SAFE SKIES.
SUSTAINABLE FUTURE.

Chinga Mazhetese, Blandine Ferrier

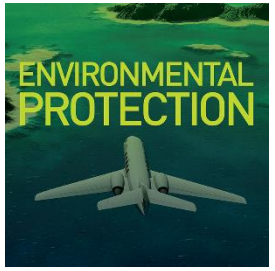
Environment Officers

ICAO Regional Offices – ESAF and WACAF

ICAO AND ENVIRONMENT

ICAO STRATEGIC OBJECTIVE

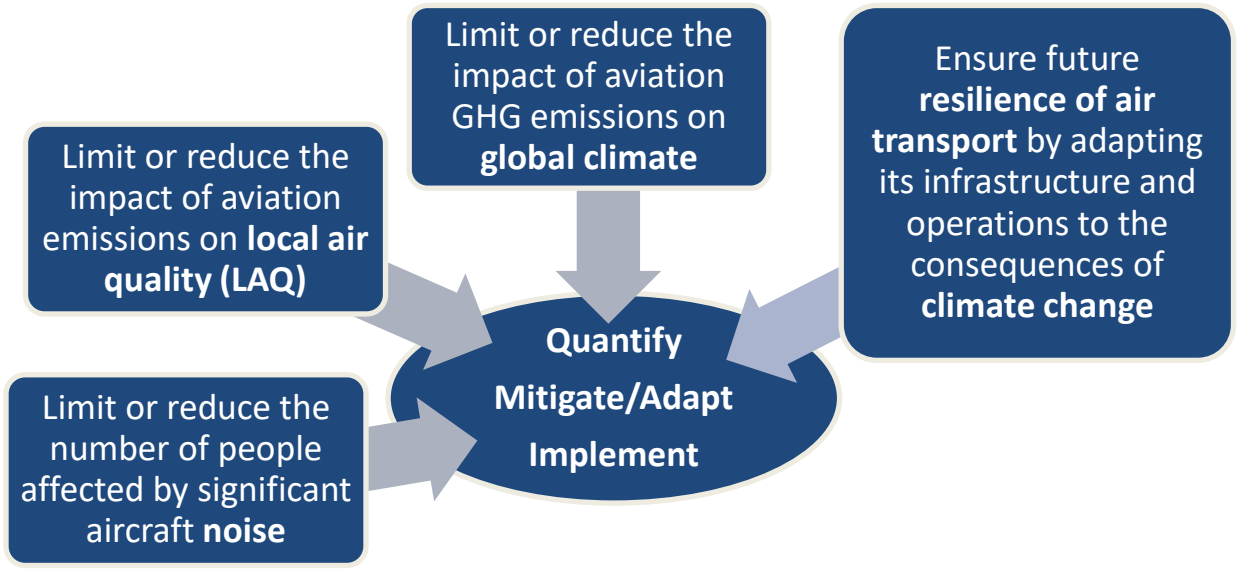
Minimize the adverse effect of global civil aviation on the environment



SUSTAINABLE DEVELOPMENT GOALS

ICAO's environmental work contributes to 14 out of the 17 United Nations SDGs

ICAO ENVIRONMENTAL GOALS



41st ASSEMBLY RESOLUTIONS

- **A41-20:** General provisions, noise and local air quality
- **A41-21:** Climate change
- **A41-22:** Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)

Introduction to SAF at ICAO

2009
First ICAO Conference on Aviation and Alternative Fuels (CAAF/1)

2010 – Inclusion of SAF as a measure to reduce CO_2 emissions (ICAO resolution A37-17)

2012 –
Rio + 20 conference – **SAF flight from Montréal to Rio with the ICAO Secretary General**

2013
Creation of the CAEP Alternative Fuels Task Force (AFTF)

2017
Second Conference on Aviation and Alternative Fuels (CAAF/2)
ICAO vision on SAF

2018 – CORSIA adoption (including SAF provisions)

2019 – First ICAO Stocktaking Seminar on SAF

2020
CORSIA methodologies on sustainability and life cycle analysis

2021
Socio-economic and environmental sustainability criteria

2022 LTAG Agreement
SAF has the greatest potential to reduce CO_2 emissions

Long term global aspirational goal (LTAG) for international aviation

The Assembly agreed to a collective long-term global aspirational goal (LTAG) of net-zero carbon emissions from international aviation by 2050

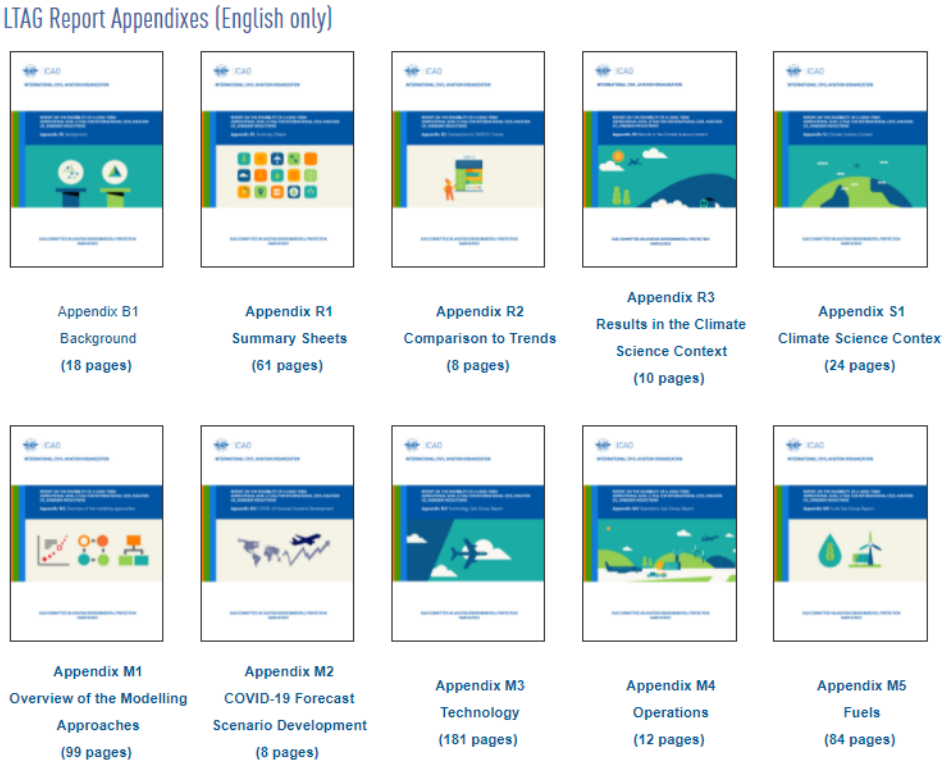
In support of Paris Agreement's temperature goal

