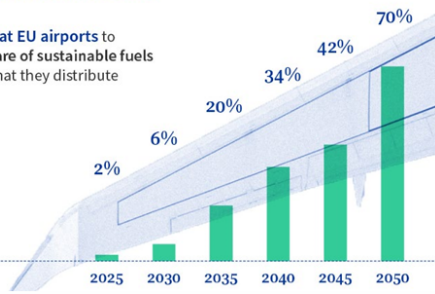
¹³ A blending quota for synthetic fuels in aviation — a power-to-liquids, or 'PtL quota' — will start at 0.5pc in 2026, rising to 1pc in 2028 and 2pc by 2030;



The ReFuelEU aviation regulation will oblige:

1. aircraft fuel suppliers at EU airports to gradually increase the share of sustainable fuels (notably synthetic fuels) that they distribute

Minimum share of supply of sustainable aviation fuels (in %)



2. airlines departing from EU airports to refuel aircraft only with the fuel necessary for the flight to avoid emissions related to extra weight caused by tankering practices (carrying extra fuel to avoid refuelling at a destination airport where fuel is more expensive)

3. EU airports to guarantee the necessary infrastructure to deliver, store and refuel with sustainable aviation fuels

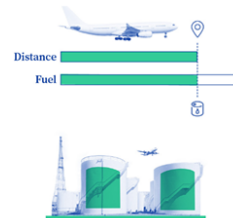


Figure 3: ReFuelEU ramp up to 2050¹⁴.

Many other countries are opting for such mandates:

- The **UK** (see section 4.7) has established a SAF Mandate requiring that, starting in 2025, SAF must constitute 2% of the total jet fuel supplied in the UK. This target is set to increase to 10% by 2030 and 22% by 2040. The mandate aims to deliver significant greenhouse gas emission reductions, with projections of 2.7 million tonnes of CO₂ equivalent (MtCO₂e) in 2030 and 6.3 MtCO₂e in 2040.
- **Indonesia** (see section 4.9) has implemented a blending mandate for international flights, requiring 1% SAF blending in 2027, increasing to 2.5% in 2030, and 12.5% in 2035.
- **Turkey** adopted a 1% SAF blending mandate in 2021, with the goal of reaching 30% by 2030.
- **Malaysia** (see section 4.9) plans to start producing SAF in 2027, with an initial production capacity of one million metric tons per year. The government has established an SAF blending mandate starting with 1%, aiming for a 47% blend by 2050.
- **Singapore** (see section 4.10) targets a 1% SAF blend by 2026, with plans to increase it to 3-5% by 2030, subject to global developments and the wider availability
- **Japan** (see section 4.6) mandates 10% SAF use for international flights starting in 2030.
- **China** (see section 4.4) plans to introduce a mandate of 2%-5% of fuel mix by 2030

2.3. Direct financing and investment of SAF projects

States opting for more interventionist approached for industrial development have used public financial institutions (PFI) such as development banks or sovereign funds to grant loans and acquire stakes of specific companies they deem of importance for national economic development. Noteworthy examples include the European Investment Bank (EIB)¹⁵, France's Bpifrance¹⁶, and Italy's Cassa Depositi e Prestiti¹⁷ and the Inter-American Development Bank (IDB)¹⁸ having funded SAF projects such as building SAF refineries and supporting the scaling of production.

¹⁴ https://www.griffith.edu.au/__data/assets/pdf_file/0031/1862464/Rosalinde-van-der-Vlies-European-Commission-Pres.pdf

¹⁵ <https://www.eib.org/en/press/all/2024-227-eib-and-cepsa-sign-eur285-million-loan-to-finance-the-construction-of-a-second-generation-biofuels-plant-in-spain>

¹⁶ <https://www.safinvestor.com/news/146561/elyse-energy/>

¹⁷ <https://www.ifc.org/en/pressroom/2024/ifc-and-the-italian-climate-fund-partner-with-eni-to-support-biofuel-production-farmers-in-kenya>

¹⁸ <https://advancedbiofuelsusa.info/interamerican-development-bank-provides-25-million-funding-boost-to-perus-biofuel-project/>

3 ICAO CORSIA: A Global Scheme for SAF Sustainability

3.1 The ICAO CORSIA framework

The International Civil Aviation Organization (ICAO) plays a key role in shaping global policies for SAF adoption. As a UN agency, ICAO coordinates international aviation standards and emissions reduction strategies, establishing sustainability criteria, lifecycle greenhouse gas (GHG) assessment methodologies, and certification frameworks to ensure SAF contributes effectively to aviation decarbonization. By setting a unified regulatory framework, ICAO helps align national and regional policies, facilitating the global transition towards sustainable aviation.

A major ICAO initiative is the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), a market-based measure designed to cap CO₂ emissions from international aviation and drive the use of lower-carbon fuels¹⁹. CORSIA requires airlines to offset emissions exceeding a baseline (average 2019 CO₂ emissions) through carbon credit purchases or the use of CORSIA-compliant SAF.

To qualify under CORSIA, Sustainable Aviation Fuel (SAF) must meet sustainability criteria—such as a minimum 10% lifecycle GHG reduction—set by ICAO guidelines. Certification is conducted through voluntary schemes recognized under CORSIA, such as the RSB Standard for ICARO CORSIA^{Error! Bookmark not defined.}. Notably, some certification schemes, like the RSB Standard, apply additional sustainability requirements that go beyond CORSIA's baseline criteria.

Furthermore, CORSIA incentivizes SAF derived from waste, residues, and other low land-use risk feedstocks to ensure a sustainable supply chain.

ICAO's policy framework not only provides a standardized approach for SAF adoption but also supports research, capacity-building, and international cooperation to enhance SAF availability and cost competitiveness. Through CORSIA, ICAO ensures emissions reductions are credible, measurable, and aligned with global climate objectives, reinforcing the aviation sector's commitment to long-term sustainability. As SAF technologies evolve and production scales up, ICAO's role in facilitating policy development and harmonization will remain crucial in advancing a cleaner aviation industry. Figure 4 shows the potential reduction of CO₂ emissions by CORSIA²⁰.

¹⁹ International Civil Aviation Organization (ICAO). CORSIA Methodology for Calculating Actual Life Cycle Emissions Values. (2024).

²⁰ https://www.icao.int/environmental-protection/CORSIA/Documents/CORSIA_FAQs_Dec2022.pdf

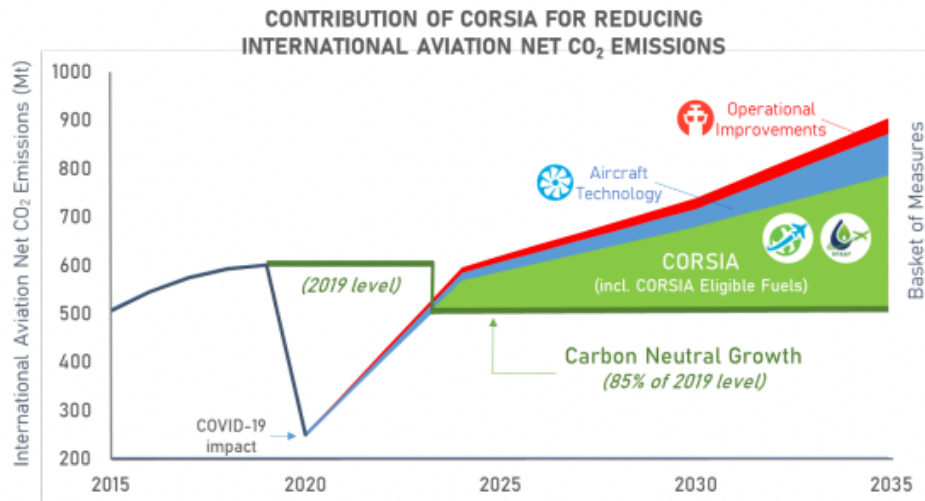


Figure 4: CORSIA estimated contribution for reducing international aviation CO₂ emissions²⁰.

Figure 5 shows the life cycle assessment reductions for Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) eligible SAF pathways and feedstocks compared to conventional jet fuel value²¹.

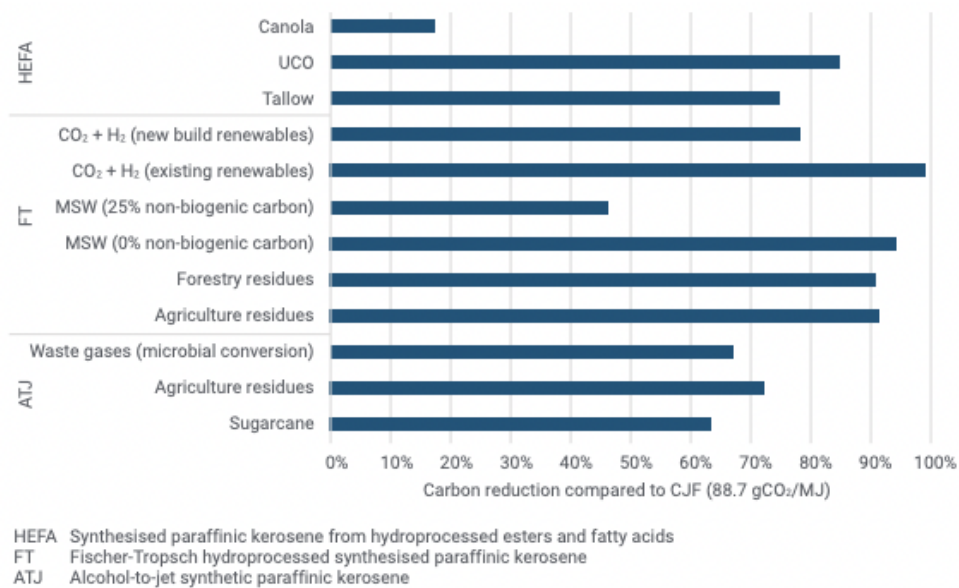


Figure 5: CORSIA LCA for eligible SAF pathways²¹.

Notably, on 17 February 2025, ICAO announced the Finvest Hub²², a global platform to connect aviation sustainability project developers with investors. The platform aims to scale SAF production and market uptake and facilitate funding of SAF production facilities, clean energy infrastructure, and other aviation decarbonisation initiatives.

²¹ Australian Government, Aviation White Paper, Towards 2050, August 2024
<https://www.infrastructure.gov.au/sites/default/files/documents/awp-aviation-white-paper.pdf>

²² ICAO Finvest Hub, <https://www.safinvestor.com/news/146974/icao-2/>

3.2. SAF recognition across CORSIA and EU frameworks

In the EU, multiple regulatory frameworks govern aviation emissions reduction efforts and the promotion of SAF, including the EU Emissions Trading System (EU ETS), the Renewable Energy Directive (RED II/III), and the ReFuelEU Aviation Regulation (see detailed description in Chapter 4.1). These EU initiatives interconnect with the ICAO CORSIA framework, creating a layered regulatory environment for airlines operating within and beyond the EU.

The compatibility and interactions of those frameworks are as follows:

- **Scope and Coverage:** The EU ETS is a cap-and-trade system designed to reduce greenhouse gas (GHG) emissions, with compliance monitored through a Monitoring, Reporting, and Verification (MRV) process. It applies to flights within the European Economic Area (EEA) (intra-EEA flights). In contrast, CORSIA applies to international flights between participating countries, such as transatlantic routes. This distinction means that a single flight is typically subject to either EU ETS (for intra-EEA flights) or CORSIA (for international flights). However, airlines operating in both intra-EEA and international markets must comply with both schemes depending on the specific routes they operate.
- **SAF Recognition:** Both the EU ETS and CORSIA allow emissions reductions through SAF usage. However, the sustainability criteria and certification processes differ between the two frameworks²³. In the EU, RED III defines the sustainability criteria for SAF, and only fuels meeting these standards are eligible for emissions reduction claims under the EU ETS. Under CORSIA, SAF must meet ICAO's CORSIA Eligible Fuels criteria to be recognized for emissions reductions. A single batch of SAF can be certified under both EU ETS and CORSIA frameworks, but it can only be claimed under one scheme for emissions reduction purposes. Current developments are exploring further alignment between the two systems.
- **Regulatory Alignment:** Efforts are ongoing to harmonize the EU's aviation emissions regulations with international frameworks. The EU has partially incorporated CORSIA into its legislation, applying it to extra-EEA international flights, while maintaining the EU ETS for intra-EEA flights. This dual approach aims to balance global competitiveness for EU airlines with effective emissions reduction within the region. The EU intends to regularly assess CORSIA's implementation and may adjust its policies in response to international developments and climate targets²⁴.

²³ https://www.iata.org/contentassets/d13875e9ed784f75bac90f000760e998/refuel-eu-aviation-handbook.pdf?utm_source=chatgpt.com

²⁴ https://climate.ec.europa.eu/eu-action/transport/reducing-emissions-aviation_en?utm_source=chatgpt.com

4 SAF Policy Updates

4.1 European Union (EU)

The EU's ambitious decarbonization strategy to reduce the **carbon footprint** of the aviation sector drives the consumption of advanced biofuels. This strategy is complex and sophisticated with multiple regulatory and non-regulatory measures, some of which apply at the EU level and some of them, apply at the national level. As a result of this some of them may have conflicting aims and objectives.

The European Climate Law²⁵ increased the EU's 2030 net GHG emission reduction target from at least 40% to at least 55% compared to 1990 levels. The complexity of EU Climate law that includes transport is indicated in Figure 6 while Figure 7 shows the various legislative initiatives related to transport.

