

Special Environment Report



ICAO

2023
1st Edition



On International Aviation Cleaner Energy Transition

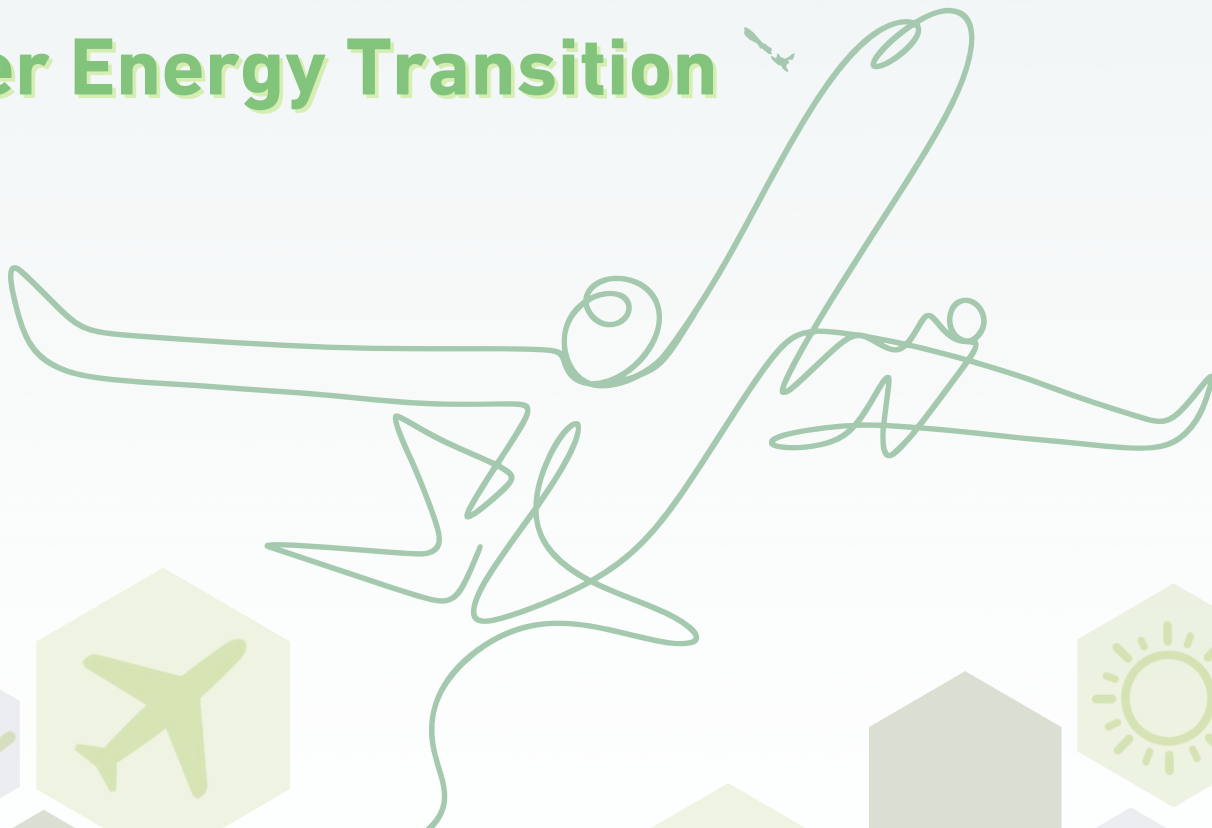


Table of Contents

Preface.....	02
1. Introduction.....	07
1.1 Report Overview.....	07
1.2 How to read this report?.....	09
2. Background and past achievements.....	10
2.1 ICAO 36th Assembly (2007).....	10
2.2 First ICAO Conference on Aviation and Alternative Fuels (CAAF/1) and other relevant events (2009).....	11
2.3 ICAO 37th Assembly (2010).....	13
2.4 ICAO 38th Assembly (2013).....	14
2.5 ICAO 39th Assembly (2016).....	14
2.6 Second ICAO Conference on Aviation and Alternative Fuels (CAAF/2) (2017).....	16
2.7 ICAO 40th and 41st Assemblies towards LTAG (2019-2022).....	16
3. Enroute towards the Third ICAO Conference on Aviation and Alternative Fuels (CAAF/3).....	23
3.1 ICAO Environmental Regional Seminars (April/May 2023).....	24
3.2 ICAO Council dialogues with the financing sector and energy providers (March/June 2023)....	25
3.3 ICAO LTAG Stocktaking on Aviation in Sector CO ₂ Emissions Reductions and Pre-CAAF/3 Policy and Finance Consultation (July 2023).....	27
3.4 Pre-CAAF/3 Outcomes Consultation (September 2023).....	34
4. Navigating CAAF/3.....	37
4.1 Policy and Planning.....	38
4.2 Regulatory framework.....	48
4.3 Implementation support.....	52
4.4 Financing.....	58
5. CAAF/3 Discussions and Outcomes.....	64
Appendix I - ICAO Global Framework for SAF, LCAF and other Aviation Cleaner Energies.....	69

Preface

Message from the President of the International Civil Aviation Organization (ICAO) Council

In the realm of international civil aviation, ICAO has demonstrated unwavering commitment to its strategic objective of environmental protection. As the industry propels toward recovery and sustainable growth, ICAO continues to lead with resilience and innovation.

One year ago, the ICAO Assembly agreed on a landmark decision on the long-term global aspirational goal (LTAG) of net-zero carbon emissions by 2050, and also requested the ICAO Council to continue to assess progress on the development and deployment of Sustainable Aviation Fuels - SAF, Lower Carbon Aviation Fuels - LCAF and other cleaner energy sources for aviation.

As a response to this request, the **Third ICAO Conference on Aviation and Alternative Fuels (CAAF/3)** was convened from 20 to 24 November in Dubai, United Arab Emirates (UAE).

The convening of CAAF/3 was agreed to take place in 2023 to review the ICAO Vision, in order to **define a global framework in line with ICAO's No Country Left Behind (NCLB) initiative** and taking into account national circumstances and capabilities.

With that spirit, this Special Environment Report focuses on detailing the progressive efforts ICAO have been taking to bring about **coordinated action on aviation cleaner fuels and energies**, which form the greatest contribution to our decarbonization efforts.



We can already see the concrete transformative progress of the sector in its transition to a cleaner energy future, and **the decision on the global framework during CAAF/3 lays the foundation that will facilitate this transition.**

Moreover, this publication has been crafted to support and facilitate concrete action to accelerate the development and deployment of the production, distribution and use of cleaner energy for aviation.

With this information, ICAO wishes to share with you **the international aviation sector's efforts to tackle climate change and collectively scale-up the use of SAF, LCAF and other aviation cleaner energies.**

Mr. Salvatore Sciacchitano

President of the ICAO Council

Preface

Message from the Secretary General of the International Civil Aviation Organization (ICAO)

Our generation is the first to become fully aware of the implications of human activity on climate change on the basis of information provided by the Intergovernmental Panel on Climate Change – IPCC – and in recent years, we have seen unprecedented events impacting aviation operations and infrastructure.

The challenges we are facing are huge and we need **a deep transformation of the sector to collectively address climate change**. This is a key moment in the history of aviation and the history of the environmental transition of our societies.

ICAO's work on environmental protection, one of the Strategic Objectives of the Organization, has progressed significantly, with the adoption and implementation of CORSIA, including the definition of a harmonized framework for sustainability assessment of fuels, the adoption of CO₂ standards for aircraft and the development of robust implementation and capacity building support for States.

The adoption by ICAO Member States of the long term global aspirational goal of achieving net-zero carbon emissions in international aviation by 2050, the LTAG, sent a strong message to the world on the commitment of the sector to the sustainability of its operations. **Now, action is required to make this goal a reality.**

The Third Conference on Aviation and Alternative Fuels (CAAF/3) highlighted to the world **the need for mutual support and collaboration to collectively enable a fair and equitable green transition for aviation.**



By delivering a robust global framework on SAF, LCAF and other cleaner energies, **CAAF/3 has sent a clear and positive signal to increase the confidence needed to scale-up the development and deployment of aviation cleaner energies**. This framework is a sound basis that now needs to be implemented.

I strongly believe that the CAAF/3 outcomes will inspire the world to engage with ICAO in this challenge, and drive investment towards the cleaner energy transition of our sector.

As the UN specialized agency for international civil aviation, ICAO will continue to work together in close cooperation with all its 193 Member States, along with stakeholders involved with aviation, energy, finance, and civil society, to **make the aviation cleaner energy transition a reality.**

Juan Carlos Salazar
Secretary General, ICAO

Preface

Message from the Director of the Air Transport Bureau of the International Civil Aviation Organization (ICAO)

ICAO's Air Transport Bureau (ATB) supports the implementation of the Strategic Objectives of ICAO, and in particular, security and facilitation, the economic development of air transport, and environmental protection.

ICAO's goal to minimize the adverse environmental effects of global civil aviation activities and related policies, standards and guidance, foster its leadership in aviation environmental activities, in cooperation other United Nations (UN) environmental policies and practices.

Last year's ICAO Assembly decision on a long term global aspirational goal (LTAG) of net-zero carbon emissions by 2050 was underpinned by ICAO's technical work, through the landmark LTAG Report published in March 2022, which sets out the timing, readiness, attainability, and costs of aviation in-sector CO₂ emissions reductions.

According to the clear statements from the LTAG Report, **Sustainable Aviation Fuels (SAF), Lower Carbon Aviation Fuels (LCAF) and other cleaner energies will be needed in much greater quantities, and scaling up their development and deployment around the world is a must.**

For that, immediate acceleration of our collective efforts is needed from all stakeholders, and States have a major role to play. This is why the last Assembly requested ICAO to convene the CAAF/3 meeting in 2023 to review the ICAO Vision, in order to define a global framework in line with the No Country Left Behind initiative.