Collective global aspirational goal, and does not attribute specific obligations or commitments in the form of emissions reduction goals to individual States

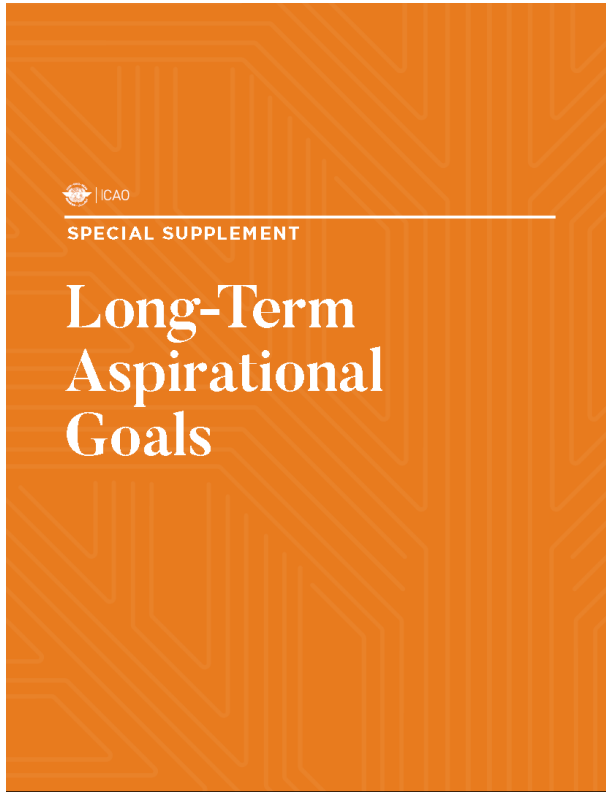
- The adopted Resolution A41-21 is available here
- Long term global aspirational goal (LTAG) for international aviation (icao.int)

