INTERNATIONAL COOPERATION FOR
SUSTAINABLE AVIATION BIOFUELS

Policies Overview for SAF

March 2024

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Table 2: Dissemination level of this report

Dissemination level of this report	
PU	**Public x**
PP	Restricted to other programme participants (including the Commission Services)
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EXECUTIVE SUMMARY

There is global interest in reducing the carbon footprint of the aviation sector which has significantly increase the demand for advanced sustainable biofuels that can be used in aviation. 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 relative short time.

This report presents the policy initiatives and actions in the EU and in key Mission Innovation Countries (MIC) being Brazil, Canada, China, India, and USA[1]. There is a continuously increasing interest in tackling aviation's GHG emissions in general and more countries are announcing new initiatives and policies. Therefore, other regions and countries of interest such as Africa and Australia will be added in future updates of the report.

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 policies available at present. More details will be incorporated in the report after the first workshop will be organised with representatives from the EU and MIC to establish working relationships and exchange of information scheduled for July 2024. After the first workshop, information on the role of airports will also be discussed as the location where SAF is stored before fuelling the planes.

This report is a working document and will be continuously updated.

Table 1 is a comparative summary of the various policies and support actions under implementation in the EU and the above mentioned 5 MIC countries.

Table 1: SAF Policies and support actions in the EU, Brazil, Canada, China, India, and USA

Region/Country	Key initiatives	Type	Comments
EU	ReFuelEU Aviation Regulation, legislation	Legislation & Mandates	Complex legislation in relation to feedstocks. Mandate targets very ambitious and in short time. High GHG minimum targets. Obligation is upon the fuel suppliers. Mandate targets also on eSAF; nuclear included.
Brazil	Policy on forthcoming mandate	Mandate	Forthcoming mandate set for 2027 aiming to reduce Brazil's aviation emissions by 1% of the sector's total emissions in 2026. Strong relationship to the ethanol route for SAF
Canada	Policy on targets	Target	1 billion litres of SAF by 2030.

[1] **Note:** China and the USA are not members of ICARUS.

			By 2035, Canada should be ready to produce SAF to meet 25 percent of total jet fuel demand.
China	Short term goal for biofuel uses in aviation	Target	Cumulatively consuming 50,000 tons of SAF by 2025. No reference yet to sustainability certification. No relationship to ASTM, thus need to develop own standards.
India	Policy on forthcoming mandate	Mandate	Use of 1% SAF for domestic airlines by 2025. The policy also aims to support farmers and rural job creation.
USA	Sustainable Aviation Fuel tax credit, legislation	Production Target	Expand production to achieve 3 billion gallons (11.4billion 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 EU policies and targets for Sustainable Aviation Fuels

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. Some of them may have conflicting aims and objectives.

The European Climate Law[2] 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 1 while Figure 2 shows the various legislative initiatives related to transport.

Figure 1: European Climate Law[3]