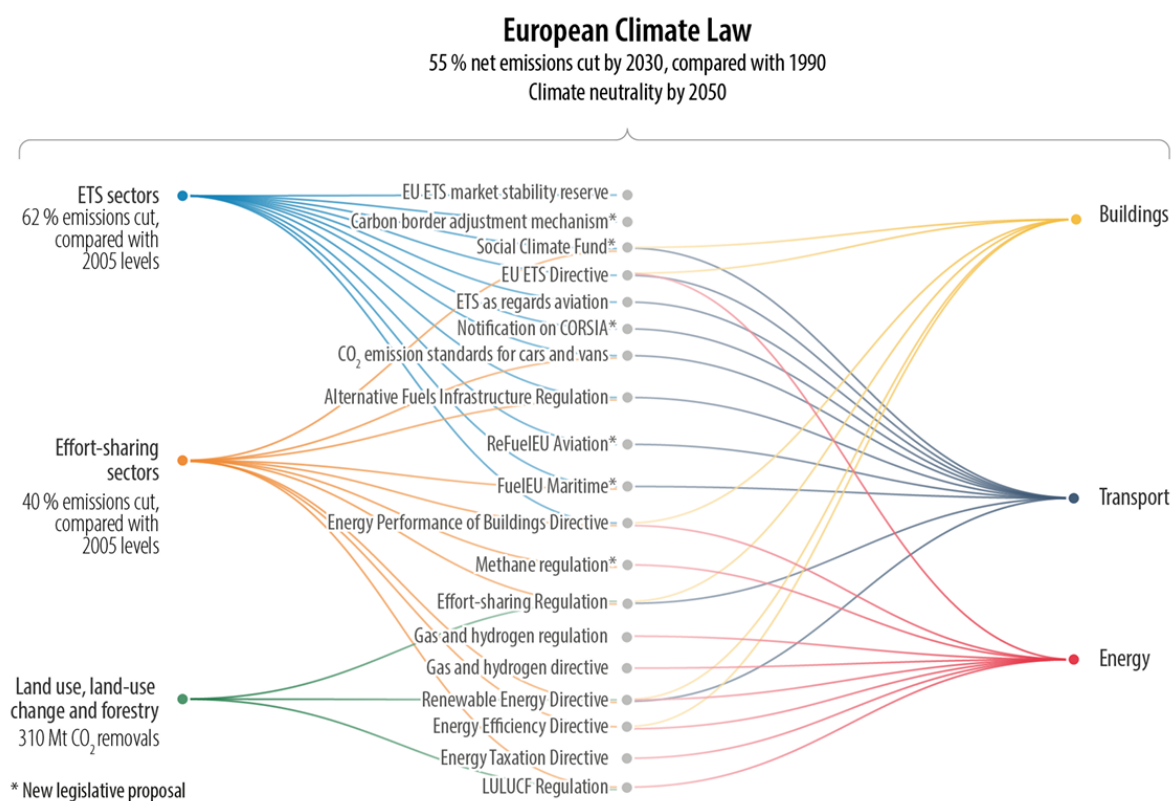


Figure 6: European Climate Law²⁶.

²⁵ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R1119>

²⁶ [https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/733513/EPRS_BRI\(2022\)733513_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/733513/EPRS_BRI(2022)733513_EN.pdf)

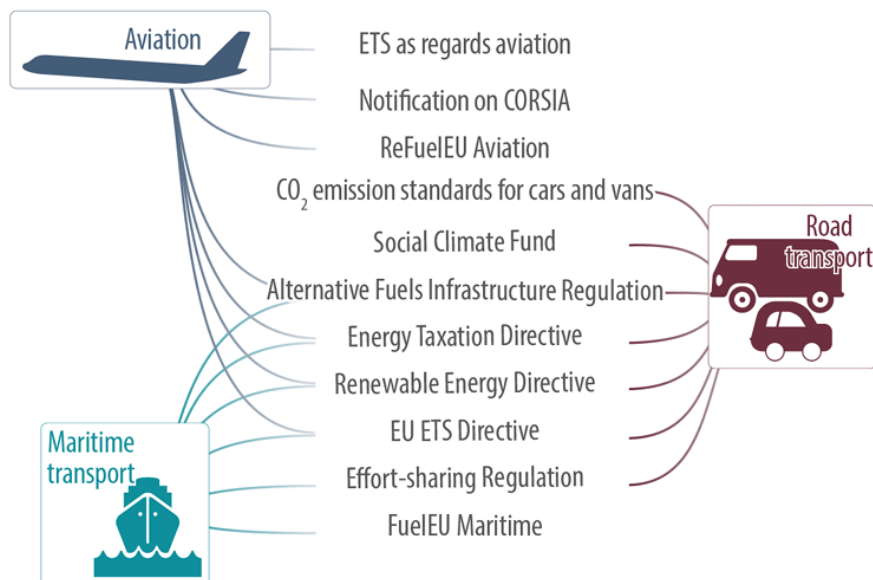


Figure 7: Transport-related legislative initiatives in the 'fit for 55' package²⁶.

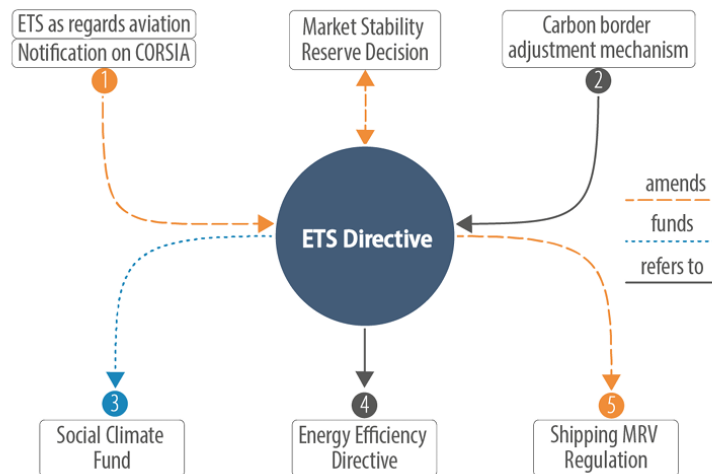
The 'Fit for 55' package²⁷ includes four laws intended to raise the ambition of the EU ETS, improve its functioning, broaden its scope to maritime transport, road transport and buildings, and provide for the participation of airlines in the ICAO CORSIA offsetting scheme^{28,29}.

As shown in Figure 8, these are complemented by a regulation introducing a carbon border adjustment mechanism to safeguard international competitiveness by pricing the carbon emissions of imports, and a regulation on a Social Climate Fund to address the social impacts of extending the EU ETS to road transport and buildings.

²⁷ https://ec.europa.eu/commission/presscorner/detail/en/IP_23_4754

²⁸ <https://www.icao.int/environmental-protection/CORSIA/Pages/default.aspx>

²⁹ Note: Monitoring, reporting and verification of CO₂ emissions under CORSIA began in 2019. 88 States volunteered to participate in the CORSIA offsetting pilot phase from 2021, including all EU and EFTA States. This has increased to 107 States in 2022 and represents a majority of ICAO Member States; EASA, European Aviation Environmental Report, 2022, Doi: 10.2822/129746 (BOOK) | 10.2822/04357 (PDF)



1. Both laws concern aviation in the EU ETS and implementation of the international CORSIA system. The second law ensured that Member States notified airlines of CORSIA obligations for 2021.
2. The amount of carbon border adjustment depends on the phasing-out of free allowances in the EU ETS.
3. Financing of the Social Climate Fund comes from revenues from the new ETS for transport and buildings.
4. Allocation of free ETS allowances depends on operators' compliance with the requirements of the EED.
5. The existing Regulation on monitoring, reporting and verification of maritime transport emissions (the Shipping MRV Regulation) was amended to align with the extension of the ETS to maritime transport.

Figure 8: Legislative initiatives related to the EU ETS in the 'fit for 55' package²⁶.

As far as aviation is concerned, following the revision of the EU ETS in 2023, free ETS allowances for airlines are being phased out, and flights going outside the European Economic Area become subject to the international CORSIA offsetting scheme while the **ReFuelEU Aviation Regulation (ReFuelEU)** promotes sustainable aviation fuels.

On February 2024 the European Commission introduced a support scheme financed through the EU ETS to support the adoption of SAF. The new Delegated Regulation³⁰ is relevant in the context of the phasing out of free ETS allowances for airlines and other industry from 2026 onwards as agreed in the reform of the EU ETS in 2023. As the price of the EU ETS credits is quite high (around 100 €) this means that airlines will have new and very significant costs they did not have because they did not pay to pollute as they received free allowance. The new EU Delegated Regulation establishes that 20 million EU ETS allowances during the period from 1 January 2024 until 31 December 2030 will be awarded to companies using SAF to cover the price difference between SAF and fossil-based fuels. As mentioned above, considering the price of the EU ETS credit is currently around 100 € this makes the overall figure of direct subsidies of 2000 million € for the current EU ETS phase (until 2030). EASA will be tasked to report yearly on conventional jet fuel and SAF prices. It is interesting to note that the Annex to the Delegated Regulation states the support is much higher for RFNBOs and co-processed fuels of non biological origin than biofuels produced from feedstock listed in Annex IX.

³⁰ Delegated Regulation C(2025) 681 final, 6.2.2025, https://climate.ec.europa.eu/news-your-voice/news/adoption-eu-rules-ets-support-system-accelerate-use-sustainable-aviation-fuels-2025-02-06_en

4.1.1 ReFuelEU Aviation Regulation

The **RefuelEU** mandates are ambitious, and the specific targets are very high compared with the market availability of Sustainable Aviation Fuels, (SAF). Furthermore, the targets must be achieved in relative short time.

There are two barriers that at present limit the market deployment of SAF:

- the availability of sustainable biomass feedstocks that can be used in the various conversion processes; in particular lipids, and,
- the technical reliability and economic viability of the various innovative technologies under development.

Both of the above barriers are being addressed under ICARUS as new SAF pathways are being studied in the project..

Although the share of aviation in the transport greenhouse gas emissions is relatively low compared to road transport -see Figure 9 -, it still represents a significant part since the EU policy is to reduce the emissions from road transport via electrification.

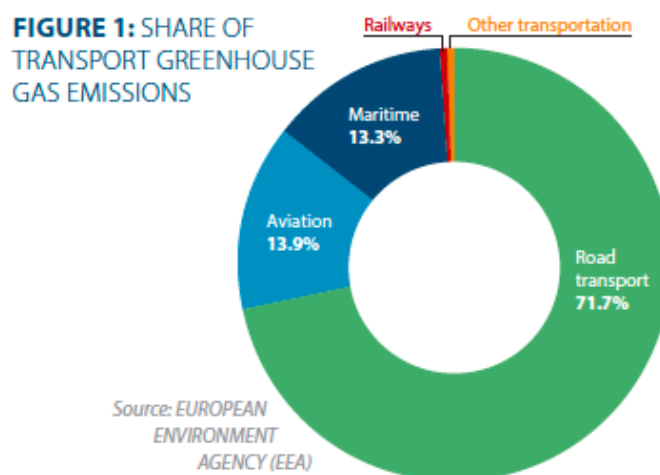


Figure 9: Share of Transport GHG emissions (from EEA).

4.1.2 Eligible SAF under the Renewable Energy Directive

The Renewable Energy Directive III³¹ (RED) has a binding overall target of 42.5% by 2030 for the share of renewables in the EU's overall energy consumption, with an additional 2.5% indicative top-up for achieving a target of 45%.

³¹ https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en

Specifically for the **transport sector**, Member States can choose between:

- a binding target of a 14.5% reduction in greenhouse gas intensity in transport from the use of renewables by 2030; or
- a binding share of at least 29% of renewables within the final consumption of energy in the transport sector by 2030, and,
- the combined share of advanced biofuels and biogas produced from the feedstock listed in Part A of Annex IX and of renewable fuels of non-biological origin in the energy supplied to the transport sector is at least 1 % in 2025 and 5,5 % in 2030, of which a share of at least 1 percentage point is from renewable fuels of non-biological origin in 2030.

What is critical in RED in relation to biofuels is ANNEX IX, which lists the feedstocks that receive special treatment for the purpose of the RED transport target. Advanced biofuels are defined as liquid or gaseous biofuels made from materials listed in Part A of Annex IX. The Commission must regularly review the list and add any feedstocks to the Annex that meet the criteria set out in Article 28(6) of RED. A delegated act³² that updates the list in the Annex to add the feedstocks that meet the criteria has been proposed. In March 2024, Annex IX Part A and Part B were updated, including new feedstocks such as crops grown on severely degraded land (except food and feed crops) or intermediate crops, which can be used for the aviation sector.

Currently the eligible types of SAF and their feedstocks that can be used in the EU are listed in Table 5.

Table 5: Eligible types of SAF and their feedstocks that can be used in the EU

<i>Aviation Fuel Type</i>	<i>Description</i>
SAF Mandate	
Aviation Biofuels	Advanced biofuels made from feedstocks in RED-II Annex IX-A
	Biofuels made from feedstock in RED-II Annex IX-B; UCO and animal fats
	Other RED-II (non-food and feed biofuels), (eg cat 3 animal fats)
Recycled carbon fuels	Fuels of which the energy content is derived from from waste streams of fossil energy (eg steel mill waste gases)
Synthetic aviation fuel sub-mandate	
Renewable fuels of non-biological origin (RFNBO)	H ₂ or liquid fuels derived from renewable energy sources (efuels)
Synthetic low-carbon aviation fuels	H ₂ or liquid fuels derived from nuclear energy

³² https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13484-Biofuels-updated-list-of-sustainable-biofuel-feedstocks_en

4.1.3 SAF availability in the EU

According to the supporting study for the ReFuelEU Aviation initiative³³, the demand for aviation fuel at EU airports would amount to around 46 million tonnes in 2030. In order to reach 5% of SAF by 2030 for all flights departing from EU airports, approximately 2.3 million tonnes of SAF would be required.

Currently, the maximum potential SAF production capacity in the EU is estimated at around 0.24 million tonnes, i.e. only 10% of the amount of SAF required to meet the proposed mandate by 2030.

In spite the significant interest in SAF the actual SAF production today is still on its infancy and in the very early stages of development. The EU SAF supply in 2020 was less than 0,05% of total jet fuel demand³⁴. Numerous projects have been announced and some of them are already in the development stage and if it is assumed that these will be built then it may be possible to meet the proposed mandates. Figure 10 shows all the projects (some already operational) that have been announced for SAF production in Europe by March 2022. However, some of them are already producing hydrotreated vegetable oil (HVO) fuels for use in the road transport and other are large scale demonstration plants with no specific plan to be retrofitted for commercial production.

Although several new projects have been announced the 2025 and 2030 targets remain very ambitious. It is estimated that more than 60% of the European SAF supply in 2030 would be covered by HEFA and Alcohol-to-Jet pathway fuels followed by imports and PtL fuels¹² as estimated in Figure 11.