For over a year, ICAO, its Member States and International Organizations have been engaged in an exceptional effort to lay the groundwork for this seminal conference. This Special Environment Report aggregates not only the historical context and milestones on this journey, but also the CAAF/3 outcomes, structured around four themes: **policy and planning, regulatory framework, implementation support, and financing.**

Following this very successful Conference, I hope all stakeholders will benefit from this report, which reflects our foresight and collective ambition towards the decarbonization of aviation.

Mohammed Khalifa Rahma

Director, Air Transport Bureau, ICAO

Preface

Message from the Deputy Director Air Transport Bureau responsible for the Environment Programme at the International Civil Aviation Organization (ICAO)

The Aviation Clean Energy Transition is on!

Just a year ago, after the adoption of the long-term global aspirational goal for international aviation (LTAG) of net-zero carbon emissions by 2050, and recognizing that cleaner energies are expected to have the largest contribution to aviation CO₂ emissions reductions, we have geared the focus of the ICAO environment programme towards the development of a global framework under ICAO to facilitate the global development, deployment and use of cleaner energy sources by aviation.

Much progress was achieved by ICAO and its 193 Member States during 2023, through a comprehensive preparatory process that culminated in the landmark decision at the **Third ICAO Conference on Aviation and Alternative Fuels (CAAF/3)**, with the adoption of the **ICAO Global Framework for Sustainable Aviation Fuels (SAF), Lower Carbon Aviation Fuels (LCAF) and other Aviation Cleaner Energies** towards the sector's cleaner energy transition.

Through the Framework, ICAO and its Member States strive to achieve a **collective global aspirational Vision to reduce international aviation CO₂ emissions by 5 per cent by 2030**, through the use of SAF, LCAF and other aviation cleaner energies, compared to zero cleaner energy use.



The adoption of this robust Framework sends a clear signal to the international community regarding the continued leadership role and determination of ICAO and its Member States in addressing emissions from international aviation. It also provides **clarity, consistency and predictability to governments, public and private investors, industry and fuel producers, on policies, regulations, implementation needs, and investments required** to support and unlock the full potential of the aviation sector's energy transition globally.

The Vision and the Framework implementation will be monitored and periodically reviewed, aspiring to have cleaner energy production facilities in all regions, before the **convening of next CAAF/4 no later than 2028, with a view to updating the ambition on the basis of market developments.**

An enormous amount of technical work has underpinned and led to the positive outcomes of CAAF/3. The 2022 ICAO LTAG supported the 2050 net-zero decision whilst providing three scenarios of the potential CO₂ reduction benefits from clean energy. In addition, an update to the short-term projections for SAF production were undertaken by January 2023 assessing the maturity level of several new initiatives on aviation clean energy.

In fact by CAAF/3, 98 new, additional SAF and aviation cleaner energy announcements were compiled in the ICAO tracking tools, demonstrating that the transition is already taking place. Although it is not expected that all these announcements will be realized, as they depend on many factors, it is clear that this Framework will strongly support their realization.

The historical decision by CAAF/3 marked the beginning of a new era for the aviation sector where consideration of its impacts on climate change will take the forefront in shaping the future of air transport.

Hope you enjoy the reading.

Jane Hupe

Deputy Director, Environment, ICAO

1. Introduction

1.1 Report overview

As part of ICAO's work to promote the aviation energy transition towards the achievement of the LTAG, Assembly Resolution A41-21, paragraph 28 f) requested the Council to “continue to assess progress on the development and deployment of sustainable aviation fuels (SAF), lower carbon aviation fuels (LCAF) and other cleaner energy sources for aviation as part of the ICAO stocktaking process”, and “**convene the CAAF/3 in 2023 for reviewing the 2050 ICAO Vision for SAF, including LCAF and other cleaner energy sources for aviation, in order to define a global framework**” in line with the No Country Left Behind (NCLB) initiative while taking into account national circumstances and capabilities.

In responding to the Assembly request, the **Third Conference on Aviation and Alternative Fuels (CAAF/3) was held from 20 to 24 November 2023 in Dubai, United Arab Emirates (UAE)**. It was a major intergovernmental meeting on the aviation energy transition, and the first ICAO Conference aiming at implementing the LTAG.

ICAO and its Member States delivered very forward-looking outcomes that **demonstrate to the world how international civil aviation is working to decarbonize and shift to SAF, LCAF, and other cleaner energies**.

The successful adoption of an ambitious and comprehensive global framework at CAAF/3 sends **a strong signal for all stakeholders to work with ICAO and its Member States in this energy transition**. It also sends a strong message to the financial sector and fuel producers on the need to support the aviation clean energy transition and further emphasizes the continued leadership role of ICAO in addressing emissions from international aviation.

Paving the road to CAAF/3, ICAO organized a **series of preparatory events** focusing on the topics to be discussed on the possible outcomes by CAAF/3. Throughout this “en route to CAAF/3”, ICAO has been providing useful material and information to facilitate the discussions that will lead to a global framework on aviation cleaner energy.

The main objective of this special report is to **provide all stakeholders with information about SAF, LCAF and cleaner energies, facilitate the understanding of the process leading to CAAF/3, as well as to present CAAF/3 outcomes such as the Global Framework for SAF, LCAF and other Aviation Cleaner Energies**.

This report also draws particular attention to ICAO's continuous work in this field, **underscoring the significant milestones reached thus far**. It aims to provide an opportunity for a broader audience to gain a **comprehensive understanding of the efforts by ICAO and its Member States in achieving the decarbonization of aviation**.

ICAO events towards CAAF/3 in 2023

April/May 2023

ICAO Environmental Regional Seminars

March/June 2023

Council dialogues with the financing sector and energy providers

11 to 13 July 2023

ICAO LTAG Stocktaking on Aviation in Sector CO₂ Emissions Reductions and Pre-CAAF/3 Policy and Finance Consultation

25 to 26 September

ICAO pre-CAAF/3 Outcomes Consultation

20 to 24 November

Third ICAO Conference on Aviation and Alternative Fuels (CAAF/3)

More specifically, this special report is designed to achieve the following objectives:

- Provide a historical context of both ICAO's fuel-related milestones, and the Conference on Aviation and Alternative Fuels (CAAF);
- Provide an overview of the process towards the CAAF/3;
- Enhance awareness about the urgency and importance of transitioning to cleaner energy solutions in the aviation sector;
- Highlight the main challenges that need to be addressed to develop and deploy SAF, LCAF and other cleaner energies;
- Underscore the significance of global engagement and collaboration among States, industry and all other stakeholders;
- Present the main discussions and outcomes of the CAAF/3 Conference, including advancements in cleaner energy technology, supporting policies, assistance and capacity building, and financing cleaner energy initiatives.



THIRD ICAO CONFERENCE ON AVIATION AND ALTERNATIVE FUELS

20 - 24 NOVEMBER 2023 | DUBAI



1.2 How to read this report?

The Figure 1 illustrates what is provided in different chapters of this report and how they are inter-related, allowing readers to effectively navigate the report.



Indicates a weblink in the reading line



Indicates a section of attention

Chapters 1 and 2 - Introduction and Background:

Provides a broader overview of ICAO's efforts in promoting a cleaner energy transition for aviation, and illustrating its journey and achievements to date.



Chapter 3 - Enroute towards CAAF/3

Provides a comprehensive insight on the recent preparatory ICAO events and dialogues leading up to CAAF/3.



Chapter 4 - Navigating CAAF/3

Provides information on the ICAO discussions on each building block that supported the CAAF/3 outcomes.



Chapter 5 - CAAF/3 Discussions and Outcomes

Provides information on CAAF/3 discussions and outcomes, including the Global Framework for SAF, LCAF and other Aviation Cleaner Energies.

Readers can connect these three chapters to gain a comprehensive overview of ICAO efforts on fostering SAF, LCAF and other aviation cleaner energies. Moreover, these chapters allow readers to:

- Understand the historical context and insight on past ICAO initiatives and milestones;
- Understand the preparatory events and main discussions leading up to CAAF/3; and
- Take note of key themes, objectives and the progression of ideas presented.

The background information and pathway toward CAAF/3, as presented in the first three chapters, allows readers to better understand the content of Chapters 4 and 5, including the context of CAAF/3 outcomes.

The information in one chapter complements and builds upon the information in the other chapter, creating a seamless flow of ideas and information throughout the report.

Delving into the building blocks that underpinned the CAAF/3 discussions and outcomes is essential for a comprehensive understanding of the Vision and Global Framework adopted. This insight is crucial for charting the course to a global scale-up in development and deployment of SAF, LCAF and other aviation cleaner energies in order to achieve the LTAG. Therefore, the information provided in Chapter 4 is specifically designed to enhance the reader's comprehension of Chapter 5.

FIGURE 1: Conceptual scheme on how to read and connect the chapters on this Special Environment Report


2. Background and past achievements

To gain a comprehensive perspective on the achievements of CAAF/3, it is essential to trace the historical trajectory that has led us to the current emphasis on SAF, LCAF and other cleaner energy sources. This journey (Figure 1) involves ICAO's continuous and evolving efforts in shaping the sustainable future of international aviation.

In the mid and late 1990s, there was a concern regarding fuel availability given the limitations on the projections of conventional jet fuel supply and on related operational costs (fuel represents a substantial proportion of the operational cost of flights). At the same time, the adverse environmental effects of pollutants resulting from combusting fossil jet fuels (e.g., oxides of nitrogen (NO_x), carbon monoxide (CO), and unburned hydrocarbons (UHC)) were a concern and measures for their reduction were under consideration by the sector. In addition, initial alternatives to conventional jet fuels were being looked at, in the search for an “ideal” solution at the time.