ICAO LTAG Report and support publications

LTAG Report



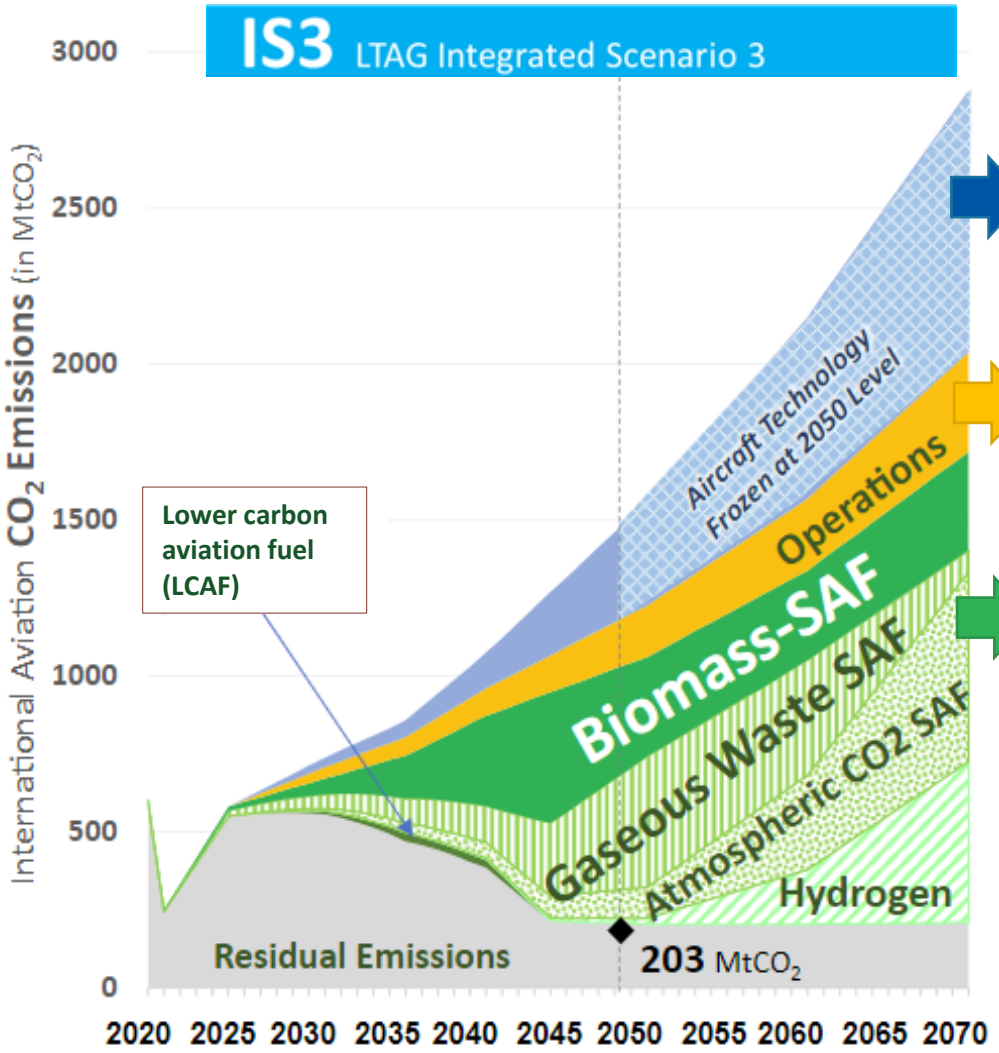
Appendixes to LTAG Report



2022 ICAO Environmental Report
Special Supplement on LTAG

https://www.icao.int/environmental-protection/LTAG/Pages/LTAGreport.aspx

LTAG Report – Contributions from technology, operations and fuels



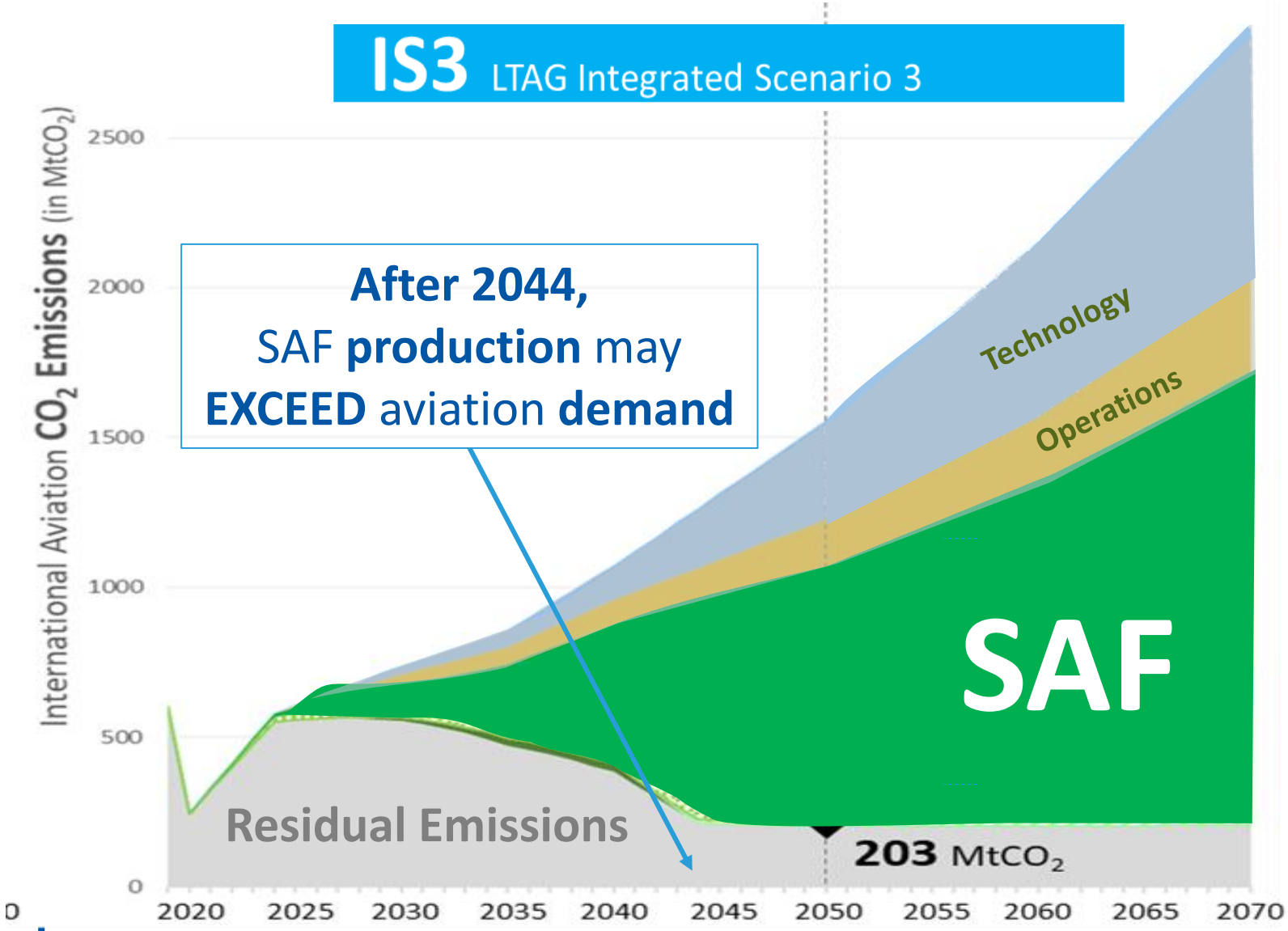
Advanced tube and wing, unconventional airframe/propulsion concept aircraft, non-drop-in fuels such as battery electric etc.