³³ European Commission, Directorate-General for Mobility and Transport, Giannelos, G., Humphris-Bach, A., Davies, A. et al., *Study supporting the impact assessment of the ReFuelEU Aviation initiative – Final report*, Publications Office of the European Union, 2021, <https://data.europa.eu/doi/10.2832/219963>

³⁴ EASA, *European Aviation Environmental Report 2022*
https://www.easa.europa.eu/sites/default/files/eaerdownloads/230217_EASA%20EAER%202022.pdf

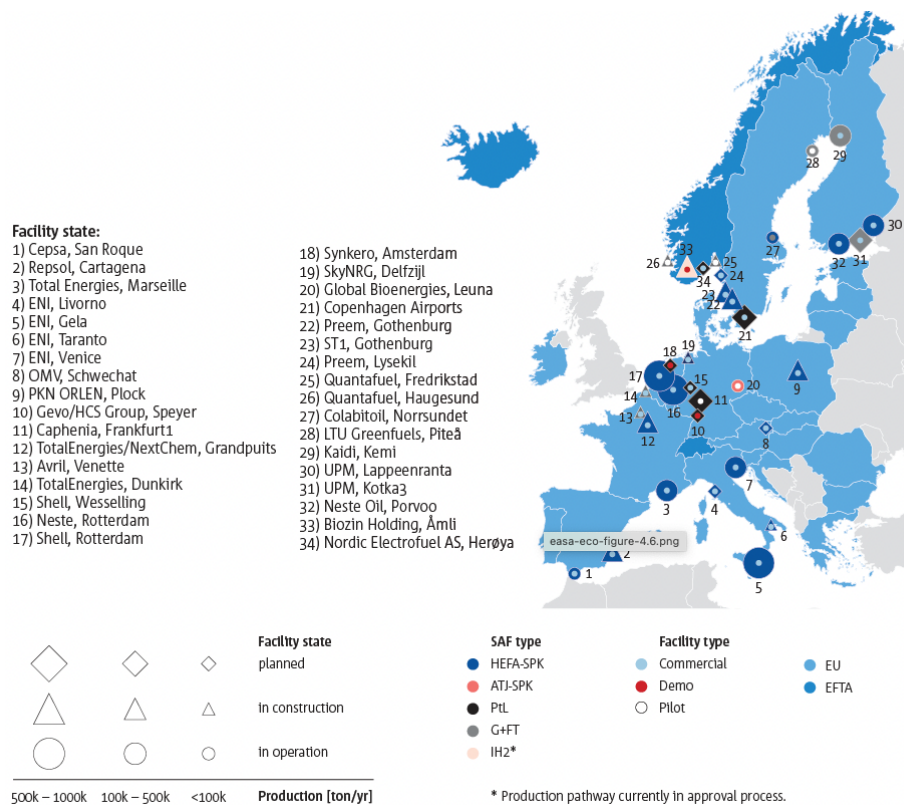


Figure 10: Current announced SAF projects within Europe, March 2022³⁴

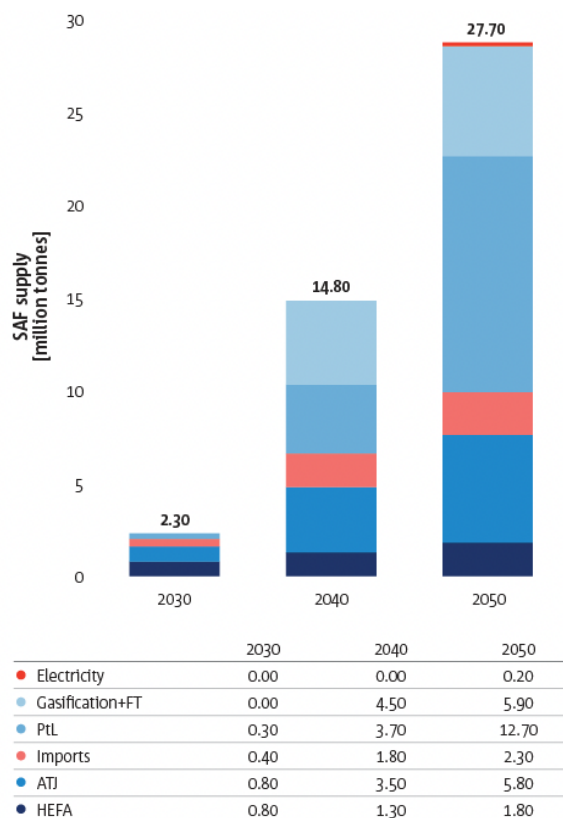


Figure 11: ReFuelEU modelled SAF supply per production pathway³⁴

4.1.4 Penalties and reporting obligations under the ReFuelEU Aviation

The ReFuelEU Aviation includes blending mandates for SAF starting with 2% in 2025, reaching 6% by 2030 and gradually increase to 70% by 2050 (with half allocated to e-fuels). The Directive also introduces incentive multipliers for Member States for directing advanced biofuels and RFNBOs in the hard to abate sectors of aviation and shipping (respectively x1,2 for advanced biofuels and x1.5 for RFNBOs). **Failure to comply with this mandate implies that the fuel providers face a penalty which will be equal to twice the price difference between fossil jet and the respective SAF carrier as well as are obliged to deliver the mandated quantities in the following year.** Airports and airlines also face comparable penalties as indicated in Table 6 below.

Airlines departing from airports in the EU are obliged to refuel at least 90 percent of their yearly required aviation fuel within the EU. This requirement was introduced to prevent tankering (the practice of loading more fuel than needed in third countries).

EU Airports with passenger traffic $\geq 800,000$ passengers or freight traffic $\geq 100,000$ 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).

Table 6: Penalties under the ReFuelEU Aviation

<i>Sector</i>	<i>Penalty description</i>
Fuel Supplier	2 x [Difference SAF or synthetic aviation fuel price - conventional kerosene price per tonne] x quantity of aviation fuel not complying with the quota
Airline	2 x the annual average price of aviation fuel per tonne, multiplied by the total yearly non-tankered quantity.
Airport	2 x yearly average price of aviation fuel per tonne x yearly non-tankered quantity

Finally, fuel suppliers must report in the Union database by 14 February of a reporting year, and for the first time in 2025. RED established the Union Database³⁵ which is intended to ensure market transparency and traceability in the supply chain for such fuels, mitigating the risk of irregularities and fraud. The MS must have the necessary legal and administrative framework at the national level to ensure that the data entered by the fuel suppliers is accurate, verified, and audited. The EC would publish annual reports about the data in the Union database with due regard to the protection of commercially sensitive information, including the quantities, the geographical origin, and feedstock type of fuels.

4.1.5 Guidelines and clarifications

³⁵ It is a comprehensive traceability tool that aims to trace consignments of renewable and recycled carbon fuels and the raw materials used for their production – from the origin of the raw materials to the point where fuels are put on the EU market for final consumption.

On 28 February 2025 the European Commission provided clarifications on specific elements of the EU law to incentivize the uptake of sustainable aviation fuels³⁶. The clarifications are related to 6 general topics listed below and are based on answering critical questions:

1. the scope of application,
2. eligible fuels under the law,
3. reporting obligations, and the
4. obligation to supply minimum shares of sustainable aviation fuels
5. enforcement of the regulation, and,
6. flight emissions label.

³⁶ C/2025/1368, 28/02/2025, COMMUNICATION FROM THE COMMISSION, on the interpretation and implementation of certain legal provisions of Regulation (EU) 2023/2405 of the European Parliament and the Council on ensuring a level playing field for sustainable air transport (ReFuelEU Aviation)

4.2 Brazil

Brazil is a leading potential producer of SAF globally, thanks to its vast agricultural capacity and strong presence in traditional 'first-generation' (crop-based) biofuels, which currently dominate the market.

Over the years, Brazil has implemented various successful biofuel policies, beginning with the Proálcool (Pro-Alcohol) initiative in 1976³⁷, launched in response to the 1975 global petroleum crisis. Decades later, following the Paris Agreement, Brazil continued this trajectory by regulating SAF in 2019 through the National Agency of Petroleum, Natural Gas, and Biofuels (ANP), with an update in 2021. The authorized SAF production pathways align with those for biofuel and green diesel, including the HEFA pathway, which converts vegetable oil, animal fat, and biomass into fuel.

Recent technological advancements, particularly in Alcohol-to-Jet (ATJ) processes, have opened significant opportunities for SAF production in Brazil. The government's strong support for ethanol has bolstered sugarcane cultivation, suggesting that similar policies could promote SAF development. To sustainably increase output, it's essential to implement robust policies addressing issues like illegal deforestation and agroecological zoning for sugarcane cultivation. Notably, the RenovaBio program, approved in 2017 and implemented in 2019, already enforces such measures by certifying biofuel production based on energy-environmental efficiency and ensuring compliance with environmental standards³⁸.

Recent technological developments, especially linked with the generalization of ATJ (Alcohol-to-Jet) have created significant new opportunities for SAF manufacture in Brazil. The Brazilian government's engagement with ethanol production is a key factor behind the popularity of sugarcane crops, and a similar scenario could unfold for SAF with the right policies. Above all, to ensure a sustainable increase in output, it is crucial to implement more robust policies that address issues such as illegal deforestation and agroecological zoning for sugarcane cultivation.

In October 2024, Brazil enacted the Fuel of the Future Law (Federal Law No. 14,993/2024), establishing the National Sustainable Aviation Fuel Program (ProBioQAV), the National Green Diesel Program (PNDV), and the National Program for Decarbonizing Natural Gas Producers and Promoting Biogas. These initiatives complement the existing RenovaBio decarbonization framework. ProBioQAV mandates a 1% reduction in aviation emissions by 2027, with a potential increase to 10% by 2037³⁹.

Unlike ethanol and biodiesel mandates, which focus on blended volumes, this policy incentivizes SAF producers to optimize production pathways with the lowest life-cycle emissions, ensuring meaningful greenhouse gas reductions⁴⁰.

³⁷ Rubismar Stolf, Ana Paula Rodrigues de Oliveira, THE SUCCESS OF THE BRAZILIAN ALCOHOL PROGRAM (PROÁLCOOL) - A DECADE-BY-DECADE BRIEF HISTORY OF ETHANOL IN BRAZIL, *Energy Systems • Eng. agric.* (Online) 40 (2) • Mar-Apr 2020, <https://doi.org/10.1590/1809-4430-Eng.Agric.v40n2p243-248/2020>

³⁸ [https://www.embrapa.br/busca-de-noticias/-/noticia/54067756/article-the-science-behind-brazilian-biofuels-policy--renovabio#:~:text=To%20convert%20the%20Energetic%2DEnvironmental,ecological%20zoning%20\(if%20a plicable\)](https://www.embrapa.br/busca-de-noticias/-/noticia/54067756/article-the-science-behind-brazilian-biofuels-policy--renovabio#:~:text=To%20convert%20the%20Energetic%2DEnvironmental,ecological%20zoning%20(if%20a plicable))

³⁹ <https://www.gov.br/planalto/en/latest-news/2024/10/lula-enacts-fuel-of-the-future-law-201cbrazil-will-drive-the-worlds-largest-energy-revolution201d>

⁴⁰ <https://www.spglobal.com/commodity-insights/en/news-research/latest-news/agriculture/051822-brazil-saf-mandate-to-target-emissions-reductions-starting-in-2027>

4.3 Canada

In 2019, 70% of GHG emissions from Canadian air carriers came from international flights, while 30 percent came from domestic flights.^{41 42} In 2022 Canada issued the Canada's Aviation Climate Action Plan (the Action Plan) setting out a vision for net-zero greenhouse gas (GHG) emissions –both domestic and international – by 2050 for Canada's aviation sector identifying the key measures to meet the objective.

4.3.1 The Canadian Industry takes the lead

The largest emissions reduction potential is through the widespread adoption of SAF. It was estimated that roughly 70 percent of fuel used by 2050 would be SAF. Figure 12 shows two wedges for SAF, reflecting the two different scenarios in terms of their lifecycle emissions reduction, assessed as a percentage reduction from conventional fuel. The first scenario assumes SAF use with a 60 percent lifecycle GHG emission reduction, and a second scenario represents a 90 percent lifecycle GHG emission reduction. This translates to 31.1 percent (for 60 percent SAF) and 46.5 percent (for 90 percent SAF) of the total reductions towards net-zero from the fixed 2019 fuel efficiency baseline¹⁶.

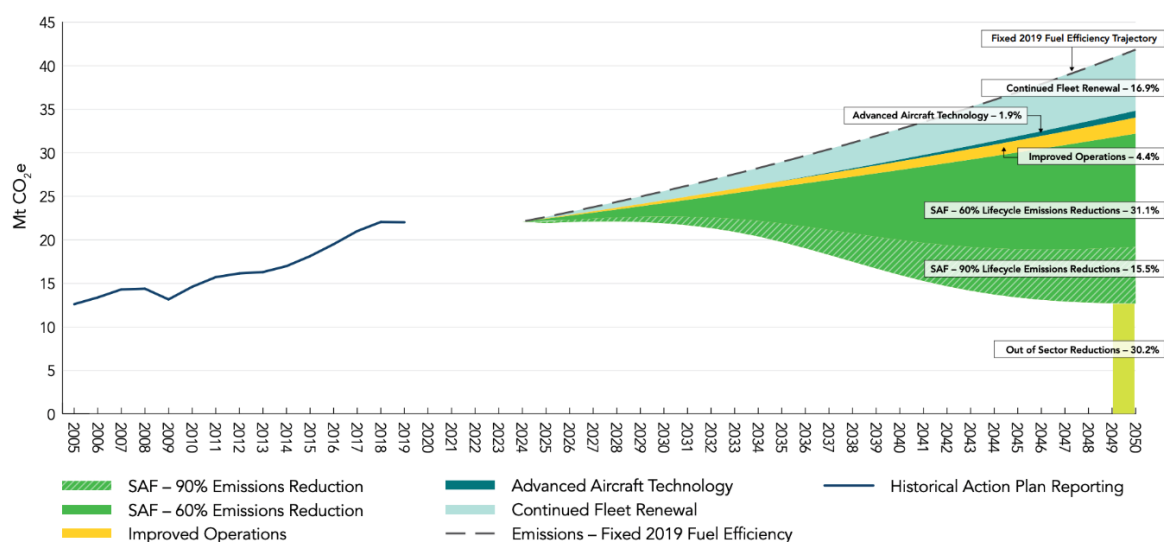


Figure 12: 2050 Canadian Aircraft Emissions Forecast – A Vision to Net-Zero⁴¹

However, despite the above efforts, in Canada there is neither a comprehensive national SAF policy nor SAF specific incentives and the industry has taken the initiative to propose a strategy to deploy SAF aiming to reduce the GHG emission of aviation. In an open letter^{43 44} addressed to the Finance Minister, the aviation stakeholders asked the federal government to adopt the following recommendations for inclusion in the national budget for 2024 to incentivise domestic SAF production:

⁴¹ <https://www.icao.int/environmental-protection/Documents/ActionPlan/CANADAs-AVIATION-CLIMATE-ACTION-PLAN-2022-2030.pdf>

⁴² Note: This Action Plan defines international activity as flight segments that begin or end outside of Canada, whereas domestic activity includes flight segments within Canada.

⁴³ <https://c-saf.ca/news-releases/>

⁴⁴ <https://www.bennettjones.com/Blogs-Section/A-Roadmap-to-Building-a-SAF-Supply-Chain-in-Canada#:~:text=Building%20a%20feedstocks%2Dto%2Dfuels,percent%20for%20departures%20from%20Canada.>

- Implementation of refundable investment tax credits at a rate of 50% for SAF production facilities.
- Introduction of a Production Tax Credit with a ten-year horizon competitive with the one in the US.
- If a Production Tax Credit is not possible, Canada should introduce a commodity price contract for difference or revenue certainty mechanism to support SAF production and boost its uptake.
- Allowing for a book and claim mechanism for SAF use in Canada.