In the early 2000s, a range of biomass feedstocks started to become the focus of research to produce biofuels for aviation, together with new techniques to lower the carbon portion of the fuel on a life cycle basis. While acknowledging the potential for significant emissions reductions and the positive outlook on biomass availability in certain scenarios, the discussions also highlighted several key considerations such as:

- Addressing Land Requirements: Ensuring an environmentally sustainable fuel supply in ample quantities may require strategic land use planning, which presents an opportunity for sustainable land management;
- Balancing Priorities: The importance to strike a balance between biofuels production and other critical aspects, such as food production, aimed to ensure the uphold of food security and environmental goals simultaneously, fostering a win-win approach.



Considering these emerging discussions on the environmental benefits of aviation fuels, **ICAO started to promote wider discussions on the topic**, in parallel with the work on minimizing aircraft emissions through the reduction of the fuel used on each flight, reflecting operational improvements.

2.1 ICAO 36th Assembly (2007)

The 36th Session of the ICAO Assembly in October 2007 (A36) was the first Assembly to explicitly **recognize the importance of research and development in fuel efficiency and alternative fuels for aviation** that would “enable international air transport operations with a lower environmental impact”. In addition, the Assembly encouraged the ICAO Council to **promote “improved understanding of the potential use, and the related emissions impacts, of alternative aviation fuels”**.

The Assembly (A36) adopted Resolution A36-22 *Consolidated statement of continuing ICAO policies and practices related to environmental protection*, which provided for the establishment of a new high-level Group on International Aviation and Climate Change (GIACC) (Appendix K of Resolution A36-22).

The GIACC (2008) was composed of senior government officials representing all ICAO regions, and with technical support provided by the **Committee on Aviation Environmental Protection (CAEP)**.

The purpose of GIACC was to develop and recommend to the Council a **Programme of Action on International Aviation and Climate Change**, based on consensus, and to identify possible **global aspirational goals in the form of fuel efficiency** for international aviation and possible options for their implementation.

GIACC identified a basket of measures for addressing greenhouse gas emissions from international aviation, **which included alternative aviation fuels** together with technology, operations and market-based measures.

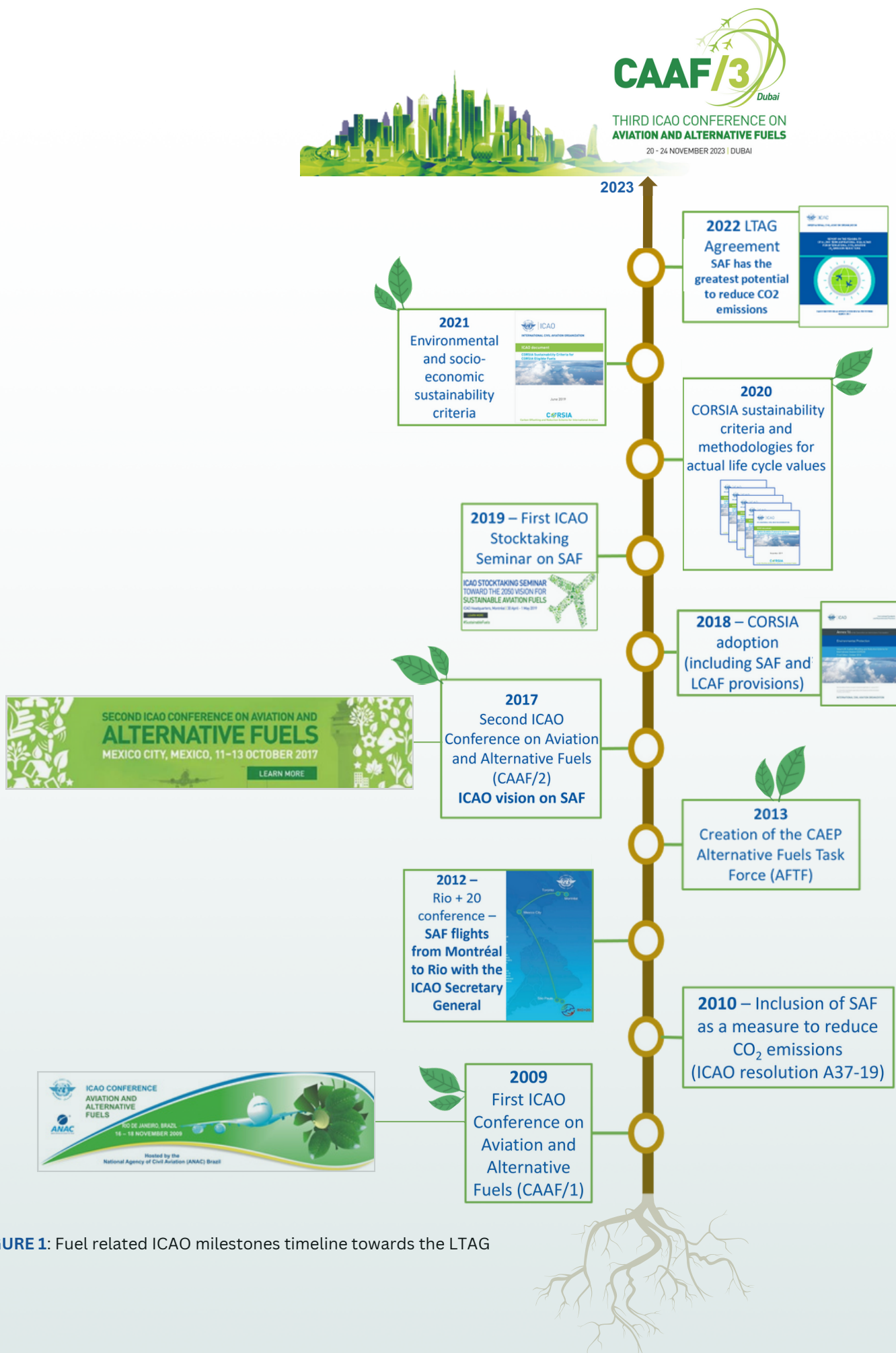


FIGURE 1: Fuel related ICAO milestones timeline towards the LTAG

2.2 First ICAO Conference on Aviation and Alternative Fuels (CAAF/1) and other relevant events (2009)

Following initial discussions from previous years on sustainable aviation fuels (back then referred to as “alternative fuels”), ICAO organized a series of events in 2009 that set the scene for the **first Conference on Aviation and Alternative Fuels (CAAF/1)**.



In February 2009, the **ICAO Workshop on Aviation and Alternative Fuels** gathered experts to discuss potential options for alternative fuels, the challenges to develop and deploy alternative fuels and the initiatives to promote cooperation. It was noted in the workshop that alternative aviation fuels could be a win-win solution for reducing aviation’s dependence on fossil fuels and a key element to help reduce the impact of aviation on climate change, paving the way for further discussions at the CAAF/1 later in that year.



The **ICAO High-level Meeting in October 2009** acknowledged that alternative fuels could become a key element toward reducing the impact of international aviation on climate change. The meeting encouraged wider discussions on the development of alternative fuel technologies and the promotion of the use of sustainable alternative fuels, including biofuels, in aviation, in accordance with national circumstances.



After this round of preparatory events and discussions, **CAAF/1 was convened by ICAO in Rio de Janeiro, Brazil, from 16 to 18 November 2009**, and addressed the key issues of sustainability, feasibility, economics, production, and infrastructure, and endorsed the use of sustainable alternative fuels for aviation.



Drop-in fuels: The drop-in nature of current SAFs means that they fulfill the same technical and safety requirements as fossil-based jet fuels and are compatible with existing infrastructure and aircraft.

One important achievement of the conference was the dissemination of the concept of **drop-in fuels, as an important means of reducing aviation greenhouse gas emissions without requesting the change of the aircraft or infrastructure**, which in turn made sustainable aviation fuels a very practical and attractive option for the decarbonization of the sector.

CAAF/1 also noted that the introduction of SAF could help address not only environmental issues, but also those of economics and supply security.



CAAF/1 also agreed on the establishment of an ICAO **Global Framework for Aviation Alternative Fuels (GFAAF)**, as a web-based living platform to facilitate the promotion and harmonization of initiatives that encourage and support the development of sustainable alternative fuels for aviation by showcasing existing activities and initiatives.

Covering a variety of information related to aviation fuels, the GFAAF database encompassed news announcements, details of past and ongoing projects, and facts and figures. Figure 2 shows an example of initiatives captured by GFAAF from its initial stages.

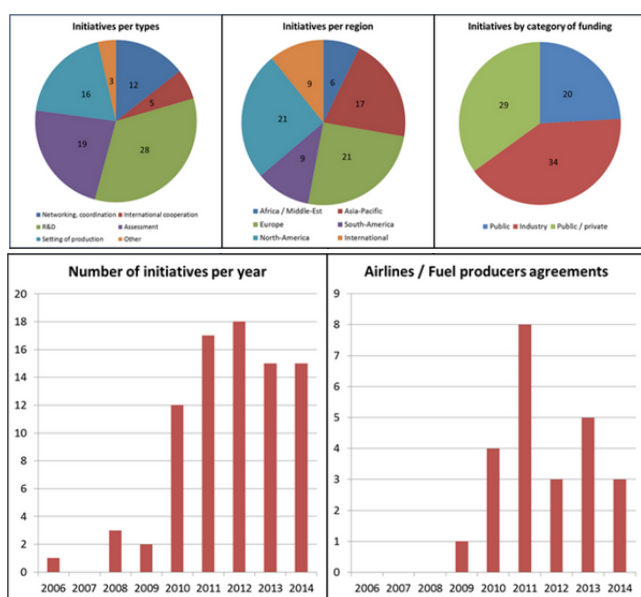


FIGURE 2: Synthesis of GFAAF database from its initial stages in 2014

Since 2009, the ICAO GFAAF has been tracking the progress provided by States and international organizations on SAF, LCAF and other cleaner energies, including the increasing number of feedstocks and fuel conversion processes, airports distributing such fuels, and associated policies adopted or under development.