Improvements in the performance of flights across all phases

Sustainable aviation fuels (SAF) and other cleaner energy have the largest impact on residual CO_2 emissions, driving overall reductions by 2050

Contributions from hydrogen may increase in the 2050s and 2060s if technically feasible and commercially viable

LTAG report and SAF



2022: 0.15 Billion Liters of SAF being produced

2045: 636 billion liters needed to replace all fossil fuels

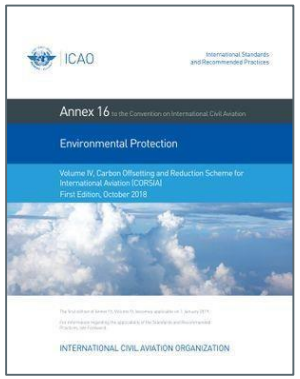
Need for immediate action to fully realize SAF potentials

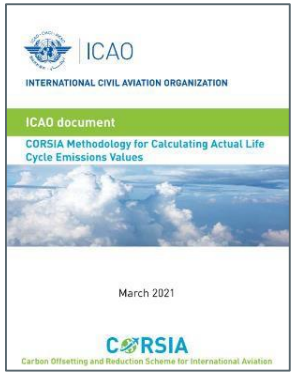
References:
https://www.icao.int/environmental-protection/LTAG/Pages/LTAG-data-spreadsheet.aspx https://www.iata.org/en/iata-repository/pressroom/fact-sheets/fact-sheet---alternative-fuels/

SAF basic definitions

What are Sustainable Aviation Fuels (SAF)?

Definition	Which Sustainability Criteria?	What is a waste?
SAF is defined as a *renewable or waste-derived aviation fuel* that meets sustainability criteria. *reference: Annex 16 Vol IV – CORSIA*	Sustainability Criteria are defined in the ICAO document *"CORSIA Sustainability Criteria for CORSIA Eligible Fuels"*	Waste is a feedstock with inelastic supply and no economic value (e.g. municipal solid waste, used cooking oil, waste gases etc.) R*eference:* ICAO document *"CORSIA Methodology For Calculating Actual Life Cycle Emissions Values"*





All documents available at https://www.icao.int/environmental-protection/CORSIA/Pages/CORSIA-Eligible-Fuels.aspx

Benefits of SAF

Drop-in nature of SAF makes it interchangeable and compatible with conventional aviation fuels

- SAFs can currently be blended at up to 50% with conventional jet fuel, and re-certified – it is handled in the same way as conventional aviation fuels
- No changes in the aircraft or its engines, nor in infrastructure, which would imply major logistical, safety and cost issues

SAF industry can provide opportunities for economic growth and employment

ICAO Policies on SAF, and related materials

ICAO work on SAF goals

- **ICAO 2050 Vision for SAF** adopted at the 2nd ICAO Conference on Aviation and Alternative Fuels (CAAF/2 - 2017)

- Calls on States, industry and other stakeholders to substitute a significant proportion of conventional aviation fuels with sustainable aviation fuels by 2050
- **Stocktaking process** supporting these goals – yearly events held since 2019

- **ICAO Global Framework for SAF, LCAF and other Aviation Cleaner Energies** adopted at the 3rd Conference on Aviation and Alternative Fuels (CAAF/3 – 2023) --Collective global aspirational Vision to reduce CO2 emissions in international aviation by 5 % by 2030, through aviation cleaner energy use

ICAO

ICAO taking the lead in SAF policies and goals

CAAF/3 DUBAI

- Adoption of a new ICAO Global Framework for Sustainable Aviation Fuels (SAF), Lower Carbon Aviation Fuels (LCAF) and other Aviation Cleaner Energies.
- Collective global aspirational Vision to reduce CO2 emissions in international aviation by 5 per cent by 2030, compared to zero cleaner energy use.
- Support the clean energy transition of the aviation sector needed to achieve the current goal of Net-Zero carbon emissions by 2050

Key outcomes from ICAO Conference on Aviation and Alternative Fuels (CAAF)/3

ICAO Global Framework for Sustainable Aviation Fuels (SAF), Lower Carbon Aviation Fuels (LCAF) and other Aviation Cleaner Energies

- Supports global scale up of aviation cleaner energies – Collective Vision to reduce 5% CO2 by 2030
- Provides clarity, consistency and predictability to all stakeholders on 1) policy and planning, 2) regulatory framework, 3) implementation support, and 4) financing
- Monitors the implementation progress on emissions reductions and means of implementation
- Aspiring to have cleaner energy production facilities in all regions by CAAF/4 (no later than 2028)
- To update the Vision at CAAF/4 on the basis of market developments

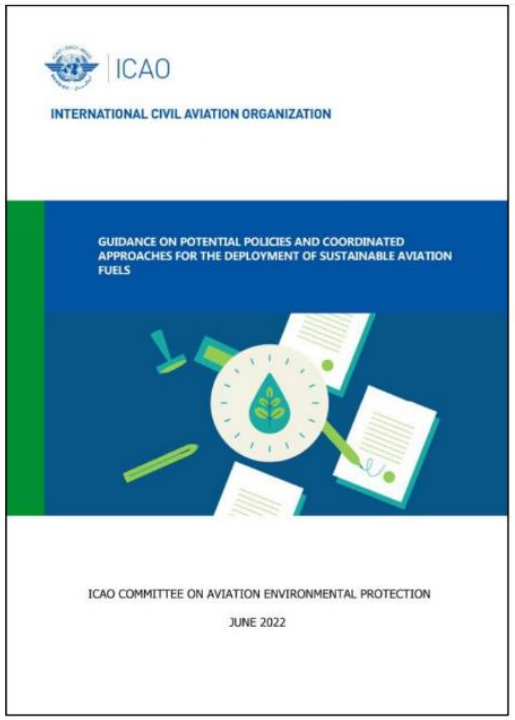
ICAO Policies on SAF

ICAO has international policies applicable to SAF

CORSIA	2050 ICAO Vision for Sustainable Aviation Fuels	Long term Aspirational goal (LTAG)
• an aeroplane operator can **reduce its CORSIA offsetting requirements** through the use of CORSIA Eligible Fuels (CEF) • Includes international approaches for **sustainability and life cycle assessment** of fuels	Calls for a **significant proportion of SAF use by 2050,** and a **level-playing field with other sectors** **ICAO Global Framework for SAF, LCAF and other Aviation Cleaner Energies**	Largest aviation CO_2 emissions reductions to come from fuel-related measures LTAG agreement (A41-21) includes aspects related to policy planning, regulatory framework, implementation support, and financing