4.3.2 The C-SAF Roadmap

The Canadian Council for Sustainable Aviation Fuels⁴⁵ (C-SAF) recently launched a Roadmap⁴⁶ for the country's aviation sector to remain competitive as it transitions to a net-zero future by 2050. C-SAF's Roadmap charts a pathway and a strategy to produce truly sustainable and affordable SAF with Canadian feedstock and clean energy, using made-in-Canada solutions that aim to promote Canadian technology. C-SAF collaborated with several national organisations and industry players to plan, design and develop the Roadmap.

The Roadmap envisions a target of 1 billion litres of SAF by 2030. By 2035, Canada should be ready to produce SAF to meet 25 percent of total jet fuel demand. This would reduce emissions by 15-20 percent for departures from Canada⁴⁷. However, to unlock SAF production and use in Canada, policies are needed to stimulate demand while keeping costs manageable and are competitive with the policies of other countries, such as the United States.

The Roadmap for SAF in Canada relies on three key objectives to balance:

- **Decarbonize now:** maximize SAF now from commercial ready pathways.
- **Feedstock activation:** establish commercial pathways for all Canada's feedstocks.
- **Innovation drive:** launch demonstrations with homegrown technology in multiple pathways.

In 2023 Transport Canada issued the report "Taking Action on the Environment"⁴⁸ supporting the above initiatives, however, no legislative action has been undertaken yet.

However, the Canadian British Columbia province has taken the lead by implementing a SAF mandate in the context of the Pacific Coast Collaborative effective 2024. It will imply that by 2026 a 2% reduction for jet fuel is targeted to reach up to 10% in 2030. Also, starting in 2026, suppliers of fossil jet fuel will incur debits according to carbon intensity.

⁴⁵ <https://c-saf.ca/>

⁴⁶ https://www.beacdn.com/download/?url=https://www.beacdn.com/apps/gLGxqEBxqE/R2P8BpgVAz/1An9jr9BzO/files/i168600934057fb6e4b490e.pdf&preview=1f&name=CSAF_Roadmap_Full_Report.pdf

⁴⁷ <https://clean50.com/projects/canadas-first-sustainable-aviation-fuels-roadmap/>

⁴⁸ <https://tc.canada.ca/sites/default/files/2024-01/tc-taking-action-environment-e-acc.pdf>

4.4 China

China's aviation market is second in size only to that of the USA. According to the International Council on Clean Transportation (ICCT)⁴⁹, Chinese flights emitted 103 million tonnes of CO₂ in 2019 – 13% of the global aviation total. Although aviation accounts for 1% of China's total emissions, its share is expected to grow as emissions from heavy industries, such as steel and cement making, fall in the next decade.

There is still no dedicated legislation in China for SAF, and this creates a barrier to investments in the production and use of SAF in China. However, several actions have been undertaken to support the production and use of SAF by the Civil Aviation Administration of China (CAAC).

In April 2005, CAAC released the Regulations on Airworthiness Management of Civil Aviation Fuels (CAAR-55). In 2006, airworthiness certification authorities for civil aviation started to certify aviation fuel suppliers and testing organizations. In March 2010, the Aviation Fuel/Oil and Chemical Airworthiness Certification Center (FCCC) of CAAC was established⁵⁰.

4.4.1 Relevant Policies

CAAC started to place more emphasis on the R&D and utilization of SAF and has defined SAF as a strategic energy reserve for decarbonizing the aviation industry. CAAC has taken a variety of measures for this purpose, including establishing a coordination mechanism, strengthening standards development, supporting domestic airlines to make SAF-powered test and commercial flights, and participating in international cooperation. Some policies recently promulgated by the State Council and CAAC also cover the demonstrative and commercial use of SAF (Table 2). The Chinese government is more encouraging of biodiesel development and has successively introduced nearly 20 laws, national plans, as well as industrial, fiscal and tax policies and product standards. The Ministry of Finance (MoF) and the State Administration of Taxation (SAT) have also released a number of official documents to provide tax benefits for biodiesel that can also benefit SAF.

China has set a short-term goal of cumulatively consuming 50 thousand tons of SAF by 2025²⁸, but the country has not developed any action plan, remains vague about its medium and long-term policy direction, and has not provided enough policy support. Key stakeholders consider that it is necessary to adopt explicit plans and favorable policies for the SAF industry's development and to leverage fiscal funding to channel private-sector capital into SAF-related industries. Furthermore, it is necessary to include SAF within carbon emissions trading and incorporate emissions reduction into the measurement of airlines' carbon emissions intensity.

The world's second-largest aviation market, with about 11% of global jet fuel use, China, is expected to unveil this year its policy on sustainable aviation fuel (SAF) use for 2030 that could spur billions of dollars of investment. It is expected that the SAF mandate for 2030 will be 2% to 5% of fuels mix.

⁴⁹ <https://theicct.org/wp-content/uploads/2021/06/CO2-commercial-aviation-oct2020.pdf>

⁵⁰ Yang Zhiyuan et al, Airworthiness Certification of Civil Aviation Fuel in China, *Procedia Engineering* 17:627–632, DOI:[10.1016/j.proeng.2011.10.079](https://doi.org/10.1016/j.proeng.2011.10.079)

4.4.2 Airworthiness certification

Since China does not have ASTM-like industry associations it had to develop its own certification system⁵¹. When Sinopec No. 1 Aviation Biofuel was certified⁵², it was characterised as one of the most-often used aircraft parts and the certification was conducted by reference to the certification of parts and in accordance with the CTSOA (Chinese Technical Standard Order Authorization) certification. Moreover, quality management covers the entire continuum of aviation biofuels, from design to production, storage, transportation, and into-plane service. On February 28, 2012, Sinopec submitted airworthiness certification application to CAAC at Great Hall of the People. Hereafter, the aviation biofuel products has successively passed the physical and chemical properties assessment and engine bench test both nationally and internationally. On April 24, 2013, the first flight applying Sinopec aviation biofuel was successfully completed in Shanghai Hongqiao Airport⁵³.

Table 7: Chinese policies related to the promotion and use of SAF.

Date of issue	Issuer	Policy title	Description
Oct. 2021	State Council	Action Plan for Peaking Carbon Emissions by 2030	Push for the substitution of advanced liquid biofuels and SAF for traditional fuels and improve fuel end-use efficiency.
Jan. 2022	CAAC	14 th Five-Year Plan (FYP) for Green Civil Aviation Development	Achieve breakthroughs in promoting the commercial use of SAF, with an aim to raise SAF consumption to over 20,000 tons in 2025 and cumulatively to 50,000 tons during the 14 th FYP period; establish an expected goal for reducing fuel use and reducing carbon emissions—reducing fuel consumption per ton kilometer for air transport fleet to 0.293 kg and CO ₂ emissions per ton kilometer for air transport to 0.886 kg ^{33,34} .
May 2022	National Development and Reform Commission (NDRC)	14 th FYP for Bioeconomy Development	The Plan points out that areas with good conditions are encouraged to promote and pilot the use of biodiesel and advance the demonstrative use of aviation biofuels ³⁵ .
Jun. 2022	NDRC and National Energy Administration (NEA), etc.	14 th FYP for Renewable Energy Development	Scale up efforts to develop non-food liquid biofuels and support the R&D and promotion of advanced technology and equipment for biodiesel and aviation biofuel production.

Source: compiled based on policies released by the government.

Gradually, China has developed its own set of standards and certification system for aviation biofuel manufacturing processes and performance measurement. Currently, aviation biofuel remains characterized as a “part” of aircraft for the purpose of airworthiness certification⁵⁴. **China has not developed standards addressing sustainability.** However, state organisations and academic institutions are conducting research on standards and methodologies for sustainability certification.

⁵¹ <https://www.caac.gov.cn/ZTZL/RDZT/XJSYY/201511/P020151126513095309047.pdf>

⁵² http://ripp.sinopec.com/ripp/en/Dt/ScientificRDNews/20140619/news_20140619_339293487115.shtml

⁵³ <http://www.chinaaviationdaily.com/news/25/25588.html>

⁵⁴ **Note:** further details on the Chinese system of aviation fuel certification are considered out of scope of this report at this stage of ICARUS.

4.5 India

In 2019, the Indian Ministry of Civil Aviation released a White Paper on the “National Green Aviation Policy” to foster inclusive and sustainable growth of the civil aviation sector while reducing environmental footprints. Additionally, the White Paper suggested the use of biofuels in the aviation industry and steered all aviation stakeholders to explore the possibilities of using biofuel and other alternative fuels with lower emissions.

In May 2023 the Indian Minister of Petroleum and Natural Gas, Mr Hardeep Singh Puri, announced that India plans to mandate the use of 1% SAF for domestic airlines by 2025⁵⁵ aiming to cut emissions from the aviation sector. This was followed by a new goal of 1% SAF in jet fuel for international flights by 2027, with this percentage doubling to 2% by 2028⁵⁶. To achieve this target, about 140 million litres of SAF will be needed. At present, there are no other policies to promote the use of SAF in India further. The SAF mandate could increase to 4-5% if the volumes of SAF would increase accordingly. The announcement came after a successful flight from Pune to Delhi with SAF provided by Praj Industries⁵⁷.

In addition to reducing emissions from the aviation sector, India aims to support farming communities and increase local job creation in rural areas. The 1% SAF blending would benefit more than 500,000 farmers by supplying sugarcane feedstock, creating more than 100,000 new green jobs.

For Indian operators, CORSIA offsetting requirements will be applicable from 2027. India filed its reservations at the 40th ICAO Assembly in 2019 regarding the current structure of CORSIA.

Although India has undertaken important steps in view of reaching net-zero emissions by 2070 as announced by Prime Minister Narendra Modi at COP26⁵⁸, and aviation is one of the targeted areas, significant progress will take time since producing SAF remains expensive, and the final products is by a factor of 2-3 more costly than fossil kerosene.

4.5.1 SAF certification and standards in India

In India, certifications in the aviation industry are predominantly regulated by the following authorities⁵⁹:

- i. **Centre for Military Airworthiness and Certification (CEMILAC)** – CEMILAC, under the authority of the Defense Research and Development Organization (DRDO), certifies the airworthiness of military aircraft, helicopters, aero-engines, etc.
- ii. **Directorate General of Civil Aviation (DGCA)** – The DGCA is responsible for certifying civil aircrafts.

To use bio-jet fuel on all military and civilian aircraft, the Bureau of Indian Standards has, in collaboration with the Indian Air Force, research organisations, and the industry, brought out a new standard for Aviation Turbine Fuels. These specifications will align Indian standards with current international standards. A committee constituted with domain experts formulated Indian Standard IS 17081:2019, Aviation Turbine Fuel (Kerosene Type, Jet A-1) containing Synthesised Hydrocarbons.⁶⁰

⁵⁵ <https://www.thehindu.com/news/national/india-eyes-to-mandate-use-of-1-sustainable-aviation-fuel-by-2025-oil-minister/article66869441.ece>

⁵⁶ <https://www.safinvestor.com/news/146259/ioc/#::~:~:text=India's%20government%20has%20set%20a,14om%20liters%20of%20SAF%20annually.>

⁵⁷ <https://www.praj.net/>

⁵⁸ <https://pib.gov.in/PressReleseframePage.aspx?PRID=1961797>

⁵⁹ <https://www.mondaq.com/india/aviation/1285156/future-of-aviation--sustainable-aviation-fuel>

⁶⁰ <https://pib.gov.in/PressReleseframePage.aspx?PRID=1561296>

This standard would enable the oil companies to manufacture bio-jet fuel for the Indian aviation industry.

The DGCA can guide Indian SAF producers through the entire process of the ICAO. However, the DGCA currently does not have a domestic certification process for SAF or other drop-in-fuels. If a SAF producer requires certification for a fuel for a test flight, the fuel will have to meet the Bureau of Indian Standard IS 17081:2019 Aviation Turbine Fuel (Kerosene Type, Jet A-1). Subsequently, the producer will also require approvals from the DGCA.

4.6 Japan

Japan's Trade and Industry Ministry (Meti) plans to introduce a SAF mandate and tax exemptions to achieve the country's target of 10% SAF use by 2030.

4.6.1 Interim report of the public-private council to promote SAF⁶¹

On May 26, 2023, the Agency for Natural Resources and Energy held a public-private council to promote the introduction of sustainable aviation fuel and compiled an interim report. The council was organised following the decision at the ICAO General Assembly in October 2022 to set a goal of reducing CO₂ emissions to 85% or less compared to 2019 levels from 2024 onwards. It was proposed that on the supply side, Japan would secure sufficient SAF manufacturing capacity and a supply chain for raw materials (including development and import) to build a system that can stably supply SAF at an internationally competitive price, while at the same time creating an environment for stable procurement of SAF on the demand side. The specific measures proposed included the following:

- The Energy Supply Structure Sophistication Act will legally set a target supply volume for SAF for 2030. Based on the needs of the demand side, it will be at least 10% of aviation fuel consumption (equivalent to 1.71 million kl. The target volume for airlines under this Act is 880,000 kl. The remainder, 830,000 kl, is assumed to be used by international airlines on return journeys
- Airlines under this Act are licensed under the Aviation Act and must achieve ICAO's carbon offset scheme (CORSIA). In addition, they will be required to set an SAF utilization target (10%) for 2030 in the Aviation Decarbonization Promotion Plan, which was made mandatory by last year's amendment to the Aviation Act.
- As support measures, in addition to providing a sufficient level of support for capital investment, such as the development of airport facilities and equipment to receive SAF, support will be provided for the establishment of a supply chain for raw materials, etc.. Consideration will be given to investment and debt guarantees. In addition, consideration will be given to reductions in tariffs and petroleum and coal taxes on the import of SAF raw materials and SAF itself. This support will be implemented through Japan's Green Innovation Fund⁶².
- Domestic supply capacity is forecast around 1.92mn kl in 2030⁶³.

The above provided the basic framework for measures toward 2030, but an additional urgent issue was identified as "environmental improvement measures to expand the use of domestic raw materials." The main domestic raw material here is "waste cooking oil." Japan's annual cooking oil consumption is 2.48 million tons, of which 500,000 tons are generated as waste cooking oil, and 380,000 tons are reusable after collection and processing. Still, of this, 120,000 tons are exported to Europe and Korea and used as SAF raw materials.

To process domestic biomass resources into SAF, the Agency for Natural Resources and Energy, the Ministry of Agriculture, Forestry and Fisheries, the Ministry of the Environment, and the Ministry of Land, Infrastructure, Transport and Tourism will work together to create an action plan by the end of the 2023.

The Japanese authorities predict neat SAF supply capacity, as shown in Figure 13.