The evolution of GFAAF continued and evolved into the ICAO SAF tracking tools, which are detailed in Chapter 4 of this report.



Global Framework for Aviation Alternative Fuels

2.3 ICAO 37th Assembly (2010)

Following the recommendations from previous discussions, in particular the outcomes of the GIACC process and HLM-ENV/09 in 2009, the 37th Session of the ICAO Assembly in October 2010 (A37) agreed on key elements of the ICAO environmental action on climate change, such as:

- **global aspirational goals for the international aviation sector of 2 per cent annual fuel efficiency improvements, and carbon neutral growth from 2020** (to ensure that while the international aviation sector continues to grow, its global CO₂ emissions would be stabilized at 2020 levels);
- further work to **explore the feasibility of a long-term global aspirational goal for international aviation**;
- development of a framework for market-based measures, including further elaboration of the guiding principles adopted by the Assembly, and **exploration of a global scheme for international aviation**; and
- **States' Action Plans**, covering information on CO₂ emissions reduction activities, on a voluntary basis, and assistance needs.

In addition to the agreement on the medium-term global aspirational goal of carbon neutral growth from 2020 (CNG 2020), **it was the first time that the ICAO Assembly requested to explore the feasibility of a long-term global aspirational goal for international aviation (LTAG).**

During the ICAO 37th Assembly (2010), the CNG 2020 aspirational goal decision marked the dawn of the ICAO Member States and other stakeholders' consideration of a long-term CO₂ emissions reductions goal for international aviation, which was adopted in October 2022 by the 41st Session of the ICAO Assembly.

Regarding sustainable aviation fuels, the 37th Assembly requested States to develop policy actions to accelerate its “appropriate development, deployment and use” and to consider measures to support its “research and development, investments in new feedstock cultivations and production facilities, as well as incentives to stimulate commercialization and use of sustainable alternative fuels for aviation to accelerate the reduction of aviation CO₂ emissions”.

These recommendations to States reflected all discussions from the previous years, including at CAAF/1 on the need to **better understand the potential and feasibility of new feedstocks and production pathways**.

Moreover, the Assembly requested the Council to “encourage Member States and invite industry to actively participate in further work on sustainable alternative fuels for aviation” and to “work with financial institutions to facilitate access to financing infrastructure development projects dedicated to sustainable aviation alternative fuels and incentives to overcome initial market hurdles”.

2.4 ICAO 38th Assembly (2013)

Noting the CAAF/1 and A37 outcomes and the progress made in proving the technological feasibility of drop-in sustainable alternative fuels for aviation, the 38th ICAO Assembly acknowledged **the need for such fuels to be developed and deployed in an economically feasible, socially and environmentally acceptable manner**, while also acknowledging **the need for increased harmonization of the approaches to sustainability**.

This was a clear reflection of the rising awareness on the need for clear **sustainability criteria to be applied for the entire supply chain of sustainable aviation fuels**.

The Assembly (A38) emphasized the sustainability aspect of alternative fuels by requesting States to “recognize existing approaches to assess the sustainability of all alternative fuels in general, including those for use in aviation which should:

- achieve net GHG emissions reduction on a life cycle basis;
- respect the areas of high importance for biodiversity, conservation and benefits for people from ecosystems, in accordance with international and national regulations; and
- contribute to local social and economic development, and competition with food and water should be avoided”.

The Assembly also requested States to adopt measures to **ensure the sustainability of alternative fuels for aviation**, building on existing approaches or combination of approaches, and monitor, at a national level, the sustainability of the production of alternative fuels for aviation; and **work together through ICAO and other relevant international bodies, to exchange information and best practices**, including on the sustainability of alternative fuels for aviation.

These pillars were a clear indication by ICAO on the need to **develop the new SAF industry in a responsible manner**, with due consideration of various sustainability aspects.

Regarding market-based measures (MBMs), **the Assembly decided to develop a global market-based measure (GMBM) for international aviation**.

2.5 ICAO 39th Assembly (2016)

During the period leading to the 39th Session of the ICAO Assembly (A39), ICAO promoted a series of events to discuss several topics concerning the environmental impacts of aviation.

For example, in 2014 and 2015, ICAO promoted a series of back-to-back seminars, with a view to supporting its Member States in their efforts to take action on aviation and climate change.

Regarding SAF, these seminars established that major challenges were “to reduce production cost, to drive investment in feedstock production and conversion facilities, to ensure sustainable deployment and the required policy support from States”.

It is important to note that the ICAO Assembly (A39) was innovative by **including the term “clean and renewable energy sources for aviation” for the first time, indicating a wider scope of fuel solutions beyond sustainable aviation fuels.**



A39 requested States to “set a coordinated approach in national administrations for policy actions and investment to **accelerate the appropriate development, deployment and use of clean and renewable energy sources for aviation, including the use of sustainable alternative fuels,** in accordance with their national circumstances” (Assembly Resolution A39-2).

The same Assembly Resolution also **brought forward for the first time the concept of cleaner energy transition**, by requesting the Council to “encourage Member States and invite industry, financial institutions and other international organizations to actively participate in exchange of information and best practices, and **facilitate the establishment of partnerships and the definition of policies that will further promote the transition to clean, renewable sources of energy for aviation, including sustainable alternative fuels,** through regional seminars”.

The Assembly also recognized for the first time that “the **technological feasibility of drop-in sustainable alternative fuels for aviation is proven**” and noted again that “the introduction of **appropriate policies and incentives to create a long-term market perspective is required**”.



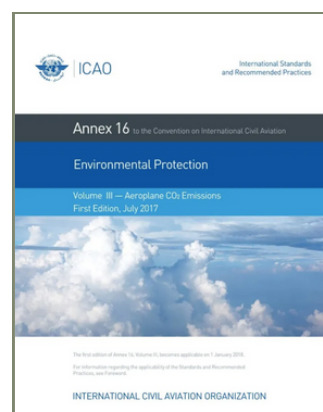
A39 also represented a landmark for aviation and climate change not only for the advancements in sustainable aviation fuels and the cleaner energy transition but mainly due to the **adoption of a global market-based measure scheme for international aviation, in the form of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)**, to address the increase in total CO₂ emissions from international aviation above the baseline levels (Assembly Resolution A39-3), to complement other elements of the basket of measures for the achievement of 2020 carbon neutral growth.

Through its Resolution A39-3: *Consolidated statement of continuing ICAO policies and practices related to environmental protection – Global Market-based Measure (MBM) scheme* the ICAO Assembly decided to “implement a GMBM scheme **in the form of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)** to address any annual increase in total CO₂ emissions from international civil aviation (i.e. civil aviation flights that depart in one country and arrive in a different country) above the 2020 levels, taking into account special circumstances and respective capabilities”.




CORSIA is the first global market-based measure for any sector and represents a cooperative approach that moves away from a “patchwork” of national or regional regulatory initiatives, through the implementation of a global approach that has been developed through global consensus among governments, industry, and international organizations.

In addition, A39 (through Resolution A39-1, Appendix B) welcomed the “recommendation by CAEP on a new global CO₂ emissions certification Standard for aeroplanes” which further led to the adoption of new Annex 16, Volume III – *Aeroplane CO₂ Emissions* in the following year (2017).



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



Build upon the previous CAAF/1 (2009) and latest discussion on the topic at the time, the **second ICAO Conference on Aviation and Alternative Fuels in October 2017 (CAAF/2)** was convened in Mexico City, from 11 to 13 October 2017. The conference adopted recommendations and approved a **Declaration, including the 2050 ICAO Vision for Sustainable Aviation Fuels**, as a living inspirational path for a significant proportion of conventional aviation fuels (CAF) to be substituted with sustainable aviation fuels by 2050.

The Declaration requested that ICAO and its Member States, in cooperation with the aviation industry and other stakeholders, to “**work together to pursue any opportunities to implement necessary policies, technology and financing measures, with an increasing proportion of SAF into the fuel supply over time towards the 2050 ICAO Vision, without any attribution of specific obligations to individual States**”.

The CAAF/2 informed that ICAO will act primarily as a “facilitator to support States on their efforts to develop and deploy SAF, by sharing information and best practices, communicating the economic and environmental value of SAF, facilitating discussions between financial institutions and industry, and developing guidance material”. It also declared that ICAO will “**facilitate capacity building and assistance for States to develop and deploy SAF that are well suited to their national circumstances and resources**”.

2.7 ICAO 40th and 41st Assemblies towards LTAG (2019-2022)

Following the request by the 40th Session of the ICAO Assembly and subsequently by the ICAO Council in 2019, since early 2020, the **ICAO Committee on Aviation Environmental Protection (CAEP) undertook technical work on the feasibility study on LTAG**, focused on the attainability and readiness of aviation in-sector CO₂ reduction measures, including innovative aircraft technologies, operations and fuels, in order to assess the in-sector CO₂ reduction potentials.

During this period, the aviation industry saw a growing number of commitments to working towards net-zero carbon emissions by 2050, most of them captured by ICAO’s Aviation net-zero initiatives and commitments Tracker tool.

After more than two years of technical work and committed efforts of over 280 experts in CAEP, the **CAEP/12 meeting in February 2022 unanimously approved its technical report on the feasibility of LTAG**, highlighting the potential for substantial CO₂ reductions from innovative aircraft technologies, operations and fuels, with the assessment of required costs and investments and including scenarios with options and roadmaps for their realization. The LTAG Report was approved by the ICAO Council for publication in March 2022.

More information on the technical feasibility of various aviation CO₂ emissions reductions scenarios is provided on the **LTAG report, available on the ICAO website**.