ICAO Policies on SAF

ICAO Guidance on Potential Policies and Coordinated Approaches for the deployment of SAF



ACT-SAF #4 SERIES

- Developed by CAEP based on studies performed since 2016
- A support reference for ICAO States to develop SAF production
  - Insight on types of policy measures and their impacts
  - Examples of policies used or under preparation
  - Links to additional helpful resources
- Completes a toolbox of guidance material for ICAO States
- Can be used in combination with the ICAO SAF Rules of Thumb

Publically available on the ICAO website

Guidance document
https://www.icao.int/environmental-protection/Pages/saf_guidance_potential_policies.aspx

SAF rules of thumb
https://www.icao.int/environmental-protection/Pages/SAF_RULESOFTHUMB.aspx

ICAO

(ICAO ACT-SAF Series)

ICAO Policies on SAF

Guidance provides details on 28 types of Policy Options, divided into 3 impact areas and 8 categories

Impact area: Stimulating Growth of SAF Supply

1 Government funding for RDD	2 - Targeted incentives and tax relief o expand SAF supply infrastructure	3 - Targeted incentives and tax relief to assist SAF facility operation	4 - Recognition and valorization of SAF environmental benefits
1.1 - Government R&D 1.2 - Government demonstration and deployment	2.1 - Capital grants ; 2.2 - Loan guarantee programs 2.3 - Eligibility of SAF projects for tax advantaged business status ; 2.4 - Accelerated depreciation/'bonus' depreciation 2.5 - Business Investment Tax Credit (ITC) for SAF investments 2.6 - Performance-based tax credit 2.7 – Bonds / Green Bonds	3.1 Blending incentives: Blender's Tax Credit 3.2 – Production incentives: Producer's Tax Credit 3.3 - Excise tax credit for SAF 3.4 - Support for feedstock supply establishment and production	4.1 – Recognize SAF benefits under carbon taxation 4.2 - Recognize SAF benefits under cap and-trade systems 4.3 - Recognize non-carbon SAF benefits: improvements to air quality 4.4 - Recognize non-carbon SAF benefits: reduction in contrails

Impact area: Creating Demand for SAF

5- Creation of SAF mandates	6 - Update existing policies to incorporate SAF	7 – Demonstrate government leadership
5.1 - Mandate renewable energy volume requirements in the fuel supply 5.2 - Mandate reduction in carbon intensity of the fuel supply	6.1: Incorporating SAF into existing national policies 6.2: Incorporating SAF into existing subnational, regional or local policies	7.1 Policy statement to establish direction 7.2: Government commitment to SAF use, carbon neutral air travel

Impact area: Enabling SAF Markets

8 - Market enabling activities
8.1 - Adopt clear and recognized sustainability standards and life cycle GHG emissions methods for certification of feedstock supply and fuel production 8.2 - Support development/recognition of systems for environmental attribute ownership and transfer 8.3 - Support SAF stakeholder initiatives

ICAO Policies on SAF

SAF estimates 'Rules of thumb'

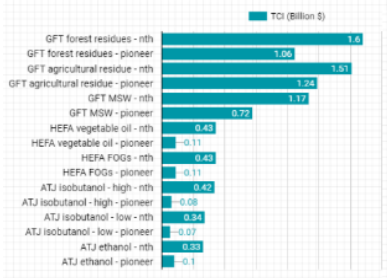
ICAO SAF Rules of Thumb – order of magnitude estimations on SAF costs, investment needs and production potential. They can be used to inform policymakers and project developers.

- Provides the impact of feedstock cost, fuel yield, facility scale, total capital investment (TCI) and minimum selling price (MSP) for both the ***n*th plant** and a **pioneer plant**.
- Provides **big-picture trends** for costs and processing technology/feedstock comparisons.

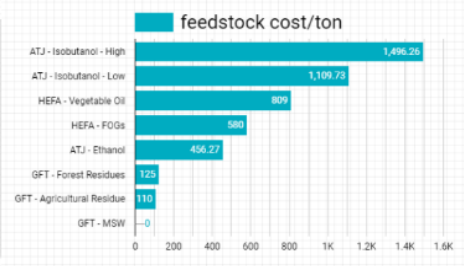
https://www.icao.int/environmental-protection/Pages/SAF_RULESOFTHUMB.aspx

Processing Technology	Feedstock	Feedstock Cost ($/tonne)	Feedstock Cost ($/L)	TCI (million $)		MSP ($/L)	
				nth	pioneer	nth	pioneer
GFT	MSW	0	-	1170	724	0,7	1,8
GFT	Forest Residues	125	-	1636	1063	1,8	3,3
GFT	Agricultural Residues	110	-	1506	1238	2,1	3,8
ATJ	Ethanol	456	0.36	333	99	0,8	1,0
ATJ	Isobutanol - Low	1110	0.89	343	67	1,3	1,4
ATJ	Isobutanol - High	1496	1.20	424	75	1,8	1,9
HEFA*	FOGs	580	-	428	112	0,8	1,0
HEFA*	Vegetable Oil	809	-	431	108	1,1	1,2

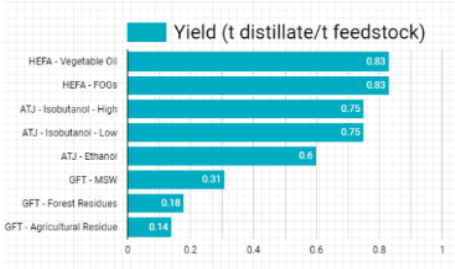
total capital investment (TCI)