⁶¹ https://www.nef.or.jp/keyword/sa/articles_si_17.html

⁶² <https://japan.influencemap.org/policy/SAF-mandate-5480>

⁶³ <https://www.argusmedia.com/en/news-and-insights/latest-market-news/2453500-japan-to-implement-policies-to-raise-saf-use-supply>

Projected SAF Utilization in Japan

According to estimates by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and airline plans, the domestic utilization of SAF (including both domestic and international aviation) is expected to reach 1.72 million kL by 2030.

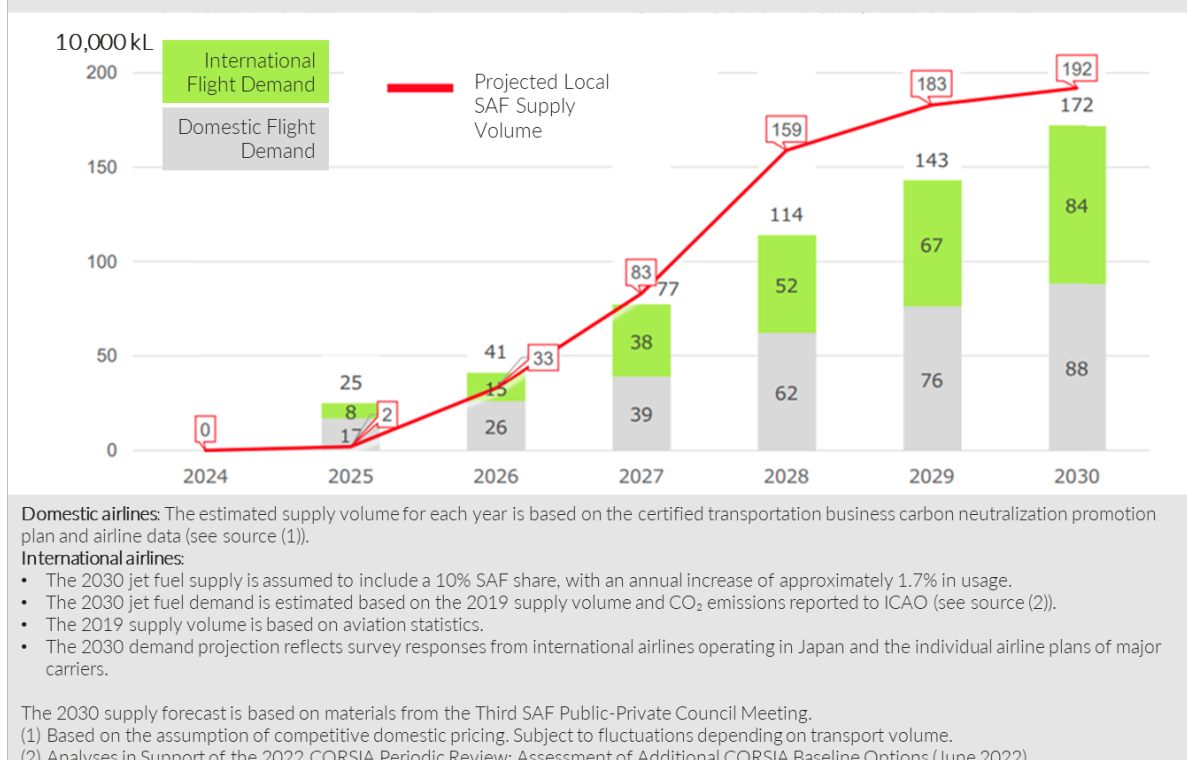


Figure 13: SAF predictions by the Japanese government (translated from original figure⁶⁴)

Finally, the 2024 Tax Reform Act also features SAF, providing tax credits of ¥30 per liter (approximately US\$0.79/gallon) to stimulate domestic investment to boost domestic SAF production, including alcohol-to-jet SAF⁶⁵.

⁶⁴ Private Communication, Takahiko Taniyama, Sumitomo Corporation; see also <https://www.icao.int/Meetings/Stocktaking2023/Documents/Stocktaking%202023%20-%20Session%205-1%20-%203%20Japan.pdf>

⁶⁵ https://www.mof.go.jp/english/policy/tax_policy/tax_reform/fy2024/o6keyhighlight.pdf

4.7 United Kingdom (UK)

4.7.1 UK SAF Mandate's roadmap

The UK Government recognised the need for SAF usage in the short, medium and long term to contribute to delivering net zero and the UK's carbon budgets. At the same time it also recognised that a mandate would be the most appropriate tool, however, such a mandate had to be standalone and outside the UK Renewable Transport Fuel Obligation (RTFO)⁶⁶.

In 2021 the Department of Transport issued a consultation paper on "Sustainable aviation fuels mandate"⁶⁷ in close consultation with the aviation industry. The Government proposed the mandate obligation to fall on suppliers of jet fuel to the UK.

The UK also provided grant funding to businesses aiming to place the UK in a strong position to develop advanced fuels capable of decarbonising harder-to-decarbonise transport modes. This support resulted in the delivery of the first few volumes of SAF to the UK market and the early planning of large-scale advanced fuels facilities capable of producing SAF commercially. At the same time of the 2021 consultation, the UK announced eight projects had been shortlisted for funding under the competition, (see Figure 14). These projects had the potential to deliver clean growth and thousands of green jobs

SAF projects shortlisted as part of the Green Fuels, Green Skies competition

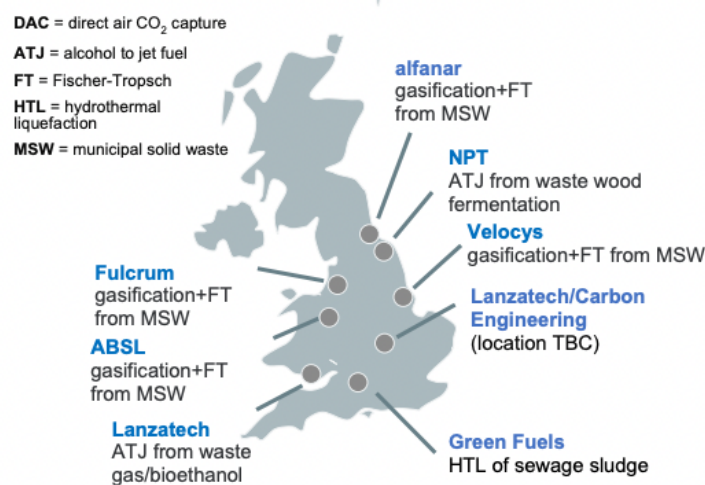


Figure 14: SAF projects shortlisted for funding in 2021⁶⁶

⁶⁶ Sustainable aviation fuels mandate, Summary of consultation responses, March 2022, <https://assets.publishing.service.gov.uk/media/622f4306d3bf7f5a8a6955a7/sustainable-aviation-fuels-mandate-consultation-summary-of-responses.pdf>

⁶⁷ Sustainable aviation fuels mandate, consultation, 2021, <https://assets.publishing.service.gov.uk/media/60fa8f86d3bf7f045a022512/sustainable-aviation-fuels-mandate-consultation-on-reducing-the-greenhouse-gas-emissions-of-aviation-fuels-in-the-uk.pdf>

Five main scenarios for the uptake of SAF as a percentage of the total liquid fuel demand expected by the UK were postulated as shown in Figure 15. These were to be considered as indicative representation of the ambition of UK subject to certain market, technology and policy conditions.

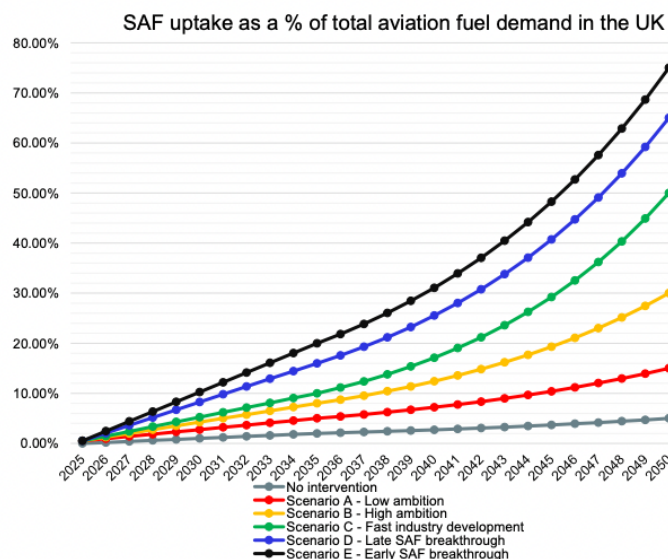


Figure 15: High-level scenarios for SAF uptake ambition⁶⁸

On 25 April 2024, the UK government confirmed plans to create an SAF mandate requiring 22% of all jet fuel in flights taking off from the UK to come from sustainable sources by 2040⁶⁹. On 18 November 2024, the UK's SAF) mandate was signed into law, and it came into force on 1 January 2025⁷⁰. At the same time, the UK government launched a new Jet Zero Taskforce to coordinate and overhaul efforts to reduce aviation GHG emissions.

4.7.2 The UK's SAF Mandate

The Jet Zero Taskforce will provide strategic leadership and take an outcome-focused, whole-system approach to support innovation, economic growth, the production and delivery of SAF and zero emissions fuels, as well as look at how to improve aviation systems to make them more efficient⁷¹. It will also explore the sector's demand for greenhouse gas (GHG) removals and the non-CO2 impacts of aviation, such as contrails, to account for the sector's overall environmental impact. The task force will include high-level government officials along with the CEOs of major airlines, such as easyJet and Virgin, airports like Heathrow and Manchester, fuel producers, trade bodies and leading universities.

The UK Mandate will require 2% SAF beginning in 2025 (approximately equal to 230,000 tonnes of SAF), ramping up to 10% in 2030 and 22% by 2040⁷². HEFA SAF will be allowed to contribute up to 100% of SAF demand in 2025 and 2026, decreasing to 71% in 2030 and 35% in 2040. E-SAF (power-to-

⁶⁸ <https://www.greenairnews.com/?p=2666>

⁶⁹ <https://biomassmagazine.com/articles/uk-to-implement-saf-mandate-beginning-in-2025>

⁷⁰ [https://www.gov.uk/government/news/greener-flights-ahead-for-uk-aviation#:~:text=The%20Sustainable%20Aviation%20Fuel%20\(SAF,UK%20a%20clean%20energy%20superpower.&text=Flights%20are%20set%20to%20be,today%20\(1%20January%202025\).](https://www.gov.uk/government/news/greener-flights-ahead-for-uk-aviation#:~:text=The%20Sustainable%20Aviation%20Fuel%20(SAF,UK%20a%20clean%20energy%20superpower.&text=Flights%20are%20set%20to%20be,today%20(1%20January%202025).)

⁷¹ <https://www.gov.uk/government/groups/jet-zero-taskforce>

⁷² The SAF Mandate: an essential guide; <https://www.gov.uk/government/publications/about-the-saf-mandate/the-saf-mandate-an-essential-guide>

liquid (PtL) technology) will be introduced starting in 2028 at 0.2% of total jet fuel demand, increasing to 3.5% of total jet fuel demand in 2040. Both obligations will include a buy-out mechanism. This will provide a method of compliance where suppliers are unable to secure a supply of SAF.

According to the Department of Transport, the buy-out prices for the mandate will be set at the equivalent of £4.70 and £5.00 per liter for the main and PtL obligations, respectively. Formal reviews of the program will be conducted at least every five years, with the first review completed by 2030. Aviation turbine fuel, aviation gasoline and hydrogen will be eligible for the reward provided they meet strict sustainability criteria.

4.7.3 Differences between the UK' SAF Mandate and ReFuelEU Aviation

The UK SAF Mandate differs from ReFuelEU, which does not permit a buy-out; instead, fuel suppliers and aircraft operators under ReFuelEU are faced with a penalty but still need to make up for their non-compliance in the following year, with income from penalties earmarked for funds that support SAF projects. However, since the start of 2024 airlines participating in the EU ETS receive support under an EU fund of up to €2 billion of EU ETS allowances aimed at mitigating the price difference between SAF and traditional kerosene, with the amount available to be claimed varying by airport⁷³.

There are further differences concerning “tankering”⁷⁴. Under ReFuelEU, there is a refueling requirement on airlines, which provides that the yearly quantity of jet fuel uplifted by that airline at a given EU airport must be at least 90% of the yearly jet fuel required in order to avoid airlines uplifting more fuel than they need at non-EU airports to take advantage of the lower cost of traditional kerosene as against SAF. The UK has confirmed that it will not introduce a minimum fuel requirement for airlines departing from UK airports when the UK SAF Mandate starts in 2025, but will conduct further research into the extent of tankering once the UK SAF Mandate is operational.

⁷³ <https://www.nortonrosefulbright.com/en/knowledge/publications/b5f9f70c/a-new-sustainable-aviation-fuel-mandate#section3>

⁷⁴ Tankering: the practice of uplifting additional fuel for inbound flights to destinations where refuelling would be more expensive, such that it is not necessary to refuel for the outbound flight.

4.8 United States of America (USA)

There have been several initiatives in the USA to promote SAF. These are listed below.

4.8.1 The Renewable Fuel Standard

The Renewable Fuel Standard⁷⁵ (RFS) is a federal program that requires transportation fuel sold in the United States to contain a minimum volume of renewable fuels. The RFS originated with the **Energy Policy Act of 2005** and was expanded and extended by the **Energy Independence and Security Act of 2007** (EISA). This regulation focused on renewable fuel for ground transportation, requiring a minimum amount of renewable fuel on an annual basis, ramping up over time.

The RFS offers SAF an “opt-in” approach, allowing SAF to generate compliance units (Renewable Identification Numbers “RINs”) without aviation fuel generating compliance obligations. Currently, SAF has been determined to generate 1.6 RINs per gallon. This approach intends to advance SAF’s competitiveness with renewable diesel, while refraining from imposing a mandated SAF use obligation.

4.8.2 Sustainable Skies Act

In May 2021, the U.S. Congress introduced the Sustainable Skies Act⁷⁶ aiming to boost incentives to use SAF. This bill allows a business-related tax credit through 2031 for each gallon of sustainable aviation fuel used by a taxpayer in the production of a qualified mixture (i.e., a mixture of sustainable aviation fuel and kerosene that is sold for use in certain U.S. aircraft).