During CAAF/2, a quantification approach to SAF was proposed, without agreement, and the conference requested such **quantification of the 2050 ICAO Vision at CAAF/3** (refer to paragraph 3 of the CAAF/2 Declaration):

“The Conference notes that this path is based on the assumptions of a progressive increased use of SAF, and should be periodically reviewed through a stocktaking process to continuously assess progress on the SAF development and deployment, including the necessity to consider policies and actions, and the organization of regular workshops and seminars, leading up to the **convening of CAAF/3 no later than 2025, with a view to updating the 2050 ICAO Vision to include a quantified proportion of CAF to be substituted with SAF by 2050**, and carbon reductions achieved by SAF”.



FIGURE 3: ICAO milestones timeline towards the LTAG in the 2020-2022 triennium

Establishing LTAG required not only the information on the goals technical feasibility but also additional considerations of a practical, economic, social and political nature. The Council of ICAO therefore established **a robust LTAG process and timeline in preparation for the 41st Session of the ICAO Assembly**, in September 2022, to ensure that all considerations and possible recommendations would be ready on time.

In line with this process and in parallel with the LTAG report development, ICAO undertook a consultative process on LTAG among States and stakeholders. ICAO organized the **LTAG Global Aviation Dialogues (GLADs)** as a series of five regional events both in May 2021 and March/April 2022, with the aim of sharing information and raising awareness on the LTAG process and technical analyses in the LTAG report, as well as allowing for the exchange of views and expectations to facilitate further LTAG work and decision-making.

In July 2022, ICAO convened the **High-Level Meeting on the feasibility of a Long-Term Aspirational Goal** for international aviation CO₂ emissions reductions (HLM-LTAG).

The meeting encouraged ICAO and its Member States to **work together to strive to achieve a collective long-term global aspirational goal for international aviation (LTAG) of net-zero carbon emissions by 2050**, and the maximum possible level of progress on the implementation of aviation in-sector CO₂ emissions reduction measures (e.g., technology, operations and fuels), **recognizing that the largest potential impact on aviation CO₂ emissions reduction will come from fuel-related measures**.

The full report of the High-Level Meeting on the Feasibility of a Long-Term Aspirational Goal for International Aviation CO₂ Emissions Reductions (HLM-LTAG) is available in the ICAO [website](https://www.icao.int/environmental-protection/Documents/Assembly/Resolution_A41-21_Climate_change.pdf).

Figure 3 shows the timeline towards the LTAG in the 2020-2022 triennium.



The 41st Session of the ICAO Assembly in October 2022 (A41) through its Resolution A41-21: *Consolidated statement of continuing ICAO policies and practices related to environmental protection – Climate change* agreed on the outcomes of the HLM-LTAG and subsequent recommendations of the Council, and resolved that, in addition to the medium-term global aspirational goal:

“ICAO and its Member States are encouraged to work together to strive to achieve a **collective long-term global aspirational goal for international aviation (LTAG) of net-zero carbon emissions by 2050**, in support of the Paris Agreement’s temperature goal, recognizing that each State’s special circumstances and respective capabilities (e.g. the level of development, maturity of aviation markets, sustainable growth of its international aviation, just transition, and national priorities of air transport development) will inform the ability of each State to contribute to the LTAG within its own national timeframe” (A41-21, paragraph 7 refers).

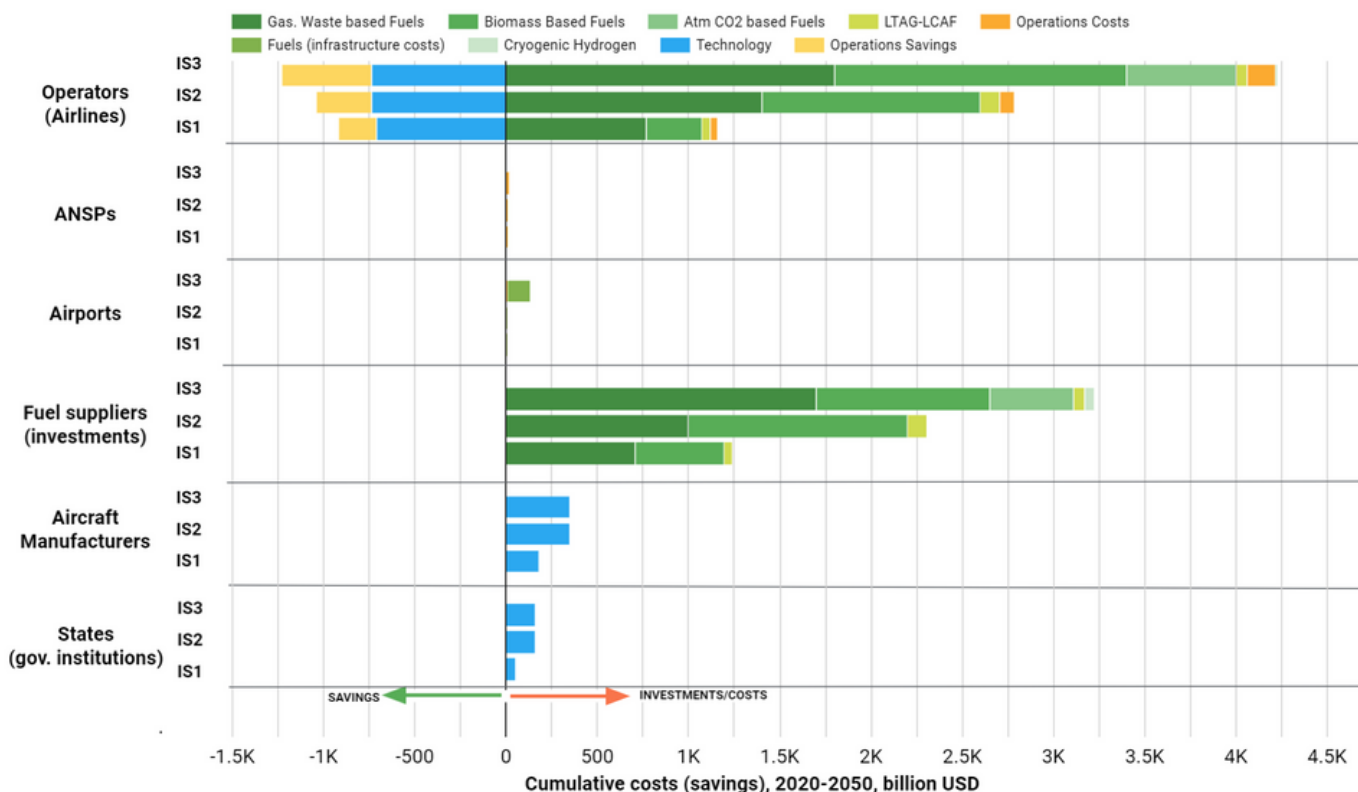
In addition, the Assembly also welcomed the **progress made on CORSIA implementation**, reaffirmed its continuous commitment to implement CORSIA and emphasized its strong support for a global solution for the international aviation industry, as opposed to a patchwork of State or regional market-based measures. Furthermore, the ICAO Assembly re-emphasized the importance of the work on climate adaptation relating to international aviation, and the need for up-to-date information through the ICAO State Action Plans initiative to reduce aviation CO₂ emissions.

The **LTAG** constitutes a **historic agreement for ICAO as it provides a clear signal to policy makers and investors** around the world that the aviation sector is engaging on a trajectory towards net-zero carbon emissions in 2050. **To achieve the LTAG, a remarkable level of collaboration across the entire aviation sector is needed**, all aligned with a common objective. This unity is crucial in addressing the multifaceted challenges inherent to the LTAG implementation, including policy formulation and financing solutions.



In the context of achieving the LTAG, one of the main challenges is **financing**.

Figure 4 provides details on the **costs and investments associated with the LTAG integrated scenarios**, as described in the LTAG report. It is possible to note the **high investment needs on SAF, LCAF and other cleaner energies sources** (e.g., cryogenic hydrogen). An interactive version of the chart in Figure 4 is available at the [ICAO website](#).



Disclaimers: cost data from the LTAG Report, Figure 3, uncertainty bars not shown. Costs associated with scenario are not meant to be added towards a total cumulative cost for 2020-2050. Costs and investments are displayed across a chain of stakeholders. Some investments from upstream stakeholders are passed on downstream in the form of incremental price of products (e.g. investments from fuel suppliers passed on to operators as part of Minimum Selling Price)

FIGURE 4: ICAO LTAG Report - Cost and Investments Associated with Integrated Scenarios

According to the LTAG report, **fuels suppliers** will need to invest up to \$ 3.2 trillions in aviation clean energies though to 2050 on a cumulative basis. The scale of this task represents both **challenges and opportunities** for ICAO Member States and other stakeholders including the financing community.



LTAG and Fuels

The LTAG analysis includes extensive information on the possible contribution of fuels towards the decarbonization of international aviation. Such information is contained in various documents, such as the LTAG report and its various appendixes, and the [ICAO Environmental Report 2022](#).



The ICAO website provides a summary of [fuels-related information from the LTAG analysis](#) that describes the main fuel-related information contained in these analyses, directing to additional references that provide further details, divided into 8 topics:

1. LTAG Fuels classification;
2. LTAG Fuel scenarios;
3. Prioritization methodology;
4. Results - Volume Projections;
5. Results - GHG emissions savings;
6. Analysis of Fuel readiness and attainability;
7. Costs and investments associated with fuels scenarios; and
8. Costs in context.



Summary of LTAG-implementation related decisions by A41

To support the achievement of the adopted LTAG, the ICAO Assembly made a set of requests to States and the Council aiming to address several key aspects of the LTAG implementation in the following years.

Accordingly, the Assembly Resolution A41-21 requested the Council to **regularly monitor progress on the implementation of all elements of the basket of measures towards the achievement of the LTAG**, including through:

- ICAO Stocktaking;
- review of the ICAO Vision for SAF;
- further assessment of the CO₂ emissions reduction;
- cost impacts of a changing climate on international aviation, regions and countries, in particular developing countries;
- impact on the development of the sector;
- cost impacts of the efforts to achieve the LTAG;
- monitoring of information from State Action Plans for international aviation CO₂ emissions reduction; and
- means of implementation.