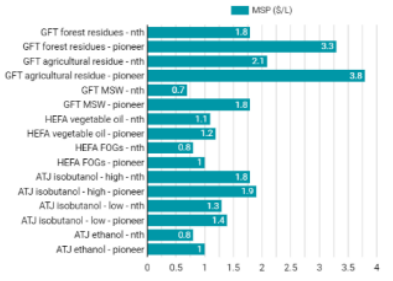
Feedstock costs



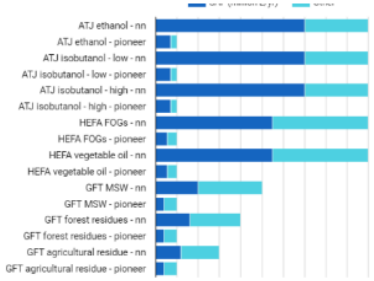
Feedstock Yield



Minimum Selling Price

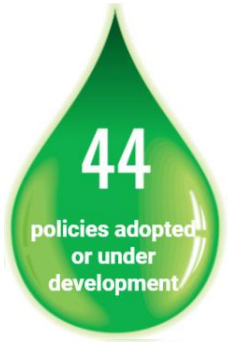


Refinery capacity



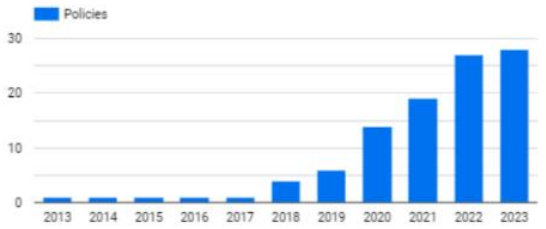
ICAO Policies on SAF

SAF Policies tracker



Tracker of Policies adopted or under development to foster SAF development

Date	State	Policy Title	Policy Description	Status	Source
13 févr. 2023	United States	Invest in Illinois Act	This legislation in Illinois provides a tax credit of $1.50 per gallon for SAF used by aircraft in the state. For the SAF to qualify for the credit, it must reduce carbon emissions by at least 50% throughout its life. The credit applies to all SAF used in Illinois, regardless of where it is produced. However, credits for SAF used before June 1, 2028, must come from renewable sources such as biomass, waste streams, renewable energy, or gaseous carbon oxides. The tax credit will be available until January 1, 2033.	adopted	https://www sustainable-
16 nov. 2022	India		SAF mandate blending under consideration	under development	https://www committed-t
18 oct. 2022	Japan		The Japanese government is seeking public comments on a draft policy to promote decarbonization in the aviation industry. The policy, in part, would require flights to be carbon neutral by 2050 and require airlines to use sustainable aviation fuel (SAF).	under development	https://biom s-draft-policy
3 oct. 2022	China	China Civil Aviation Green Development Policy and Action	Target of 50k tons of SAF use by 2025 SAF performance testing, airworthiness certification, exploration of new paths for its development.	adopted	http://www.c 15425.html
16 août 2022	United States	Inflation Reduction Act (SAF blenders tax credit)	The bill provides a $1.25 per-gallon credit for each gallon of SAF sold as part of a qualified fuel mixture, including that it has a demonstrated lifecycle greenhouse gas (GHG) reduction of at least 50 percent compared to conventional jet fuel. The credit, available for two years beginning January 1, increases up to $1.75 per gallon on a sliding scale based on the percentage of lifecycle GHG emissions reduced beyond 50 percent. Beginning in 2025, SAF would be eligible for credits up to $1.75 per gallon under a new Clean Fuel Production Credit (CFPC). That credit is set to expire at the end of 2027.	adopted	https://www aviation/202
19 juil. 2022	United Kingdom	Jet Zero Strategy	Increasing support for sustainable aviation fuels (SAF), by creating secure and growing UK SAF demand through a SAF mandate that will require at least 10% of jet fuel to be made from sustainable sources by 2030 and kickstarting a domestic	adopted	https://www sets-out-stra free-flying



ACT-SAF #4 SERIES

ICAO

Considerations when developing a SAF Roadmap

Collecting context specific data (feedstock, renewable energy sourcing, etc.)

feasibility studies to identify the capacity and propose specific roadmaps to develop local supply chains

Setting a vision for promoting SAF

States' decisions can influence market expectations, set targets, develop long-term strategies, establish national goals for SAF

Developing national SAF roadmaps

develop suitable regulations and incentives to support the scale-up of commercial production facilities and ensure economic viability and competitiveness

Managing risk

different strategies and policy to promote SAF, depending on the States' specific market background and feedstock availability – maximize environmental benefits

Flexible and inclusive policy

determine if the SAF roadmap should be sector-specific or be a part of a broader national energy strategy

Resources from ICAO

Sustainable Aviation Fuels (SAF) and ACT-SAF programme

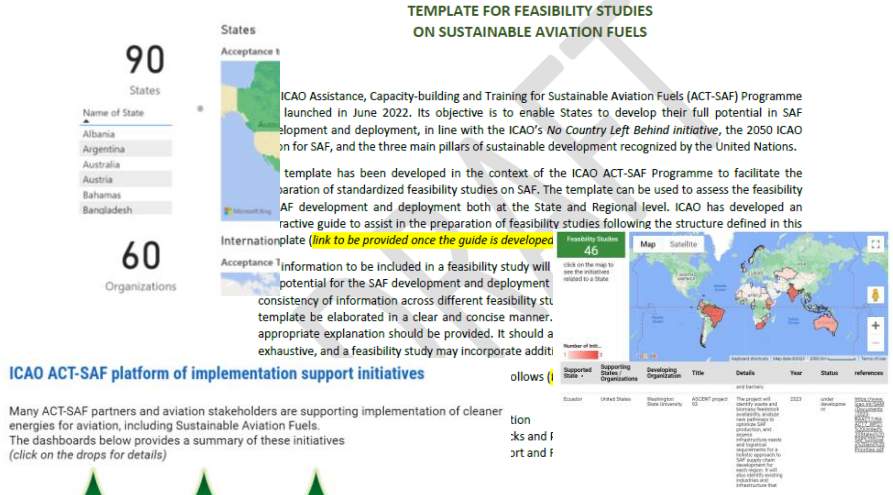
Technical analysis done at ICAO shows that SAF and other cleaner energy have the largest impact on residual CO2 emissions, driving overall reductions by 2050