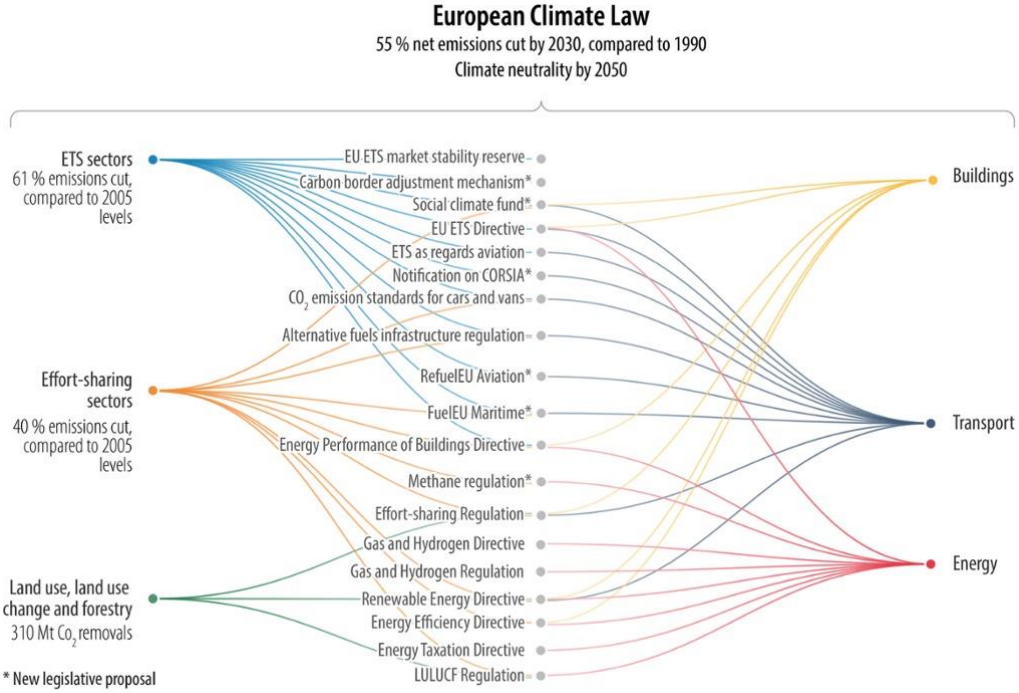
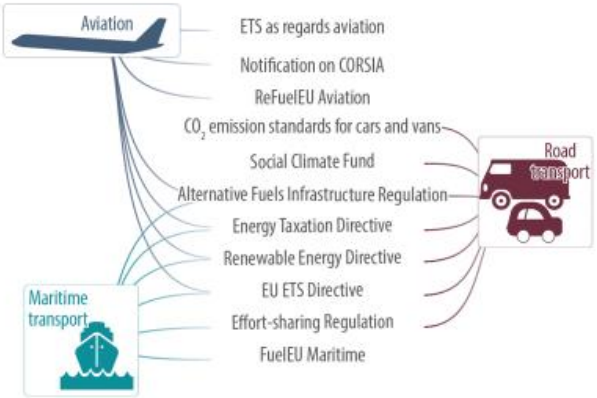


Figure 2: Transport-related legislative initiatives in the 'fit for 55' package

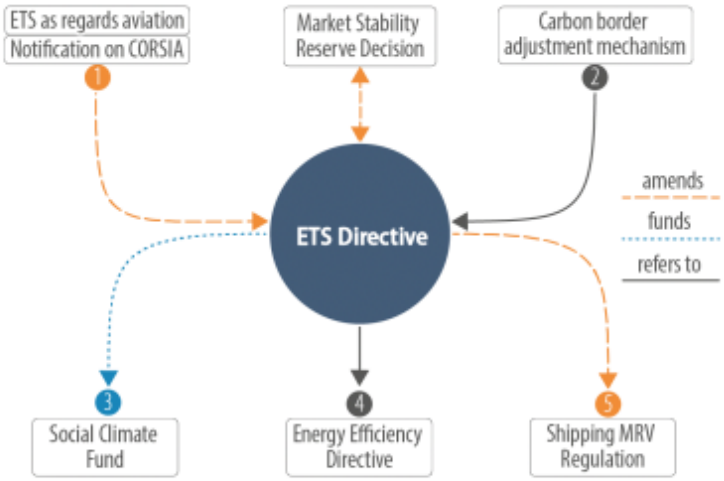


[2] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R1119
[3] https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/733513/EPRS_BRI(2022)733513_EN.pdf

The 'Fit for 55' package[4] 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 Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) offsetting scheme[5],[6].

As shown in Figure 3, 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.

Figure 3 – Legislative initiatives related to the EU ETS in the 'fit for 55' package[2]



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.

As far as aviation is concerned, 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.

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:

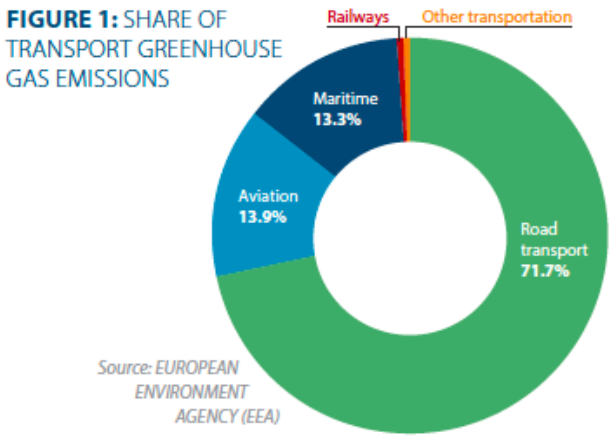
[4] Https://ec.europa.eu/commission/presscorner/detail/en/IP_23_4754
[5] https://www.icao.int/environmental-protection/CORSIA/Pages/default.aspx
[6] Note: Monitoring, reporting and verification of CO_2 emissions under CORSIA began in 2019. 88 States volunteered to participate in the CORSIA offsetting 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)

- 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.