The credit will start at \$1.50 per gallon for blenders that supply SAF with a demonstrated 50% or greater lifecycle GHG savings and rewards higher GHG achievement up to the maximum of \$2 per gallon. The legislation requires eligible SAF to utilize the full set of ICAO sustainability criteria as one of the safeguard provisions to ensure its environmental integrity

4.8.3 SAF in the Sustainable Aviation Fuel tax credit

In September 2021 the Biden Administration took serious steps to progress toward the USA climate goals for 2030 essentially aiming to unlocking the potential for a fully zero-carbon aviation sector by 2050⁷⁷. Strong coordination amongst the Departments of Energy, Transportation and Agriculture, along with other national bodies, aimed to the production and use of billions of gallons of sustainable fuel that will enable aviation emissions to drop 20% by 2030 when compared to business as usual. The objective of these new agency steps and industry partnerships is to transform the aviation sector, create good-paying jobs, support American agriculture and manufacturing, and help the USA tackle the climate crisis. A Memorandum of Understanding⁷⁸ was signed among the Departments of Energy, Transportation and Agriculture, indicating the actions each Department would undertake to achieve the goals. This Memorandum resulted in the SAF Grand Challenge Roadmap⁷⁹ report issued in 2022.

⁷⁵[https://afdc.energy.gov/laws/RFS#:~:text=The%20Renewable%20Fuel%20Standard%20\(RFS,Act%20of%202007%20\(EISA\).](https://afdc.energy.gov/laws/RFS#:~:text=The%20Renewable%20Fuel%20Standard%20(RFS,Act%20of%202007%20(EISA).)

⁷⁶ <https://www.congress.gov/bill/117th-congress/house-bill/3440#:~:text=This%20bill%20allows%20a%20business,use%20in%20certain%20U.S.%20aircraft>

⁷⁷ <https://www.whitehouse.gov/briefing-room/statements-releases/2021/09/09/fact-sheet-biden-administration-advances-the-future-of-sustainable-fuels-in-american-aviation/>

⁷⁸ https://www.energy.gov/sites/default/files/2021-09/S1-Signed-SAF-MOU-g-08-21_o.pdf

⁷⁹ <https://www.energy.gov/sites/default/files/2022-09/beto-saf-gc-roadmap-report-sept-2022.pdf>

The report is a U.S. government-wide approach to work with industry to reduce cost, enhance sustainability, and expand production to achieve 3 billion gallons per year of domestic sustainable aviation fuel production that achieve a minimum of a 50% reduction in life cycle greenhouse gas emissions (GHG) compared to conventional fuel by 2030 and 100% of projected aviation jet fuel use, or 35 billion gallons of annual production, by 2050.

A Sustainable Aviation Fuel tax credit was proposed as part of the Build Back Better Agenda⁸⁰. This credit would help cut costs and rapidly scale domestic production of sustainable fuels for aviation. The proposed tax credit requires at least a 50% reduction in lifecycle greenhouse gas emissions and offers increased incentive for greater reductions. The announcement, build upon this proposal through a whole-of-government effort to advance cleaner aviation, as well as work in concert with bold actions taken by the aviation-related industries. Key federal actions related to SAF include:

- A new Sustainable Aviation Fuel Grand Challenge to inspire the dramatic increase in the production of sustainable aviation fuels to at least 3 billion gallons (11.4 billion litres) per year by 2030;
- New and ongoing funding opportunities to support sustainable aviation fuel projects and fuel producers totaling up to \$4.3 billion (€4.0 billion);
- An increase in R&D activities to demonstrate new technologies that can achieve at least a 30% improvement in aircraft fuel efficiency;

The Administration also planned to release an aviation climate action plan, which would set forth a comprehensive plan for decarbonising aviation.

Among the various initiatives announced there were three critical ones related to:

Supporting the US farmers:

USDA will support U.S. farmers with climate-smart agriculture practices and research, including biomass feedstock genetic development, sustainable crop and forest management at scale, and post-harvest supply chain logistics. USDA will also support fuel producers with carbon modeling components of aviation biofuel feedstocks.

Dedicated feedstock development:

- *DOE Bioenergy Technologies Office (BETO) recently announced \$35 million (€32.3 million) for 11 projects developing feedstock and algae technologies for advancing the domestic bioeconomy and today announced additional selections totaling over \$61M (€56.5 M) to advance biofuels and support reduced cost of SAF pathways, including 11 projects that are scaling up promising technologies to produce SAF.*

Providing loan guarantees:

- *DOE Loan Programs Office (LPO) is offering up to \$3 billion (€2,77 billion) in loan guarantees. Commercial-scale SAF projects that utilize innovative technology and avoid, reduce, or sequester greenhouse gas emissions and meet other program requirements may be eligible for loan guarantees under LPO's Title 17 Innovative Energy Loan Guarantee Program.*

Finally, it enticed the passenger airlines to accelerate adoption of SAF.

⁸⁰ <https://www.whitehouse.gov/build-back-better/>

4.8.4 SAF in the Inflation Reduction Act

President Joe Biden signed into law the Inflation Reduction Act⁸¹ (IRA) in 2022; a piece of legislation containing \$369 billion (€340 billion) in climate investments. The IRA contains provisions to encourage progress towards a US SAF production target of 3 billion gallons (11.4 million metric tonnes) per year by 2030.

The main incentives are \$300 million in R&D grants until September 2026 and two rounds of **SAF tax credits**: Until 2025, any “sale or use of a qualified [SAF] mixture” used and produced by a US taxpayer qualifies for tax credits of \$1.25 per gallon; and from 2025 until the end of 2027, the \$1.25 per gallon credit will also have an applicable supplementary amount based on the lifecycle greenhouse gas (GHG) emissions of up to \$0.50 per gallon, for a total of up to \$1.75 per gallon – a Clean Fuel Production Credit (CFPC)⁸².

4.8.5 SAF: Building Supply Chains

In May 2024 the Department of Energy (DoE) released a Request For Information (RFI) titled “Sustainable Aviation Fuel (SAF) Grand Challenge: Building Supply Chains”⁸³ to solicit feedback from stakeholders on issues related to the “Building Supply Chains” action area of the SAF Grand Challenge Roadmap. The RFI’s objective was to gather insights, perspectives, and innovative ideas to help inform future strategy and actions across the agencies. The report reflects a confluence of diverse perspectives from stakeholders and underscores not just the complexity of the SAF supply chain, but also the breadth of the opportunities present in this space. The critical aim of the report was to identify the best structure possible for SAF ecosystem in the US. The report underscored the importance of both long-term stable policies and collaborative actions by stakeholders to drive the development and deployment of SAF supply chains.

The report emphasised the urgent need for developing a stable ecosystem amongst all decision makers at Federal and State level as well as amongst all stakeholders with attention to the supply chain. Only under such conditions technical and financial risks can be mitigated.

⁸¹ <https://www.whitehouse.gov/cleanenergy/inflation-reduction-act-guidebook/>

⁸² [https://www.ishkaglobal.com/News/Article/6881/Briefing-Status-and-progress-of-UK-EU-and-US-SAF-policy#:~:text=US%20SAF%20credits&text=Signed%20into%20law%20by%20President,tonnes\)%20per%20year%20by%202030.](https://www.ishkaglobal.com/News/Article/6881/Briefing-Status-and-progress-of-UK-EU-and-US-SAF-policy#:~:text=US%20SAF%20credits&text=Signed%20into%20law%20by%20President,tonnes)%20per%20year%20by%202030.)

⁸³ Bioenergy Technologies Office. 2023. “Department of Energy Releases Request for Information on Building Supply Chains to Meet Sustainable Aviation Fuel Grand Challenge Goals.” Sept. 21, 2023. www.energy.gov/eere/bioenergy/articles/departments-energy-releases-request-information-buildingsupply-chains-meet.

4.9 Southeast Asia: Indonesia, Thailand, Malaysia, Philippines

4.9.1 Existing and Emerging Policies for SAF Development in Southeast Asia

Existing policies for SAF in Southeast Asia remain in varying stages of development, with a mix of mandates, incentives, and strategic frameworks being considered or implemented at national and regional levels. While international frameworks such as ICAO CORSIA (see Chapter 3) provide overarching guidelines, national policies across ASEAN member states shape the region's trajectory of SAF production and adoption. These policies address feedstock availability, technological pathways, investment incentives, and regulatory requirements, with an increasing focus on sustainability and alignment with global carbon reduction targets.

Three recent reports were selected to inform the drafting of this section 4.9, as they provide key insights into SAF policy development in Southeast Asia:

- the Roundtable on Sustainable Biomaterials (RSB) Sustainable Feedstock Assessment for SAF in Southeast Asia⁸⁴,
- the International Renewable Energy Agency (IRENA) Sustainable Aviation Fuels in Southeast Asia report⁸⁵, and
- the ASEAN Biofuel Research and Development Roadmap⁸⁶.

While the RSB and IRENA reports focus specifically on SAF policies, sustainability risks, and feedstock opportunities, the ASEAN Biofuel Roadmap provides an overarching strategy for biofuels in the region. This roadmap highlights the need for regional collaboration on feedstock supply chains, research and development, and policy harmonization to facilitate biofuel deployment across ASEAN.

At the regional level, ASEAN has initiated discussions on SAF through the ASEAN Sustainable Aviation Action Plan (ASAAP), recognizing its importance in decarbonising the aviation sector. However, a unified regional policy framework for SAF is still in development, and progress remains uneven across member states. The ASEAN Centre for Energy (ACE) has advocated for cross-border collaboration in feedstock supply chains and SAF production infrastructure, aiming to align policies and attract investment. These regional efforts are essential to providing policy coherence and creating market stability for SAF development in Southeast Asia.

At the national level, Singapore, Indonesia, Malaysia, and Thailand are leading SAF policy development, while Vietnam, the Philippines and Cambodia have initiated feasibility studies and strategic discussions on SAF integration. Meanwhile, countries such as Brunei, Laos, and Myanmar have shown little to no active policy engagement on SAF, with no formal strategies or mandates currently in place. Singapore has taken the most structured approach to SAF policy, launching the Sustainable Air Hub Blueprint, which includes incentives for SAF production and adoption, alongside a commitment to developing a national SAF target (see dedicated Chapter 4.10 for Singapore).

⁸⁴ Roundtable on Sustainable Biomaterials (RSB). Sustainable Feedstock Assessment for Sustainable Aviation Fuel Production in Southeast Asia. (2024).

⁸⁵ International Renewable Energy Agency (IRENA). Sustainable aviation fuels in Southeast Asia: A regional perspective on bio-based solutions. (2024).

⁸⁶ ASEAN Centre for Energy (ACE). ASEAN Biofuel Research and Development Roadmap. (2023).

While Southeast Asia holds significant potential for SAF production due to its abundant feedstock resources and growing aviation sector, policy frameworks remain fragmented, and many countries lack long-term regulatory certainty. To accelerate SAF deployment, governments will need to introduce clearer policy incentives, set blending mandates, and establish mechanisms for investment and technology transfer. Regional cooperation through ASEAN-led initiatives, including the ASEAN Biofuel Research and Development Roadmap, could also help align national strategies and support the development of an integrated SAF market across Southeast Asia.

Figure 16 provides a summary of biofuel and SAF mandates and voluntary schemes, and table 7 shows a list of existing and planned SAF plants across ASEAN countries as reported in RSB's sustainable feedstock study⁸⁴. The study also includes detailed ASEAN country profiles, including SAF policies and market developments.

Table 5: Summary of biofuel and SAF mandates and voluntary schemes across ASEAN countries⁸⁰

Countries	Ethanol	Biodiesel	SAF	CORSIA member
Brunei Darussalam	N/A	N/A	N/A	
Cambodia	N/A	N/A	N/A	✓
Indonesia	E5 by 2023 E20 by 2025 E50 by 2050	B30 by 2020 B35 by 2023 B40 by 2030	2% blending 2016 3% blending 2020 5% blending 2025 10% blending 2050 Indonesia plans to prepare a National Roadmap on commercial SAF use and production.	✓
Lao PDR	N/A	N/A	N/A	
Malaysia	E10	B20	Sustainable Aviation Energy task force in 2022 under Ministry of International Trade and Industry. Blending target 47% in 2050.	✓
Myanmar	N/A	N/A	N/A	
The Philippines	E20 by 2020 E20/85* by 2025 and 2030	Current B10 B20 by 2025 and 2030	Meeting 2023 with DOE, CAAP, PNOC and EASA to discuss potential advantage of exploring SAF in the country in preparation for CORSIA's compliance by 2027.	✓
Singapore	N/A	N/A	1% SAF uplift target by 2026, with the goal to increase to 3–5% by 2030. Introduction of SAF levy on air transport users to achieve the SAF uplift target.	✓
Thailand	Current E85 20-25% biofuel share in total energy demand by 2037	Current B20	Without official mandates.	✓
Timor-Leste	N/A	N/A	N/A	
Vietnam	Current E10 13% and 25% of the transport sector's fuel demand in 2030 and 2050 respectively	Current B10	Without official mandates.	

(*) Aspirational and voluntary goal

Figure 16: Summary of SAF mandates in ASEAN countries⁸⁴.

Table 8: Existing and planned SAF plants in Southeast Asia⁸⁴.

Country	Company	Location	Year	Main feedstock	Pathway	SAF production (Mt/year)
Indonesia	Pertamina	Cilacap	Present	Palm kernel oil	HEFA-SPK	0.14
		Cilacap	2024	N/A	N/A	0.28
		Plaju Palembang	2026	N/A	HEFA-SPK	0.93
	Chandra Asri/LX International	Cilegon, Banten	N/A	N/A	HEFA-SPK	0.30
The Philippines	WasteFuel	Manila, Luzon	2025	MSW	FT-SPK	0.07
Thailand	BCP and Thanachok Group	Bangchak Refinery (Bangkok)	2024-2025	UCO	HEFA-SPK	0.29
	BBGI	N/A	N/A	N/A	ATJ	N/A
	PTT	N/A	N/A	N/A	HEFA + ATJ	N/A
Singapore	Neste	Singapore	Present	Waste, oil, UCO	HEFA-SPK	1.00
Malaysia	Petronas + Honeywell	Pengerang Integrated Complex	2025	Oils, waste	HEFA-SPK	0.17*
	Ecoceres	Johor	N/A	N/A	HEFA-SPK	N/A
	Vandelay Ventures	Suria Capital, Sabah	N/A	N/A	HEFA-SPK	0.25
TOTAL						3.42

(*) Production estimated. Based on announcement of total production of SAF, HVO and bionaphta. Literature points out that a typical cracking and coking refinery can produce 10% of jet fuel.