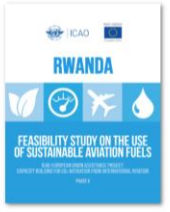
ACT-SAF is an ICAO initiative to facilitate the development and deployment of SAF

Tailored support for States

Facilitate cooperation under ICAO coordination

Dedicated platform to facilitate knowledge sharing and progress monitoring



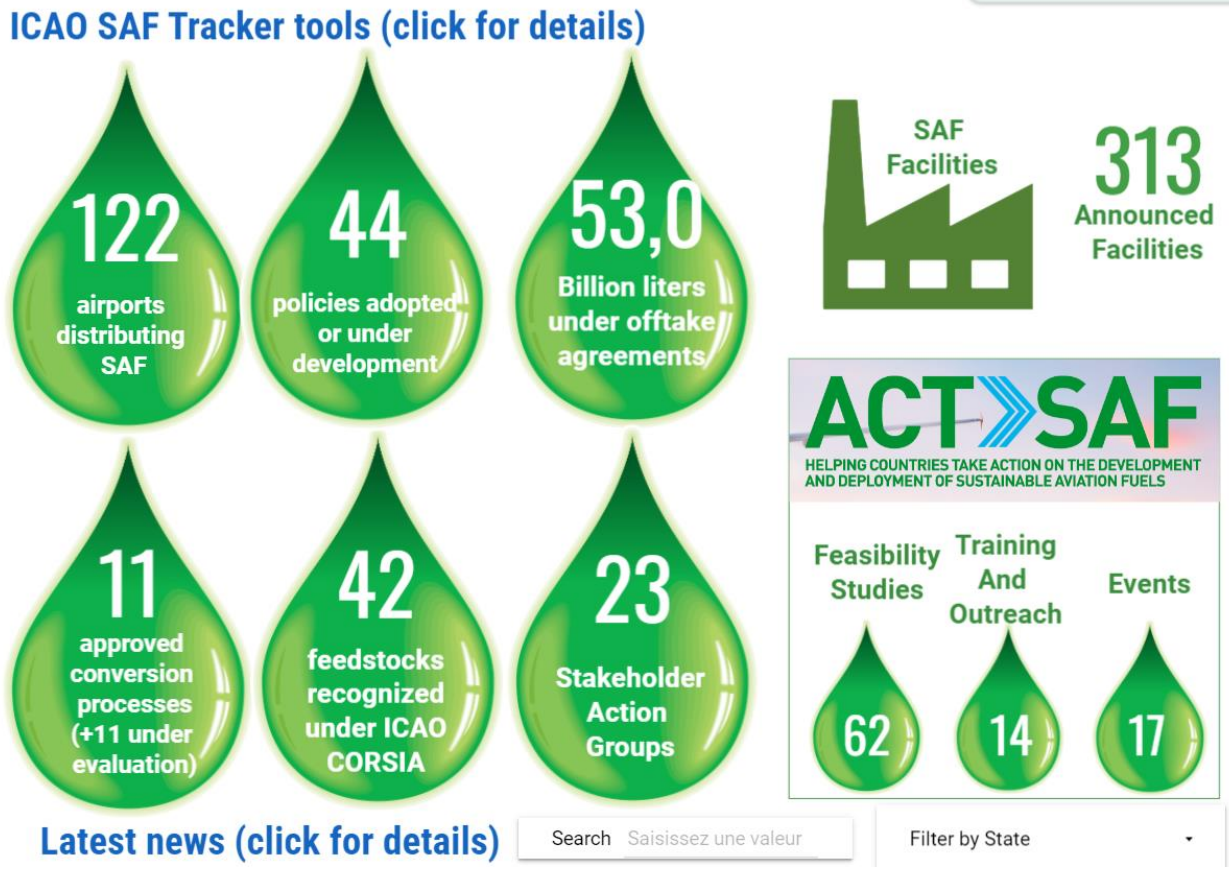


SAF tracker tools

SAF tracker tools are also available in the ICAO website

Provides updated information on

- SAF offtake agreements from airlines
- SAF production facilities
- Airports offering SAF
- Policies fostering SAF market development
- Latest news



For more details, please refer to ICAO SAF Tracking Tools

Additional Resources on the ICAO website

ICAO provides guidance material to support SAF development and deployment

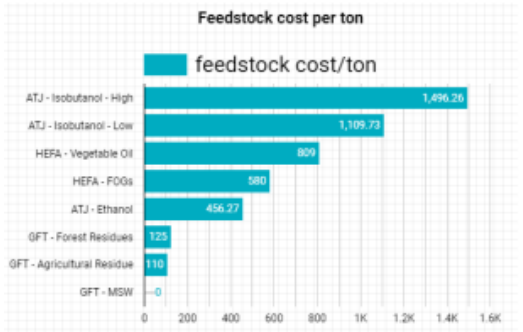
Guidance on potential policies and coordinated approaches for the development of SAF

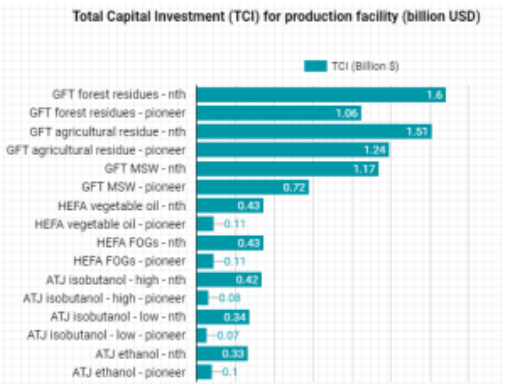
- Stimulate growth of SAF supply
- Create SAF demand
- Enable a SAF marketplace

For more details

SAF Rules of Thumb – what does it take to produce SAF?