Although the share of aviation in the transport greenhouse gas emissions is relatively low compared to road transport -see Figure 4-, it still represents a significant part since the EU policy is to reduce the emissions from road transport via electrification.

Figure 4:_Share of Transport GHG emissions



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 2050[7].

The ReFuelEU-Aviation rapid market uptake of SAF is indicated in Figure 5.

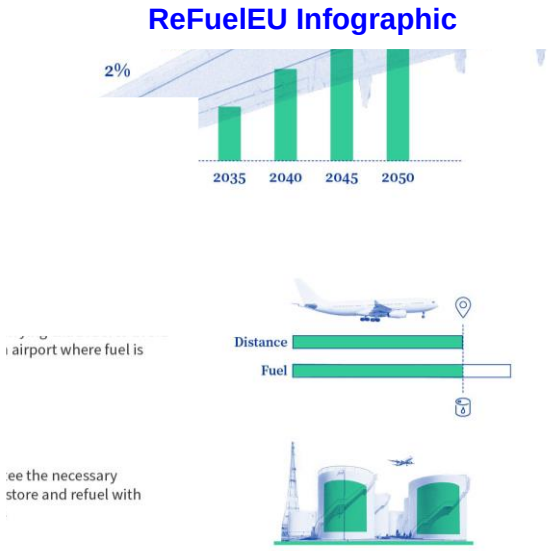
What is important to note is that the ReFuelEU the obligation to meet the targets and comply with the regulation is for the ***fuel suppliers*** **and** ***neither*** the member states, nor the airlines. Furthermore, the fuel suppliers may market SAF in other countries in a global scale. Therefore, national mandates that surpass the ReFuelEU targets are not allowed, and national measures adopted by the Netherlands[8] and Germany[9] need to be repealed.

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

[8] 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

[9] 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;

Figure 5: ReFuelEU ramp up to 2050



1.2 Eligible SAF under the Renewable Energy Directive

The Renewable Energy Directive III[10] (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%.

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. Advaced 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 act[11] that updates the list in the Annex to add the feedstocks that meet the criteria has been proposed.

Currently the eligible types of SAF and their feedstocks that can be used in the EU are listed in Table 2.

https://www.argusmedia.com/en/news-and-insights/latest-market-news/2170964-german-government-agrees-draft-biofuels-law

[10] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202302413

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

Table 2: Eligible types of SAF and their feedstocks that can be used in the EU

Aviation Fuel Type	Description
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	
Renewbale fuels of non-biological origin (RFNBO)	H2 or liquid fuels derived from renewable energy sources (efuels)
Synthetic low-carbon aviation fuels	H2 or fliquid uels derived from nuclear energy

1.3 SAF availability in the EU

According to the supporting study for the ReFuelEU Aviation initiative[12], 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 ion 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 demand[13]. Numerous projects have been announced and some of them are alreday 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 6 shows all the projects (some already operationsal) that have been announced for SAF poroduction 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 retrofited 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 fuels[12] as estimated in Figure 7.

[12] 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**

[13] https://www.easa.europa.eu/eco/eaer/topics/sustainable-aviation-fuels/current-landscape-future-saf-industry