To this end, the Council will consider necessary methodologies for the monitoring of progress, and report to a future session of the ICAO Assembly.

In its preambles, Resolution A41-21 noted key aspects from CAAF/1, CAAF/2, and previous Assemblies, including the need to update the 2050 ICAO Vision to include a quantified proportion of such fuels to be used by 2050, while recognizing **that the technological feasibility of drop-in sustainable aviation fuels is proven and that such fuels are expected to have the largest impact on aviation CO₂ emissions reduction by 2050**. It added that these fuels are expected to have a large impact on emissions reductions beyond 2050, and that the introduction of appropriate policies and incentives to create a long-term market perspective is required.

Furthermore, the Assembly recognized the continuing developments in drop-in fuels such as SAF and LCAF to reduce aviation CO₂ emissions, and welcomed the development of new fuels and cleaner energy sources for aviation, including the use of hydrogen and renewable electricity, to be developed and deployed in an economically feasible, socially and environmentally acceptable manner.

This was **the first time that an ICAO Assembly mentioned hydrogen as a source of cleaner energy, signaling the increasing discussions to scale-up hydrogen as an important clean energy source for the future of aviation**.

Regarding CORSIA, it **recognized the fact that sustainability criteria, sustainability certification, and the assessment of life cycle emissions of such fuels were developed and updated as part of the work on CORSIA implementation**.

Paragraph 27 of Resolution A41-21 requested States to encompass a range of significant provisions, compelling **national administrations to collaboratively devise policy actions and investments aimed at expediting research, development, deployment, and utilization of cleaner and renewable energy sources within aviation**. This encompassed sustainable aviation fuel (SAF) and lower carbon aviation fuel (LCAF), aligning with individual national contexts.

Furthermore, it requested States to **work with relevant stakeholders to accelerate the fuel research, certification and development as well as processing technology and feedstock production, and the certification of new aircraft and engines to allow the use of 100 per cent SAF, in order to decrease costs and support scale-up of sustainable fuel production pathways up to a commercial scale**.

According to the Resolution, this could be fostered by States especially through **encouraging and promoting SAF and/or LCAF purchase agreements as well as supporting timely delivery of any necessary changes to airport and energy supply infrastructure**, taking into account the sustainable development of States.

A41-21 also requested States to recognize existing approaches to assess the sustainability of all fuels in general, including those for use in aviation which should achieve net GHG emissions reduction on a life cycle basis, contribute to local social and economic development, and that should avoid competition with food and water.

Important **requests to the ICAO Council** were also **made in paragraph 28 of Resolution A41-21**, and those involved:

- a) encourage Member States and invite industry, financial institutions and other international organizations to actively participate in exchange of information and best practices, and facilitate the establishment of partnerships and the definition of policies **that will further promote the transition to cleaner, renewable sources of energy for aviation**, including SAF and LCAF, through regional seminars;
- b) continue to maintain the **ICAO Global Framework for Aviation Alternative Fuels (GFAAF)**;
- c) continue to give a **global view of the future use of SAF and LCAF** and to account for changes in life cycle GHG emissions in order to assess progress toward achieving global aspirational goals;
- d) **work with financial institutions to facilitate access** to financing infrastructure development projects dedicated to SAF and LCAF and incentives to overcome initial market hurdles;
- e) **cooperate with other relevant international initiatives**, including the Sustainable Energy for All (SE4ALL) initiative, to facilitate aviation's access to renewable energy; and
- f) **continue to assess progress on the development and deployment of SAF, LCAF and other cleaner energy sources for aviation** as part of the ICAO stocktaking process, and convene the CAAF/3 in 2023 for reviewing the 2050 ICAO Vision for SAF, including LCAF and other cleaner energy sources for aviation, in order to define a global framework in line with the No Country Left Behind (NCLB) initiative and taking into account national circumstances and capabilities.

The **means of implementation of the LTAG** was another key topic addressed by Resolution A41-21. The Assembly recognized that “**means of implementation commensurate to the level of ambition, including financing, will promote the achievement of the LTAG**”. It added that “it requires substantial investments for States, according to their national circumstances, and that various possible modalities and/or funding mechanisms could be used by ICAO to facilitate financing and investment support for implementation of specific aviation CO₂ emissions reduction measures” (paragraph 17 of Resolution A41-21 refers).

Paragraph 18 of Resolution A41-21 requested the Council to further **consider the establishment of a climate financing initiative or funding mechanism under ICAO**, while addressing the possible financial, institutional and legal challenges, and report to the 42nd Session of the ICAO Assembly.

Paragraph 18 of the same Resolution also requested the ICAO Council to **promote the voluntary transfer of technology**, in particular for developing countries and States having particular needs, to enable them to adapt to cutting-edge technology and to enhance their contribution to achieve the LTAG.

The Assembly welcomed the establishment of the **ICAO Assistance, Capacity-building and Training for SAF (ACT-SAF) programme** and stated that it should be extended to add support to the implementation of other emissions reduction measures in an ICAO ACT-LTAG programme (e.g., aircraft technologies, operational improvements, infrastructural changes, LCAF and other cleaner energy sources for aviation). The ACT-SAF Programme is detailed in Chapter 4 of this report.



3. En route towards the third Conference on Aviation and Alternative Fuels (CAAF/3)

Following the 41st Session of the ICAO Assembly, implementing the LTAG of net-zero carbon emissions by 2050 has been a major priority for all stakeholders, by **transforming this collective sectoral goal into concrete roadmaps, actions and projects** in order to “achieve the maximum possible level of progress on the implementation of aviation in-sector CO₂ emissions reduction measures” (e.g., technology, operations and fuels) (A41-21, paragraph 21 refers).

Recognizing that “the largest potential impact on aviation CO₂ emissions reduction will come from fuel-related measures” (A41-21, paragraph 21 refers), **creating the right conditions for the scaling-up production, distribution and use of SAF, LCAF and other cleaner energies, all around the world, is a key priority for the years to come.**

While ICAO has recognized the role of SAF in reducing aviation CO₂ emissions since the first CAAF/1 in 2009, current SAF production remains low compared to the aviation fuel consumption, resulting in prices remaining higher than those of conventional fuel. Consequently, a **rapid ramp up of SAF production is vital for narrowing the price gap** in order to minimize any impact on the global growth of the sector, and it will also create new **economic, social and environmental benefits** for States.

To enhance production of aviation cleaner energy, the Assembly requested the Council to “continue to assess progress on the development and deployment of SAF, LCAF and other cleaner energy sources for aviation as part of the ICAO stocktaking process, and **convene the CAAF/3 in 2023 for reviewing the 2050 ICAO Vision for SAF, including LCAF and other cleaner energy sources for aviation, in order to define a global framework in line with the No Country Left Behind (NCLB) initiative and taking into account national circumstances and capabilities**” (A41-21, paragraph 28 f) refers).

To do so, a **robust process towards CAAF/3 was established** with a variety of meetings and events throughout the year 2023, leading up to the CAAF/3 which was convened from 20 to 24 November 2023 (Figure 1).

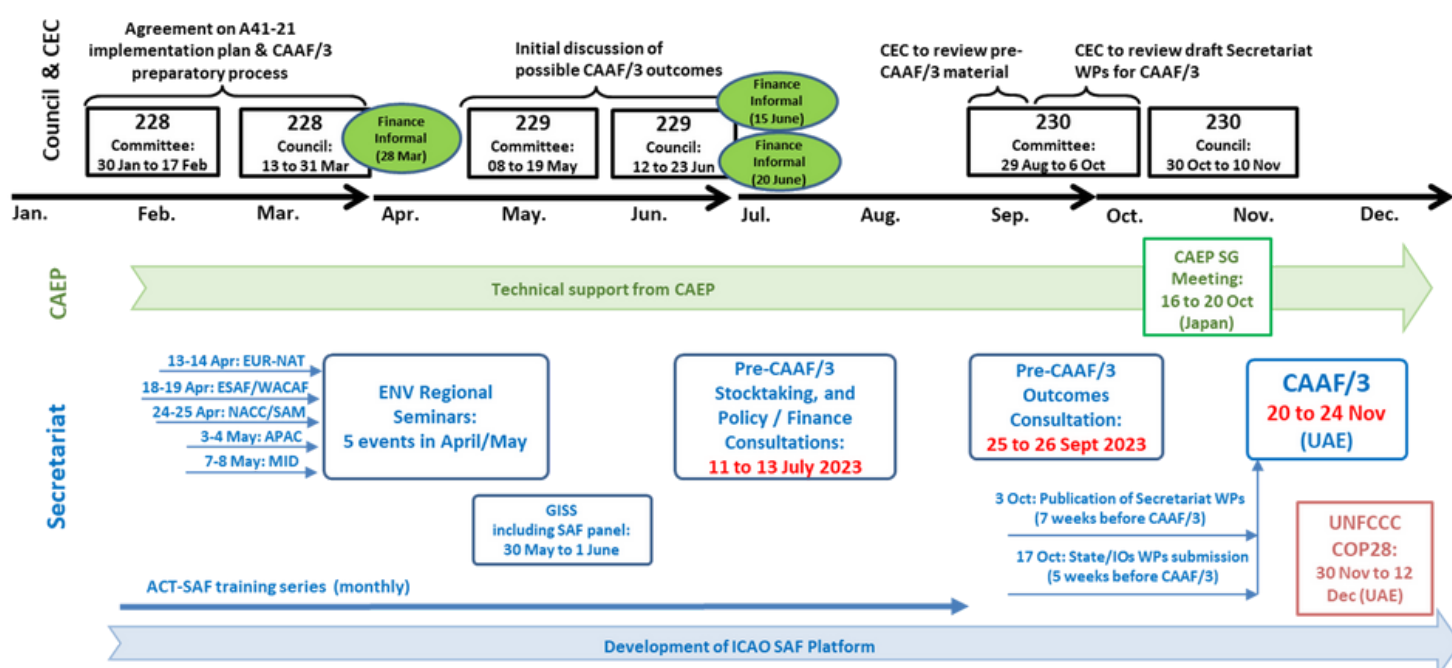


FIGURE 1: ICAO timeline towards CAAF/3

3.1 ICAO Environmental Regional Seminars (April/May 2023)

As part of the preparatory activities for CAAF/3, ICAO organized a series of in-person regional seminars in April and May 2023 to raise awareness on the results of the 41st Session of the ICAO Assembly and the progress of work related to SAF, LCAF and other aviation cleaner energy, as well as to exchange initial views of States on the expectations for CAAF/3. The dates and cities of the five regional seminars (State letter ENV 5/1.13 – 23/10 refers) are reflected in Table 1.