- Estimation on SAF costs, investment needs and production potential
- Trade-offs between variables





Additional Resources

SAF feasibility studies under Phase I and II of the ICAO-EU Project – Capacity building for CO_2 mitigation from international aviation – available on the ICAO website

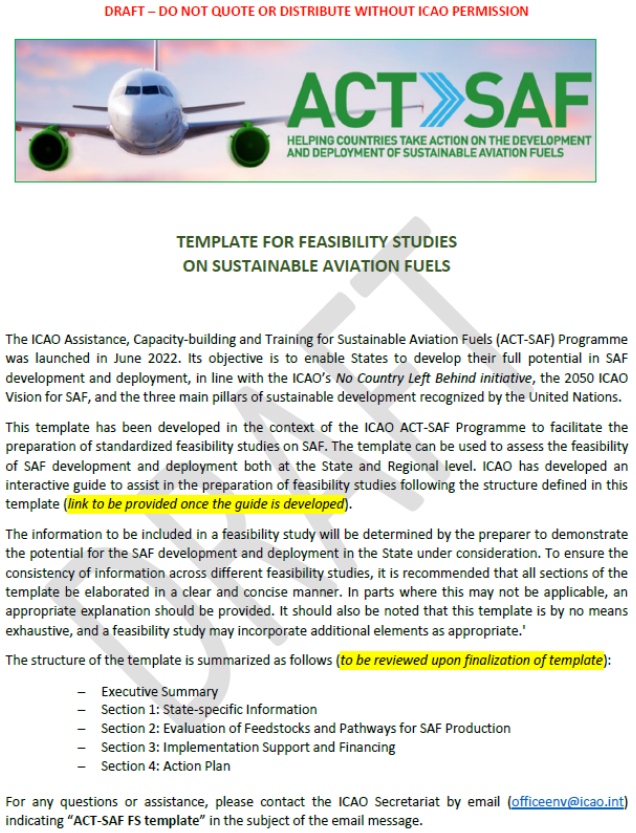
https://www.icao.int/environmental-protection/Pages/ICAO_EU.aspx

https://www.icao.int/environmental-protection/Pages/ICAO_EU_II.aspx

Feasibility Studies Template and Guide

Developed to facilitate the preparation of standardized feasibility studies

- Template highlights the structure of feasibility studies, which includes State-specific information, evaluation of potential feedstock and pathways, documentation on implementation support, and proposed action plan
- Supporting Guide complements the template through incorporating examples of outcomes from publicly available feasibility studies, to show in a practical manner the approaches in support of the development of a feasibility study



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ACT SAF

HELPING COUNTRIES TAKE ACTION ON THE DEVELOPMENT AND DEPLOYMENT OF SUSTAINABLE AVIATION FUELS

TEMPLATE FOR FEASIBILITY STUDIES ON SUSTAINABLE AVIATION FUELS

The ICAO Assistance, Capacity-building and Training for Sustainable Aviation Fuels (ACT-SAF) Programme was launched in June 2022. Its objective is to enable States to develop their full potential in SAF development and deployment, in line with the ICAO's *No Country Left Behind initiative*, the 2050 ICAO Vision for SAF, and the three main pillars of sustainable development recognized by the United Nations.

This template has been developed in the context of the ICAO ACT-SAF Programme to facilitate the preparation of standardized feasibility studies on SAF. The template can be used to assess the feasibility of SAF development and deployment both at the State and Regional level. ICAO has developed an interactive guide to assist in the preparation of feasibility studies following the structure defined in this template (*link to be provided once the guide is developed*).

The information to be included in a feasibility study will be determined by the preparer to demonstrate the potential for the SAF development and deployment in the State under consideration. To ensure the consistency of information across different feasibility studies, it is recommended that all sections of the template be elaborated in a clear and concise manner. In parts where this may not be applicable, an appropriate explanation should be provided. It should also be noted that this template is by no means exhaustive, and a feasibility study may incorporate additional elements as appropriate.'

The structure of the template is summarized as follows (*to be reviewed upon finalization of template*):

- Executive Summary
- Section 1: State-specific Information
- Section 2: Evaluation of Feedstocks and Pathways for SAF Production
- Section 3: Implementation Support and Financing
- Section 4: Action Plan

For any questions or assistance, please contact the ICAO Secretariat by email (officeenv@icao.int) indicating **"ACT-SAF FS template"** in the subject of the email message.

Coming soon a Business Implementation Template

Next steps

CAAF/3 - ICAO Global Framework, as a landmark decision to support global scale up of aviation cleaner energies

- A clear signal on the continued leadership of ICAO
- Provides clarity, consistency and predictability to all stakeholders on policies, regulations, implementation support and investments

CAAF/4 before 2028 CAAF/4 on the basis of market developments

States are invited to include SAF in their SAP, start working on developing a Roadmap for SAF development/deployment

States are invited to join ACT SAF

Thank You

ICAO 80