Figure 6:_Current announced SAF projects within Europe, March 2022

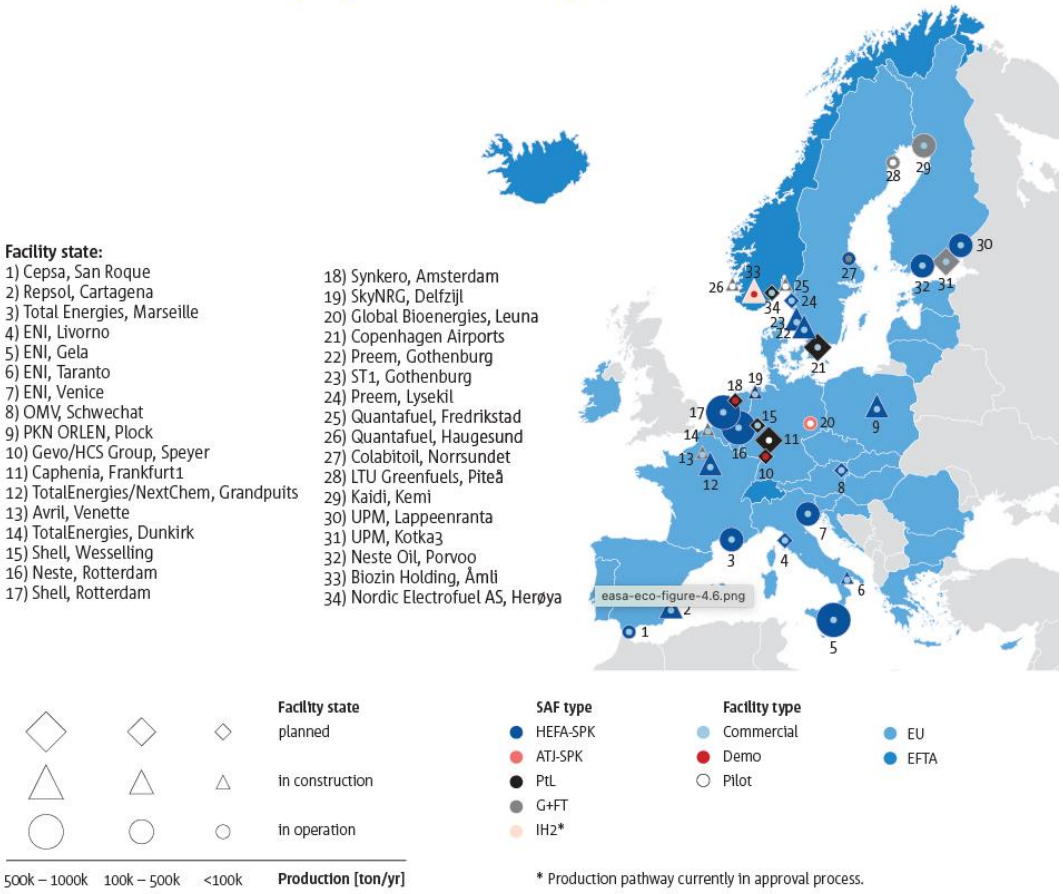
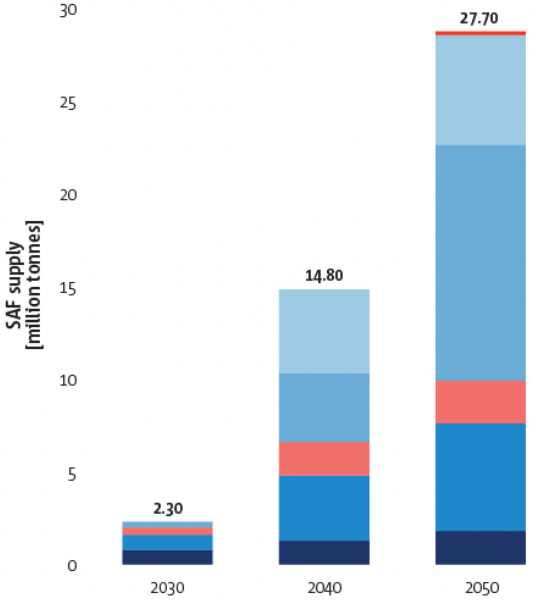


Figure 7:_ReFuelEU modelled SAF supply per production pathway[12]



	2030	2040	2050
Electricity	0.00	0.00	0.20
Gasification+FT	0.00	4.50	5.90
PtL	0.30	3.70	12.70
Imports	0.40	1.80	2.30
ATJ	0.80	3.50	5.80
HEFA	0.80	1.30	1.80

2 Brazil's policies and targets for Sustainable Aviation Fuels

Over the years, Brazil has introduced various successful policies related to biofuels such as the Proálcool (Pro-alcohol) initiative[14], which was launched in response to the global petroleum crisis in 1975. In addition, Brazil demonstrated its dedication to the Paris Agreement by implementing the National Biofuels Policy, RenovaBio[15] in 2019.

In connection with encouraging SAF production and use, there is a forthcoming mandate set for 2027, aiming to reduce Brazil's aviation emissions by 1% of the sector's total emissions in 2026, with the potential to increase this target to 10%[16] by 2037.

The adoption of ethanol-to-jet technology shows enormous potential for SAF production in Brazil. Another crucial aspect for assessing the implementation of ethanol-to-SAF is the availability of technology pathways. A few technology developers are capable of providing such technologies.

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 agrological zoning for sugarcane cultivation.