4.9.2 Selected national SAF strategies and policy developments^{84,85,86}

Indonesia

Indonesia, a major biofuel producer, is actively integrating Sustainable Aviation Fuel (SAF) into its National Energy Policy (RUEN). A National Roadmap outlines progressive SAF blending targets: 1% by 2027, 2.5% by 2030, 12.5% by 2040, 30% by 2050, and 50% by 2060. Efforts focus on aligning with ICAO CORSIA and EU RED standards, while addressing deforestation risks linked to palm oil. Indonesia is also engaging foreign investors and technology providers to accelerate SAF infrastructure development, notably through public-private partnerships, with state-owned Pertamina leading SAF production initiatives

Malaysia

Malaysia's National Energy Transition Roadmap (NETR) highlights SAF as a core component of its biofuel and aviation decarbonization strategy. With strong feedstock availability, including palm oil residues and used cooking oil (UCO), the country faces challenges in meeting EU RED and ICAO CORSIA sustainability standards. To improve global market access, Malaysia is developing sustainability certification mechanisms. In 2022, the Sustainable Aviation Energy Task Force was established under the Ministry of International Trade and Industry (MITI) to coordinate SAF policy and foster public-private partnerships. Malaysia has set an ambitious 47% SAF blending target by 2050, with plans to introduce an initial 1% blending mandate (timeline yet to be defined). The government is also exploring

investment incentives and tax benefits to attract foreign investors and technology partners. While formal SAF mandates are still pending, Malaysia's progress depends on regulatory alignment with international sustainability frameworks and the expansion of local SAF production capabilities.

Thailand

Thailand has integrated SAF into its Alternative Energy Development Plan (AEDP) 2024, setting a blending target of 1% by 2026 and 8% by 2036. To promote SAF production, the government is offering fiscal incentives, including a three-year corporate tax exemption for SAF-mixed jet fuel suppliers. The country has strong feedstock availability, including used cooking oil (UCO), sugarcane residues, and palm oil byproducts. Initial production will focus on UCO, transitioning to alcohol-to-jet (ATJ) pathways using molasses-derived ethanol as blending rates increase. Though large-scale SAF facilities are currently lacking, Thailand is working with industry stakeholders and foreign investors to develop infrastructure. Bangchak Corporation plans to start commercial SAF production by late 2024, with a daily capacity of one million liters. Sustainability compliance remains central, with efforts to align with ICAO CORSIA standards and establish certification mechanisms to enhance global market access.

4.10 Singapore

4.10.1 Singapore's aviation policies

In 2024 the Civil Aviation Authority of Singapore (CAAS) issued a comprehensive report⁸⁷ aiming to reduce domestic aviation emissions from airport operations by 20% from 2019 levels (404ktCO₂) in 2030 and achieve net zero domestic and international aviation emissions by 2050. To achieve these goals, CAAS will roll out 12 initiatives across the airport, airline, and air traffic management (ATM) domains to decarbonise the Singapore aviation sector.

Figure 17 shows the projected emissions from Singapore-based airlines from the implementation of ICAO's basket of measures in the medium term. CAAS estimates that technology and operational improvements can bring an emissions reduction of 16% from 2030 BAU levels. In addition, SAF and market-based measures can reduce emissions by about 4% and 17% respectively. These measures would bring Singapore's 2030 international aviation emissions below the 2019 baseline.

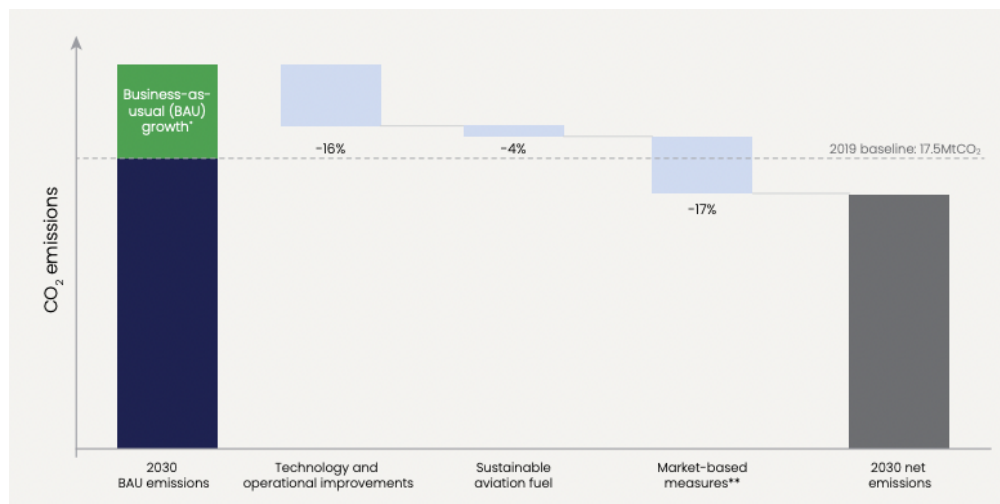


Figure 17: Singapore's Contributions to reduction in international emissions⁸⁷

CAAS foresees a rather low contribution for SAF in its national plans. To kickstart SAF adoption in Singapore, flights departing Singapore will be required to use SAF from 2026. CAAS aims for a 1% SAF target for a start to encourage investment in SAF production and develop an ecosystem for more resilient and affordable supply. CAAS goal is to raise the SAF target beyond 1% in 2026 to 3 – 5% by 2030, subject to global developments and the wider availability and adoption of SAF.

CAAS will introduce a SAF levy for the purchase of SAF to achieve the uplift target. As the market for the supply of SAF is still nascent and the price of SAF can be volatile, CAAS will adopt a fixed cost envelope approach to provide cost certainty to airlines and travelers. The levy will be set at a fixed quantum based on the SAF target and projected SAF price at that point in time. For example, the quantum of the SAF levy in 2026 will be set based on the volume of SAF needed to achieve a 1% SAF target and the projected SAF price in 2026. The amount collected through the SAF levy will be used to purchase SAF, based on the actual price of SAF at the time of purchase. Furthermore, CAAS will implement a central SAF procurement in order to manage the increased cost of using SAF on the cost of air travel.

⁸⁷ Singapore's Sustainable Air Hub Blueprint, CAAS 2024, <https://www.caas.gov.sg/docs/default-source/docs--so/singapore-sustainable-air-hub-blueprint.pdf>

4.10.2 SAF production in Singapore and region

Singapore has an extensive petrochemical sector providing a good base for SAF production. NESTE has expanded their SAF refinery capacity and at present can provide 1.25 billion litres SAF⁸⁸. However, there is scope for increased SAF production in Singapore and CAAS will work with the government to expand the SAF production.

⁸⁸ <https://www.neste.com/news-and-insights/renewable-solutions/singapore-refinery-expansion>

4.11 South-Korea

4.11.1 Existing and Emerging Policies for SAF Development in South-Korea

South Korea has taken notable steps in developing SAF policies, combining regulatory mandates, incentives, and infrastructure development to accelerate SAF adoption. In line with global efforts, the country introduced a mandate requiring a minimum 1% SAF blend for international flights departing from South Korea by 2027, aligning with ICAO and reflecting similar regulatory moves in Europe and North America⁸⁹. To support this transition, the South Korean government is implementing an SAF Expansion Strategy, which includes tax incentives and financial support for domestic production, aimed at addressing cost barriers and fostering a competitive SAF market⁹⁰. In addition, the “Petroleum and Petroleum Alternative Fuel Business Act,” enforced in August 2024, facilitates the use of bio-based feedstocks and promotes investment in SAF infrastructure, complementing existing policies to reduce the aviation sector’s carbon footprint⁹¹. To further solidify its regulatory framework, South Korea is set to introduce national SAF certification and testing standards by December 2024, ensuring quality assurance and compliance with global SAF benchmarks⁹².

A report by the Institute for Energy Economics and Financial Analysis (IEEFA) provides a comprehensive assessment of South Korea’s SAF policies and industry developments, positioning the country within the global SAF landscape⁹³. The report highlights South Korea’s strong waste recycling infrastructure, with an 86% waste recycling rate, which offers an advantage in SAF feedstock availability by utilizing waste fats, oils, grease, and municipal solid waste. This could reduce the country’s reliance on imported bio-feedstocks and strengthen its long-term energy security. The report also underscores the growing role of private sector investment, with major refiners such as SK Energy and S-Oil expanding SAF production. SK Energy launched the country’s first dedicated SAF production line in Ulsan in 2024, while S-Oil is working to expand its biofuel capacity to 150,000 tonnes per year by 2030, demonstrating corporate commitment to SAF market growth⁹⁴. These combined efforts place South Korea among the more proactive nations in Asia pursuing SAF policy and industry development, setting an example for other countries seeking to balance emissions reduction with economic and technological competitiveness.

⁸⁹ Institute For Energy Economics and Financial Analysis. Can South Korea’s aviation industry pivot to green skies? <https://ieefa.org/resources/can-south-koreas-aviation-industry-pivot-green-skies> (2024).

⁹⁰ Reuters. South Korea plans mix of sustainable aviation fuel for international flights from 2027. *Reuters* (2024).

⁹¹ Advanced Biofuels USA. Advanced BioFuels USA – South Korea Enforces New Legislation to Boost Sustainable Aviation Fuel Industry. <https://advancedbiofuelsusa.info/south-korea-enforces-new-legislation-to-boost-sustainable-aviation-fuel-industry> (2024).

⁹² Sun, D. S Korea’s SK Energy supplies first SAF cargo to Europe | Latest Market News. <https://www.argusmedia.com/en/news-and-insights/latest-market-news/2644170-s-korea-s-sk-energy-supplies-first-saf-cargo-to-europe> (2025).

⁹³ Kim, Michelle. *Can South Korea’s Aviation Industry Pivot To Green Skies?* https://ieefa.org/sites/default/files/2024-12/IEEFA%20Report%20-%20Can%20South%20Korea's%20Aviation%20Industry%20Pivot%20Towards%20Green%20Skies_December2024.pdf (2024).

⁹⁴ SAF Investor. S-Oil considering dedicated SAF plant in South Korea. *SAF Investor* <https://www.safinvestor.com/news/144885/s-oil-considering-dedicated-saf-plant-in-south-korea/> (2024).

4.12 Australia

The Australian government has announced a package of measures to help advance production and use of sustainable aviation fuel and other low carbon liquid fuels (LCLF)⁹⁵. Australia views sustainable aviation fuel as a long-term strategy to decarbonise aviation's emissions; however, actual legislation in the form of a national mandate isn't expected before 2028. The government considers establishing a national production capacity first before any legislative proposal to avoid increased SAF price

The Australian government issued the comprehensive Aviation White Paper – Towards 2050⁹⁶ on 26 August 2024 setting out the strategy for a long-term vision for the aviation industry. Work continues on a Roadmap and Action Plan in coordination with the industry aiming to identify detailed actions and policies to be implemented. As a priority “Future Made in Australia” sector, the government has committed to fast-tracking support for a low carbon liquid fuel (LCLF) industry, with an initial focus on SAF and renewable diesel. The government's commitments include developing a certification scheme to verify the emissions from the production of SAF; undertaking consultation on the costs and benefits of options for a production incentive and demand-side measures; and providing access to the \$1.7 billion Future Made in Australia Innovation Fund to support the development of nascent LCLF production technologies

The Bureau of Infrastructure and Transport Research Economics (BITRE) has derived preliminary estimates of Australia's aviation carbon emissions based on its latest long-term forecasts of domestic and international air passenger and freight activity, expected improvements in aircraft efficiency and trends in average aircraft size and load factors⁷⁰.

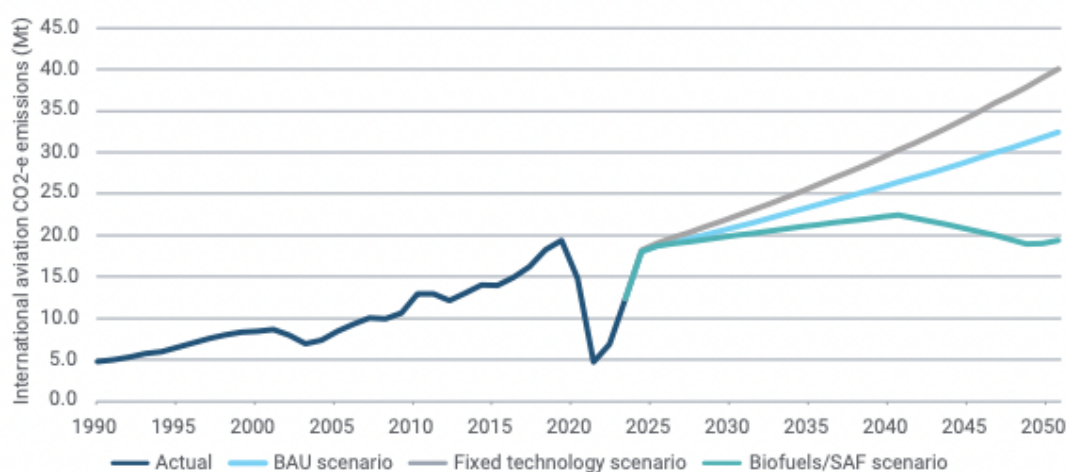


Figure 18: Actual and projected future Australian international aviation CO2-e emissions under alternative scenarios, 1990–2050⁹⁶

⁹⁵ <https://www.greenairnews.com/?p=6043>

⁹⁶ Australian Government, Aviation White Paper, Towards 2050, August 2024

<https://www.infrastructure.gov.au/sites/default/files/documents/awp-aviation-white-paper.pdf>

Australia has limited refining capacity to produce SAF locally and at present there is no SAF production in Australia. The Commonwealth Scientific and Industrial Research Organisation's (CSIRO) has concluded that Australia's SAF production will be insufficient to meet jet fuel demand until 2050⁹⁷. For this reason, the government committed to consult on options for LCLF production incentives and demand measures to accelerate development of an LCLF industry in Australia, with an initial focus on producing SAF and renewable diesel.

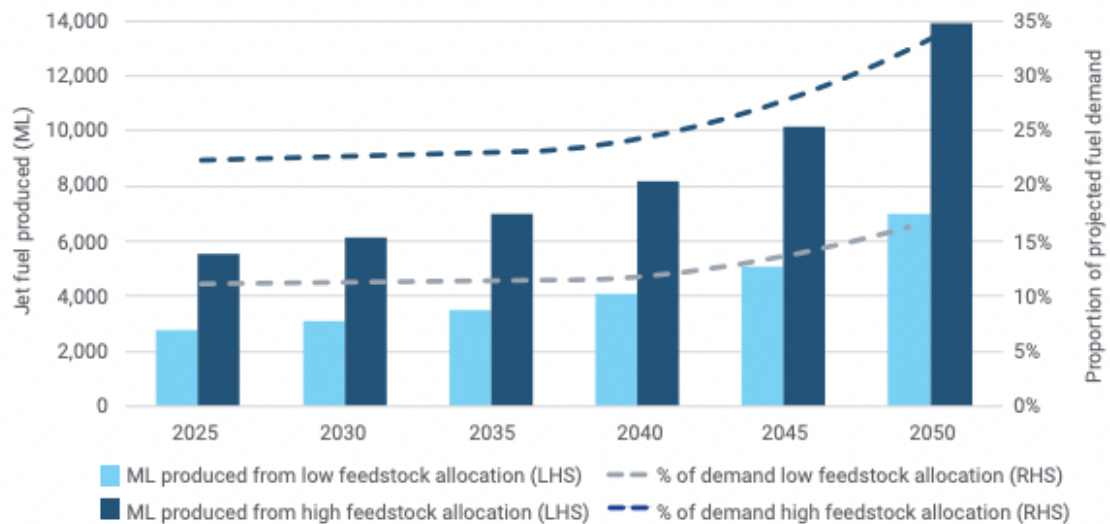


Figure 19: Potential Australian total SAF production and contribution toward domestic jet fuel demand⁹⁶.