Dates	ICAO Regions	City
13 and 14 April 2023	European and North Atlantic (EUR/NAT)	Rotterdam, Netherlands
18 and 19 April 2023	Eastern and Southern African (ESAF); Western and Central African (WACAF)	Nairobi, Kenya
24 and 25 April 2023	North American, Central American and Caribbean (NACC); South American (SAM)	Santo Domingo, Dominican Republic
3 and 4 May 2023	Asia and Pacific (APAC)	Bangkok, Thailand
7 and 8 May 2023	Middle East (MID)	Cairo, Egypt

TABLE 1 : ICAO 2023 Regional Environment Seminars

Each regional seminar discussed four topics:

- 1) **Supporting policies** to promote the development and deployment of cleaner energy for aviation – opportunities and challenges;
- 2) **Assistance, capacity-building and training** for cleaner energy, including ICAO ACT-SAF;
- 3) **Financing** cleaner energy; and
- 4) Exchange of views on **expectations for CAAF/3**.



Substantial material was provided for participants in the regional seminars, including the LTAG Report information on fuels, various types of policies and opportunities/challenges for the development and deployment of aviation cleaner energies, information on costs and financing opportunities as well as basics of SAF project financing, and ICAO's work on each topic.



A short self-test was also developed for participants to support them in better preparing for their engagement during the seminars.

The participants in all regions expressed their **support for defining a path for the aviation clean energy transition and establishing an ICAO global framework for SAF, LCAF and other cleaner energies**, including elements related to policy and planning, regulatory framework, implementation support, and financing.

A lot of **synergies** were also observed, including the following:

- CAAF/3 should **respect the basis agreed at A41 for LTAG**, being thoughtful of Assembly Resolution A41-21
- Support to the continued development of a **SAF policy toolkit** to facilitate policy development and de-risk financing, but no support for a single global policy to be applied to all States (no “one size fits all”), and the need to consider a combination of policies
- Support for **State Action Plans** as a means to showcase States’ situation, actions and needs
- **ICAO’s sustainability criteria** for fuels to be extended beyond its use in **CORSIA**
- Need for **using existing tools** such as the CORSIA Central Registry, CORSIA Eligible Fuels or State Action Plans, rather than adding new tools and consequential administrative burden
- Interest in using **Bilateral Air Services Agreements and partnerships** to promote SAF
- Need for **tailored support** to address different readiness levels of States (e.g., national policy/structure, feasibility studies, feedstock availability/certification, pilot projects, business cases, production, distribution)
- Coordination and transparency to implementation support under the **ICAO ACT-SAF platform**, avoiding duplication of efforts
- Need for engagement and **coordination across all stakeholders** and ministries
- Support to the definition of **global goals and roadmaps, without attributing specific obligations to individual States**, and respecting each State’s respective capabilities
- Financing as of major concern – **need to have clear roles for ICAO, States and industry to facilitate access to financing**.

3.2 ICAO Council dialogues with the financing sector and energy providers (March/June 2023)

As part of the preparatory activities for CAAF/3, the ICAO Council discussed the challenges and opportunities to decarbonize aviation with financing institutions on 28 March 2023, with private banks and investment companies on 15 June 2023 as well as with energy companies on 20 June 2023.

The objectives of these informal Council meetings were to:

- Highlight the **importance on the deployment and scale-up of SAF, LCAF, and other cleaner energies for aviation**, in view of reaching the LTAG of net-zero emissions by 2050;
- Discuss the **importance of unlocking significant investments** to support a massive scale-up of cleaner energy in aviation to reach the net-zero goal; and
- Exchange **views on financing and partnership opportunities** for banks and investors supporting aviation decarbonization.

In light of the LTAG implementation, these meetings were of paramount importance by sending **a strong signal to investors and energy companies to highlight the commitment of States and the industry** to boost the market of SAF, LCAF and other cleaner energy sources.

These dialogues were also critical to **engage key stakeholders and keep the momentum of the transition of aviation towards cleaner energy**.

The speakers raised:

- their strong interest in the transition of aviation towards cleaner energy;
- their production and investment capacities;
- their support for the ICAO LTAG agreement of Net-Zero emissions by 2050, which provides a key signal to the industry and financing community to unlock investments;
- their support for a global and harmonized framework on SAF, LCAF and cleaner energies and a timeline defined by ICAO; and
- Their support for a close collaboration and continued dialogues with ICAO.

These dialogues have laid an **encouraging and optimistic foundation for further extensive work with these stakeholders**.

28 March 2023 - ICAO Council discussions with international financing institutions (IFIs)

Participants: The African Development Bank, the Emirates Development Bank, the European Bank for Reconstruction and Development, the European Investment Bank, the Inter-American Development Bank, the World Bank, and contributions from the Air Transport Action Group (ATAG).

Key takeaways from presentations:

- **The transition towards SAF is a key necessity** to achieve net-zero carbon emissions in aviation by 2050. It will require significant investments across all world regions;
- **International financing institutions are already supporting SAF projects** such as feasibility studies around the world, and work is already ongoing;
- While a significant share of the financial support needed to scale-up SAF at global level will need to come from private investors, **public investments have a critical role to play in de-risking SAF projects** and enabling the SAF market to take-off;
- **Blended finance**, which combines public and private sector funding to mobilize investments can act as a catalyst for SAF projects and pave the way for early-stage investment into production facilities;
- Tools such as **taxonomies for SAF financing** could support IFIs' assessments of SAF projects, with a view to facilitate investments; and
- **Predictability of SAF offtakes and reliability of the regulatory landscape** are essential to provide investors with the necessary confidence to support SAF projects.

15 June 2023 - ICAO Council discussions with private banks and investment companies

Participants: BNP Paribas, Caisse des Depots et de Placements du Québec, Bank of America, Breakthrough Energy, GenZero, Meridiam, Impact on Sustainable Aviation and the Air Transport Action Group.



Key takeaways from presentations:

- **Examples of successful financing policies** (including tax incentives and blended finance) in the field of renewable energy could be particularly relevant to boost private investments in SAF and cleaner energies for aviation, and to support market scale-up;
- **States have a key role to play in shaping financing programs** of multilateral development banks in view of de-risking capital investments for SAF projects with e.g. concessionary loans;
- While all regions may not have the possibility to adopt large-scale financial or fiscal incentives, when adopted in certain States such schemes can also **unlock financing of SAF projects in other parts of the world**;
- **Clear, long-term and harmonized regulatory frameworks are a key pre-requisite for banks to invest** in SAF projects, in particular, certainty on the sustainability of the feedstock and the associated lifecycle emission reductions;
- Elevating the **cross-sectoral issue** of aviation decarbonization as part of a broader energy transition and linking developing and developed markets can bring more opportunities in financing; and
- Schemes such as **book-and-claim** could provide investors with perspectives on a fully global SAF market.

20 June 2023 - ICAO Council discussions with energy companies

Participants: ARAMCO, ENI, ExxonMobil, Gevo, Indian Oil Corporation, Neste, Petrobras, Shell, TotalEnergies, and World Economic Forum.



Key takeaways from presentations:

- **Key role of ICAO** in ensuring that all stakeholders commit to the energy transition;
- **Defining a clear harmonized framework** to ensure the use of SAF is important to have confidence to scale up the investments and production facilities;
- While the SAF price gap remains present, it is reasonable notably due to low blend ratios;
- Successful scale-up of the SAF industry cannot solely rely on obligations (e.g. mandates) or incentives (e.g. financial incentives) but **will come as a result of inclusive and balanced policies combining obligations and incentives**;
- While opting for SAF technologies with the highest climate and environment benefits will contribute to a more effective decarbonisation of aviation, it is key to have **technology-neutrality as a core principle**, and to consider a broad range of options for feedstock and conversion technologies.
- ICAO can explore the following aspects in its global framework for aviation cleaner energy – time horizon (e.g. medium term), and metrics (volumetric, carbon intensity).

More discussions on policymaking and financing the transition to cleaner energies took place between States, industry and financing institutions at the **ICAO Stocktaking on aviation in-sector CO₂ emissions reductions and pre-third Conference on Aviation Alternative Fuels (Pre-CAAF/3) policy and finance consultations** on 11-13 July 2023, which are detailed in the following section.

3.3 ICAO LTAG Stocktaking on Aviation in Sector CO₂ Emissions Reductions and Pre-CAAF/3 Policy and Finance Consultation (July 2023)

The LTAG Stocktaking on aviation in sector CO₂ emissions reductions and the first pre-CAAF/3 consultation event was held from 11 to 13 July 2023 as a hybrid format at ICAO Headquarters in Montréal, Canada. Building upon the continued success of annual Stocktaking events since 2019, the 2023 LTAG Stocktaking highlighted the latest developments and innovations from technologies, operations, fuels and cleaner energies, with a **focus on in-sector fuel-related measures in the lead up to CAAF/3**.