[14] 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. agríc. (Online) 40 (2) • Mar-Apr 2020, https://doi.org/10.1590/1809-4430-Eng.Agric.v40n2p243-248/2020

[15] https://www.gov.br/mme/pt-br/assuntos/secretarias/petroleo-gas-natural-e-biocombustiveis/renovabio-1/renovabio-ingles

[16] https://brazilian.report/liveblog/politics-insider/2023/07/19/future-fuel-emissions/

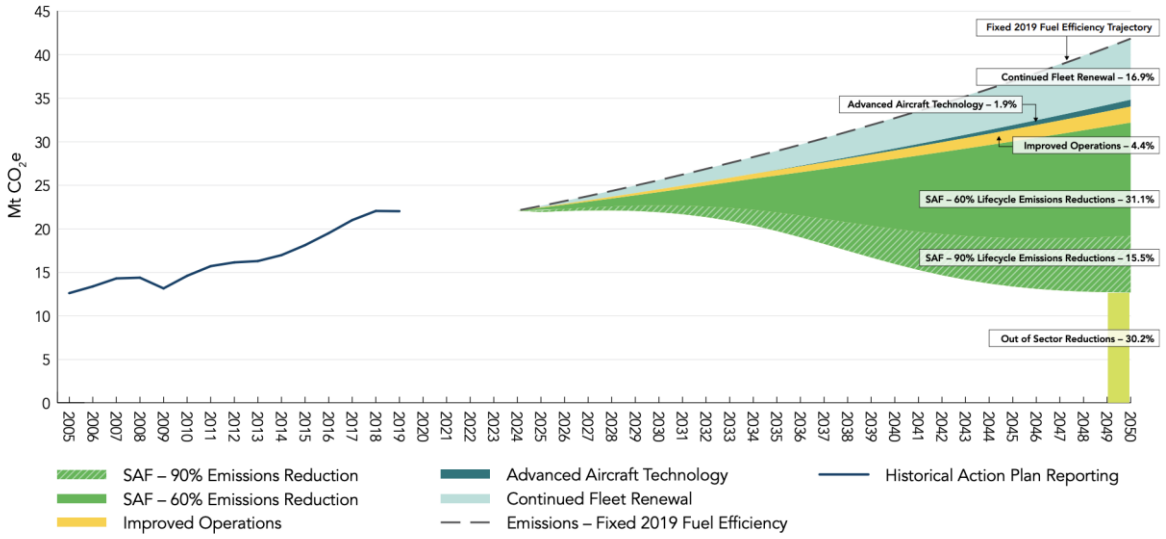
3 Canada's policies and targets for Sustainable Aviation Fuels

In 2019, 70% of GHG emissions from Canadian air carriers came from international flights, while 30 percent came from domestic flights.[17] [18]. 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.

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 8 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 baseline[16].

Figure 8: 2050 Canadian Aircraft Emissions Forecast – A Vision to Net-Zero [16]



However, in spite of gthe 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

[17] https://www.icao.int/environmental-protection/Documents/ActionPlan/CANADAs-AVIATION-CLIMATE-ACTION-PLAN-2022-2030.pdf

[18] 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.

aiming to reduce the GHG emission of aviation. In an open letter[19][20] 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 in order to incentivise domestic SAF production:

- 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 competitve 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.

3.2 The C-SAF Roadmap

The Canadian Council for Sustainable Aviation Fuels[21] (C-SAF) recently launched a Roadmap[22] 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 Canada[23]. 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" [24] supporting the above in itiatives, however, no legislatrive action has been undertaken yet.

[19] https://c-saf.ca/news-releases/

[20] 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.

[21] https://c-saf.ca/

[22] https://www.beacdn.com/download/?url=https://www.beacdn.com/apps/gLGxqEBxaE/R2P8Bpg VAz/1Angjr9BzO/files/i1686009340s7fb6e4b490e.pdf&preview=1f&name=CSAF_Roadmap_Full_Report.pdf

[23] https://clean50.com/projects/canadas-first-sustainable-aviation-fuels-roadmap/

[24] https://tc.canada.ca/sites/default/files/2024-01/tc-taking-action-envinronment-e-acc.pdf

4 China's policies and targets for Sustainable Aviation Fuels

China's aviation market is second in size only to that of the USA. According to the International Council on Clean Transportation (ICCT)[25], 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 are still no dedicated legislation in China for SAF and this creates a barrier to investmenst 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). From 2006, airworthiness certification authorities for civil aviation started to certify aviation fuel suppliers and testing organizations. In March 2010, the Aviation Fuel/Oil and Aerochemicals Airworthiness Certification Center of CAAC was established[26].