⁹⁷ Commonwealth Scientific and Industrial Research Organisation (CSIRO), Sustainable Aviation Fuel Roadmap, CSIRO website, Australian Government, 2023; <https://www.csiro.au/en/research/technology-space/energy/Sustainable-Aviation-Fuel>

4.13 Africa: South-Africa, Ethiopia, Côte d'Ivoire

4.13.1 Existing and Emerging Policies for SAF Development in Africa

Existing policies for SAF in Africa remain in the early development stages, with a mix of mandates, incentives, and strategic frameworks being considered or implemented at national and regional levels. Current SAF policies are largely driven by international commitments, such as ICAO CORSIA (see Chapter 3), which encourages SAF adoption through carbon reduction incentives^{98,99}. Several African countries have initiated feasibility studies and policy discussions to integrate SAF into their aviation sectors. However, beyond a few leading nations such as South Africa, Ethiopia, and Côte d'Ivoire, most African countries have limited or no dedicated SAF policies in place.

While SAF feasibility studies were conducted in the scope of an ICAO-European Union assistance project for Kenya¹⁰⁰, Rwanda¹⁰¹, Burkina Faso¹⁰², Zimbabwe¹⁰³, and Côte d'Ivoire^{104,105}, and initial studies being available for Egypt^{106,107} and Nigeria¹⁰⁸, the countries lack clear SAF mandates or financial incentives to scale up production⁹⁹. Similarly, Benin, Cabo Verde, Mali, Senegal, Botswana, Madagascar, and Seychelles were part of the ICAO-European Union Assistance Project on CO₂ mitigation in aviation. However, no dedicated SAF feasibility studies were conducted for these countries; instead, a focus was on capacity-building, emissions monitoring, and State Action Plans.

Across the continent, policy frameworks for SAF development generally focus on three key areas: supply-side incentives, demand creation, and enabling market mechanisms. Supply-side measures include research and development (R&D) funding, infrastructure expansion support, and targeted tax relief for SAF producers¹⁰⁴. Demand-side initiatives, such as blending mandates and tax credits, remain limited but are under discussion in various policy forums¹⁰⁹. Enabling policies, including sustainability

⁹⁸ International Civil Aviation Organization (ICAO). CORSIA Methodology for Calculating Actual Life Cycle Emissions Values. (2024).

⁹⁹ Spielberg, R. SAF project landscape in Africa - Insights on current project and expansion plans. (2024).

¹⁰⁰ ICAO, EU. *Feasibility Study on the Use of Sustainable Aviation Fuels in Kenya*.
https://www.icao.int/environmental-protection/Documents/FeasibilityStudy_Kenya_Report-Web.pdf?utm_source=chatgpt.com (2018).

¹⁰¹ ICAO, EU. *Feasibility Study on the Use of Sustainable Aviation Fuels in Rwanda*.
https://www.icao.int/environmental-protection/Documents/ACT-SAF/Feasibility_Studies/Feasibility_Study_Rwanda.pdf (2023).

¹⁰² ICAO, EU. *Feasibility Study on the Use of Sustainable Aviation Fuels in Burkina Faso*.
https://www.icao.int/environmental-protection/Documents/FeasibilityStudy_BurkinaFaso_Report-Web.pdf.

¹⁰³ ICAO, EU. *Feasibility Study on the Use of Sustainable Aviation Fuels in Zimbabwe*.
https://www.icao.int/environmental-protection/Documents/ACT-SAF/Feasibility_Studies/Feasibility_Study_Zimbabwe.pdf (2023).

¹⁰⁴ ICAO, EU. *Feasibility Study on the Use of Sustainable Aviation Fuels in Cote d'Ivoire*. (2023).

¹⁰⁵ Atlantic Renewables. SAF Project in Cote d'Ivoire. (2024).

¹⁰⁶ European Bank for Reconstruction and Development. *Feasibility Study for Sustainable Aviation Fuel in Egypt*.
<https://www.ebrd.com/work-with-us/projects/tcpsd/18514.html> (2023).

¹⁰⁷ SAF Investor. Egypt 120K TPA SAF site progresses forward. *SAF Investor*.
<https://www.safinvestor.com/news/146400/egypt/> (2024).

¹⁰⁸ Maire Tecnimont Group. New contract for SAF feasibility study in Nigeria.
<https://www.groupmaire.com/en/newsroom/press-releases/detail/new-contracts-usd-96-million-2022/> (2022).

¹⁰⁹ Roundtable on Sustainable Biomaterials (RSB). Sustainable Aviation Fuel in SA: Report on the SAF Stakeholder Meeting in South Africa. (2022).

certification and market-based mechanisms, are also being explored to ensure compliance with international SAF sustainability standards¹¹⁰.

In addition to these national and regional efforts, the most significant development in Africa's SAF policy landscape is the ongoing approval process of the "Continental Strategy for Accelerating the Development and Deployment of SAF and Low Carbon Aviation Fuels (LCAF)" (2024-2050) by the African Union (AU), the African Civil Aviation Commission (AFCAC), and ICAO¹¹¹. This draft strategy has been endorsed by ministers of AU member states and outlines a unified policy framework to accelerate SAF deployment across Africa and sets clear production targets such as achieving 5% SAF/LCAF blending by 2030 and up to 100% SAF/LCAF deployment in the longer term¹¹². A key aspect of this strategy is the promotion of regional SAF production hubs, regulatory harmonization, and the integration of SAF development into AU initiatives such as the Single African Air Transport Market (SAATM) and the African Continental Free Trade Area (AfCFTA). If fully adopted, this would mark the first coordinated SAF policy framework at the continental level, complementing national initiatives while providing a structured roadmap for SAF industry growth.

Future policy directions indicate an increasing focus on creating structured mandates and incentives to drive SAF production and adoption. The ICAO ACT-SAF initiative is expected to play a significant role in shaping national SAF strategies, facilitating knowledge sharing, and supporting financing mechanisms for SAF projects across Africa¹¹⁰.

However, despite growing policy efforts, significant gaps remain in SAF implementation. The Continental SAF Strategy (2024 draft) identifies major barriers such as regulatory fragmentation, lack of investment incentives, and inadequate financing mechanisms¹¹¹. It emphasizes the need for stronger institutional frameworks, technical capacity-building, and public-private partnerships to support SAF market development. Without harmonized national policies, investment incentives, and infrastructure improvements, Africa risks lagging behind other regions in SAF adoption, despite its significant feedstock potential and aviation market growth¹⁰⁴.

4.13.2 Selected national SAF strategies and policy developments

Even Côte d'Ivoire, despite its feasibility study, does not yet have investment tax incentives, a dedicated SAF policy framework, or blending mandates in place¹⁰⁴. South Africa, while actively discussing SAF policy measures, still lacks formal SAF blending mandates, leading to investor uncertainty¹⁰⁹.

Ethiopia stands out for having developed an SAF roadmap, focusing on feedstock cultivation and pre-feasibility studies^{99,113}. Côte d'Ivoire has undertaken a detailed feasibility study and is exploring financial mechanisms, including capital grants, loan guarantees, and tax incentives, to stimulate SAF production and infrastructure investment¹⁰⁴. South Africa, identified as a key player in SAF production due to its existing industrial infrastructure and feedstock availability, is considering policy measures

¹¹⁰ European Civil Aviation Conference. ECAC Guidance on Sustainable Aviation Fuels (SAF). (2023).

¹¹¹ African Union. Continental Strategy for Accelerating, Development and Deployment of Sustainable Aviation Fuels (SAF), Low Carbon Aviation Fuels (LCAF) and Aviation Cleaner Energies for the Sustainable Development of Air Transport in Africa (2025-2050)- Draft. (2024).

¹¹² African Ministers Endorse Landmark Strategies to Underpin Climate Resilience, Promote Alternative Fuels | African Union. https://au.int/en/pressreleases/20241205/african-ministers-endorse-landmark-strategies-underpin-climate-resilience?utm_source=chatgpt.com.

¹¹³ Roundtable on Sustainable Biomaterials (RSB). Development of Sustainable Aviation Fuel in Ethiopia: A Roadmap. (2021).

such as production incentives, public-private partnerships, and research grants to enhance SAF development. However, without clear mandates, investment remains uncertain^{109,114}.

Ethiopia

Ethiopia has developed a 10-year Sustainable Aviation Fuel (SAF) Roadmap aimed at establishing an enabling policy environment, demonstrating SAF potential, and implementing forward-looking strategies. The roadmap highlights castor and Ethiopian mustard as key feedstocks suitable for SAF production using Hydroprocessed Esters and Fatty Acids (HEFA) technology¹¹³. Additionally, Ethiopia's policy efforts focus on attracting investment in SAF research and development, incentivizing feedstock cultivation, and aligning SAF production with international sustainability standards⁹⁹. While Ethiopia has no SAF blending mandates yet, its government is actively exploring financial incentives to scale up production and secure international partnerships.

South Africa

South Africa has significant potential for SAF production, supported by existing industrial infrastructure and abundant feedstocks such as sugarcane by-products and invasive alien plants¹¹⁴. However, the country lacks a formal SAF blending mandate, creating uncertainty for investors¹⁰⁹. Current policy discussions focus on developing incentives for SAF production, including tax benefits, public-private partnerships, and research grants. Additionally, the WWF and industry stakeholders have identified SAF as a key strategy for both economic development and aviation decarbonization, urging the government to create a structured SAF policy framework.

Côte d'Ivoire

Côte d'Ivoire has taken steps toward SAF policy development through its ICAO-funded feasibility study, which assesses feedstock availability, economic viability, and policy support mechanisms¹⁰⁴. The study proposes two SAF production pathways: (1) Alcohol-to-Jet (ATJ) using cassava-based ethanol and (2) Fischer-Tropsch synthesis from cassava residues¹⁰⁵. However, the country currently lacks targeted SAF incentives, blending mandates, and investment tax relief, which are key to attracting investors and scaling production. To advance its SAF ambitions, Côte d'Ivoire is exploring international financing options and seeking policy measures to improve investment conditions. Given its reliance on cassava-based feedstock, ensuring supply chain stability and sustainable land use will be essential for long-term viability. Addressing these challenges will be crucial for Côte d'Ivoire to move beyond feasibility studies toward actual SAF production. These three countries demonstrate varied approaches to SAF policy development, with Ethiopia focusing on feedstock potential, South Africa exploring financial incentives and industry partnerships, and Côte d'Ivoire conducting feasibility studies to attract investment. However, none have implemented formal SAF blending mandates, highlighting a key policy gap in Africa. Apart from South Africa, neither Ethiopia nor Côte d'Ivoire have the necessary infrastructure, such as biorefineries and SAF storage facilities, to support large-scale production. For SAF to flourish, significant investment in industrial infrastructure and technology is essential, as establishing refineries requires substantial funding. Additionally, a shortage of skilled labor remains a challenge, underscoring the need for policies that prioritize capacity building and specialized education to support long-term SAF sector growth.

¹¹⁴ IATA. News Article: SAF in SA. <https://www.iata.org/en/pressroom/2024-releases/2024-07-03-01/> (2024).

5 Discussion and Conclusion

This report provides an updated comparative analysis of SAF policies across key global regions, expanding on the previous edition by incorporating developments in the UK, Japan, Australia, Southeast Asia, Singapore, South Korea, and Africa. While SAF policy frameworks continue to evolve, significant disparities exist in their scope, implementation, and effectiveness.

Key Findings

- **Mandates and Legislative Action:** Only the **EU, UK, and US** have enacted binding SAF legislation. Mandates have been introduced in the **EU and UK** and are planned in **Brazil, China, India, and South Korea**. In contrast, **Canada and the US** are relying on volumetric production targets rather than blending mandates.
- **e-SAF Regulations:** The **EU and UK** are currently the only jurisdictions with specific mandates for **e-SAF**, with the EU mandate also including hydrogen from nuclear electricity.
- **Emerging SAF Ecosystems:** Several countries, including **Australia, Ethiopia, Côte d'Ivoire, Singapore, and South Africa**, are actively working to develop SAF supply chains. However, most are still in the early stages, with limited concrete legislative action.
- **Feedstock and Resource Security:** Countries such as **Canada, India, and the US** are focusing on expanding **biomass feedstock availability** to meet SAF production goals. India's policies also emphasize **farmer support and job creation** in the biofuels sector. While the EU is focusing on advanced feedstock—mainly waste and residue feedstocks—it aims to avoid using resources that compete with food production.
- **Investment and Financing Tools:** The **US has introduced loan guarantees** to support SAF facility deployment, demonstrating one of the most structured financial support mechanisms.
- **Sustainability and Certification Gaps:** **China currently lacks sustainability certification requirements for SAF** and does not align with ASTM standards, necessitating the development of a national certification framework.
- **Non-Mandate Policy Approaches:** Countries like **Indonesia, Japan, Malaysia, and Thailand** have set **national SAF blending targets** but without binding obligations. Singapore has announced a **short-term SAF blending requirement** for departing flights starting in 2026.

Policy Gaps and Challenges

Despite growing regulatory efforts, SAF remains economically uncompetitive without additional financial incentives. The current focus on mandates and production targets does not fully address the price gap between SAF and fossil-based fuels. While subsidies and tax credits exist in some regions, few countries have implemented carbon pricing, tax incentives, or credit mechanisms that could make SAF financially viable at scale.

Another challenge is the lack of globally harmonized SAF sustainability standards and certification frameworks. While ASTM certification is widely recognized, China and other markets must develop their own SAF standards, which could lead to market fragmentation and delays in international SAF trade.

Future Outlook

This report has focused on countries with the most advanced SAF policy frameworks, but it is important to acknowledge that early-stage initiatives are emerging in other regions. While these efforts have not been included due to their preliminary nature, they may be incorporated in future editions as policies evolve.

The next update of this report, planned for 2026, will continue to track global SAF policy developments, including new financial mechanisms, regulatory frameworks, and international cooperation efforts. As SAF adoption accelerates, the extent to which policies address economic barriers and ensure a level playing field for SAF deployment will be a key factor in determining long-term success.