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 2025[28], but the country has not developed any action plan, remains vague about its mediumand 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.

4.2 Airworthiness certification

Since China does not have ASTM-like industry associations it had to develop its own certification system[27]. When Sinopec No. 1 Aviation Biofuel was certified[28], it was characterised as one of the most-often used aircraft parts and the certification was conducted by reference to the certification of parts

Table 2: Chinese policies related to the promotioon and use of SAF

[25] https://theicct.org/wp-content/uploads/2021/06/CO2-commercial-aviation-oct2020.pdf

[26] The Present and Future of Sustainable Aviation Fuels in China, Institute of Energy, Peking University, October 2022, https://energy.pku.edu.cn/docs/2022-10/bc31f41c450d46e4bbea5a33c8aeab40.pdf

[27] https://www.caac.gov.cn/ZTZL/RDZT/XJSYY/201511/P020151126513095309047.pdf

[28] http://ripp.sinopec.com/ripp/en/Dt/ScientificRDNews/20140619/news_20140619_339293487115.shtml

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	14th 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 14th 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)	14th 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.	14th 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.

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 Airport[29].

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 certification[30]. China has not developed standards addressing sustainability. However, state organisations and academic institutions are conducting research on standards and methodologies for sustainability certification.

[29] http://www.chinaaviationdaily.com/news/25/25588.html

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

5 Indian policies and targets for Sustainable Aviation Fuels

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 the environmental footprints[31]. Additionally, the White Paper suggested the use of biofuels in the aviation industry and steered all aviation stakeholders to explore the possibilities of the use of 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 2025[32] aiming to cut emissions from the aviation sector. To achieve this target about 140 million litres of SAF will be needed. At present there are no other policies to further promote the use of SAF in India. The SAF mandate copuld increase to 4-5% if the volumles of SAF would increase accordingly. The announcement came after a successful flight from Pune to Delhi with SAF provided by Praj Industries[33].

In addition to reducing emissions from the aviation sector, India aims to support the 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 important steps have been undertaken by India in view of reaching net-zero emissions by 2070 as announced by Prime Minister Narendra Modi at COP26[34], 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.

5.1 SAF certification and standards in India

In India, certifications in the aviation industry are predominantly regulated by the following authorities[35]:

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 Ithe 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

[31] https://www.civilaviation.gov.in/sites/default/files/Whitepaper%20on%20National%20Green%20Aviation%20Policy.pdf)
[32] https://www.thehindu.com/news/national/india-eyes-to-mandate-use-of-1-sustainable-aviation-fuel-by-2025-oil-minister/article66869441.ece
[33] https://www.praj.net/
[34] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1961797
[35] https://www.mondaq.com/india/aviation/1285156/future-of-aviation--sustainable-aviation-fuel

17081:2019, Aviation Turbine Fuel (Kerosene Type, Jet A-1) containing Synthesised Hydrocarbons.[36] 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.

[36] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1561296

6 USA policies and targets for Sustainable Aviation Fuels

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

6.1 The Renewable Fuel Standard

The Renewable Fuel Standard[37] (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.

6.2 Sustainable Skies Act

In May 2021, the U.S. Congress introduced the Sustainable Skies Act[38] 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

6.3 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 2050[39]. 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 Understanding[40] 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 Roadmap[41] report issued in 2022.

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

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

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

[40] https://www.energy.gov/sites/default/files/2021-09/S1-Signed-SAF-MOU-9-08-21_0.pdf

[41] 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 Agenda[42]. 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 planed 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.

[42] https://www.whitehouse.gov/build-back-better/

6.4 SAF in the Inflation Reduction Act

President Joe Biden signed into law the Inflation Reduction Act[43] (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)[44].

[43] https://www.whitehouse.gov/cleanenergy/inflation-reduction-act-guidebook/

[44] **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.**

7 Conclusions

At present only the EU and US have enacted legislation for the deployment of SAF.

Mandates have been adopted in the EU and are planned in Brazil and India while Canada, China and the USA are basing their policies on volumetric targets.

Only the EU has a specific mandate for eSAF and this also includes hydrogen from nuclear electricity.

There is strong reference to develop new crops in Canada, India, and USA to ensure that biomass resources will be available to meet the production targets.

USA has clear and specific loan guarantees to support the deployment of SAF facilities in the USA.

India, further prominently considers support to farmers and improving local employment.

Policies in China do not refer to sustainability certification. There is no relationship with ASTM so China must develop its own national SAF standards and certification.