Over 1000 participants registered for the three-day event, where nearly 100 panelists from governments, aviation and energy stakeholders, research institutions, start-up companies and civil society shared their visions, ambitious plans and roadmaps for decarbonizing aviation. A simultaneous SAF-LAB Exhibition was held on site at ICAO Headquarters, showcasing various stages of the SAF supply chain, such as feedstock, processing, distribution, certification and financing. This provided participants with a practical and current view of the innovations in this area.

The event showcased the mobilization of all stakeholders to decarbonize the sector and achieve the Long-Term Global Aspirational Goal (LTAG) of net-zero carbon emissions by 2050.

All presentations from the ICAO LTAG Stocktaking on Aviation in Sector CO₂ Emissions Reductions and Pre-CAAF/3 Policy and Finance Consultation are available at the **event's website**.

In addition, all the sessions are available to watch in the **ICAO.TV** streaming platform.



AIRCRAFT TECHNOLOGIES

After an introductory Session 1, the event turned its focus to aircraft technologies (in Session 2), where the industry presented the latest developments and the progress achieved so far on **new technologies such as hydrogen and hybrid aircraft**. A strong emphasis was placed on the **near-term feasibility and plans for achieving 100% SAF use in aircraft** (compared to the current 50% SAF drop-in limit). This showed the need for States and all stakeholders to continue the work on technical certification with ASTM, aiming at increased levels of SAF use.

AIRPORTS, OPERATIONS AND INFRASTRUCTURE

In Session 3, the industry demonstrated its **continued efforts to implement new ATM** and other operational improvements. The need for promoting **multi-stakeholder partnerships** was strongly supported in order to work with all the supply-chain stakeholders, with a view to facilitating aviation's decarbonization through increased SAF distribution at airports.

SAF, LCAF AND CLEANER ENERGIES

To feed into the process towards CAAF/3, the event's Session 4 covered four topics on: SAF feedstocks and processing; new technologies to expand cleaner energy in aviation; certification and accounting of cleaner energies for aviation; and on how to enable the aviation cleaner energy transition. **Many new projects were announced** during Session 4, including the development of new facilities, new alternative fuels technologies and new feasibility studies. The panelists highlighted **the need to encourage research to certify new fuel pathways, and to create a global framework to attract investments, scale up SAF and lower prices**.

AIRCRAFT TECHNOLOGIES (SESSION 2)

Focusing on the specifics of Session 2 (Aircraft Technologies), the presenters shed light on:

- 100% SAF compatibility is expected by 2030;
- 100% SAF standards are expected in the near-term as well as greater SAF blending ratios;
- Roadmaps were presented with multiple pathways to decarbonize aviation, including fuel efficiency technology, hybrid-electric, hydrogen, 50% SAF and 100% SAF;
- An international consensus and alignment on long-term SAF goals is critical to enable the aviation industry's net-zero decarbonization goal;
- The need to send a strong signal to energy producers and financial markets was underlined to accelerate production and to encourage States to support with national policy actions;
- Stakeholders highlighted the need to acknowledge the role of hydrogen before 2050 and to develop a hydrogen ecosystem, involving international organizations and coalitions;
- Tests are underway to measuring the contrail formation when using hydrogen or 100% SAF;
- The 2023 test of the world's largest aircraft powered with an H₂-Electric engine, is an important part of the technology validation;
- Ambition to bring to the market a hydrogen powered aircraft by 2035 was presented;
- Breakthrough technology demonstrators such as hybrid electric and hydrogen combustion are part of the medium- to long-term milestones in most roadmaps; and
- The next generation of aircraft would continue to utilize improvements in aerodynamics and structures.

AIRPORTS, OPERATIONS AND INFRASTRUCTURE (SESSION 3)

Regarding the specifics of Session 3 (Airports, Operations, and Infrastructure), the presenters shed light on:

- Driving change and sustainability alone, without business partners, is simply not sustainable;
- New concepts were presented, such as the "Airport City Sustainability Campus" as a technology incubator, and the "Airport City Solar" as a solar farm at an airport;
- Samples were given of airport partnerships with key players in the SAF industry, and with universities on SAF R&D;
- Airports recognized their role as a significant driver of hydrogen fuel demand, supporting its growth as a Hydrogen Hub;
- The international airline perspective was presented on the increasing use of SAF, from trial-use, proactively introducing SAF, small and large scale supply chain management, to the point of creating a new market;
- Air traffic management (ATMs) provides optimized trajectories at every stage of a flight, including solutions such as "fellow flying" and enroute trajectories optimized for weather; and
- Solar technologies have been successfully deployed on airport terminal buildings, and have been utilized on unused or unproductive airport property in over 100 airports worldwide.



SAF, LCAF AND CLEANER ENERGIES (SESSION 4)

This session was divided into four parts, covering a range of topics.

In the section titled "**Part I - SAF Feedstocks and Processing**", the presenters discussed:

- **SAF production will require an increased supply of feedstocks to respond to aviation decarbonization targets.** In the near future, we can have lignocellulosic and municipal solid waste on a larger scale, while the use of algae and Power-to-X (PtX) will be important in medium/longer term;
- Gasification plus Fischer-Tropsch (FT) and **new pathways** (i.e., pyrolysis or HTL) are crucial to scaling up SAF;
- **Feedstocks for eFuels** are also important and have their own challenges, such as the availability of renewable energy, CO₂ and water;
- An abundance of **low carbon sources** exist in several regions and can be used as SAF feedstock; and
- Land should be used first for food and the whole supply chain should be incentivized to improve sustainability.

In the section titled "**Part II - New technologies to expand cleaner energy in aviation**", the presenters discussed:

- **Regulatory policy is needed** to enable Methanol to Jet and other new SAF pathways. Such policies are essential to creating the environment for greater SAF investment and utilization;
- The need for the SAF market to be transparent via harmonized carbon intensity was highlighted;
- Up to 100 Direct Air Capture (DAC) plants are expected to be online by 2030; DAC enables a complementary solution for carbon reduction and removal, such as Durable Carbon Dioxide Removal (CDR) and SAF, for hard to abate transportation sectors like aviation;

- Methanol derived from the gasification of biomass and waste, as well as from lower carbon hydrogen and captured CO₂, can be converted into SAF;
- The key success factors needed to build a thriving efuel (PtL) industry are: growth in global demand for efuels, financial incentives, policy certainty, using government capital to de-risk commercial projects and make them attractive to investors, and a global alignment on standards for critical items (LCA, book & claim, feedstock acceptability, etc.); and
- Existing technologies that directly turn CO₂ from the atmosphere into sustainable aviation fuel through a Power-to-Liquids (PtL) process pathway can provide long-term and sustainable GHG emissions reduction solutions for aviation, while also fostering the scale up of innovative technology.

During Session 4, in the section titled "**Part III - Certification and accounting of cleaner energies for aviation**", the presenters discussed:

- Book & claim can be a useful tool in unlocking the willingness to pay for SAF throughout the whole SAF supply chain;
- A chain of custody model to include book and claim should bring clarity, consistency, comparability, be recognized and accepted by regulatory agencies globally, and have interoperability with individualized book and claim systems and registries;
- Aviation must find a faster way to accelerate the verification process of credits under a book and claim scheme, which currently can be up to 15 months;
- Some of the challenges of buying SAF environmental attributes are: how do customers (Scope 1 and 3) understand – and verify – what they are purchasing and how do they know the product has not been previously sold or claimed; and
- SAF certificates (SAFc) build from existing certification systems could provide a key investment tool for customers.

During Session 4, in the section titled "**Part IV – Enabling the aviation cleaner energy transition**", the presenters discussed:

- Roadmaps to decarbonize aviation, including technologies for ultra-efficient aircraft, to enable the transition to low-carbon fuels and unlock the potential of electric/hybrid propulsion;
- The development of a comprehensive SAF strategy was supported, considering that a roadmap for scaling up SAF should take into consideration the diverse maturity of SAF pathways (certified and new ones);
- The importance of fostering partnerships and collaborations all over the world on the implementation of SAF and cleaner energy roadmaps;
- The power of open and inclusive alliances in coordinating the whole value chain to boost the supply and demand for aviation cleaner energies was highlighted.
- Some speakers emphasized the fact that the production remains concentrated in the United States and Europe for the time being, offering great opportunity for the other regions of the world to enter this emerging market and support to fulfill the gap between demand and supply;
- From an airline perspective, the fuel usage reduction long-term roadmap can include four key measures: future aircraft technology, fleet renewal, operational efficiency and alternative propulsion. However, what cannot be reduced can be transitioned to SAF, and generally this represents more than 50% of the emissions reduction potential of an airline;
- From an international airport perspective, the main lever to directly influence SAF uplift could be a landing charge incentive;
- From a research perspective, hydrogen and sustainable aviation fuels related research is creating leaders in technology and management, increasing research capabilities in aviation and the environment while also facilitating access to funding.



FIGURE 3: Progress on SAF captured by ICAO SAF tracker tools between the two latest Stocktaking events (2022 and 2023)

Pre-CAAF/3 Policy and Finance Consultation

During the three-day event (11 to 13 July 2023), the Stocktaking was followed by a pre-CAAF/3 initial consultation among States, **focusing on policy matters (Session 5) and finance matters (Session 6), with involvement of public and private financial institutions and other relevant stakeholders**, to consider relevant elements of a global framework for aviation cleaner energy.

The need to **create the right conditions for SAF to deploy in all regions** has been expressed with **support to developing countries and States with particular needs**, considering the various circumstances (e.g. feedstocks, energy mix, infrastructure, stakeholders).

The need for a **harmonized regulatory framework as well as blended finance** was highlighted as a key **to provide certainty and confidence to drive investments** for the scaling-up production of SAF, LCAF and other cleaner energies.

POLICIES (SESSION 5)

During Session 5, in the section titled “**Part I – Recent developments**”, States shared insights about their latest policy developments related to SAF, LCAF and other aviation cleaner energies, including:

- Various strategies, highlighting the importance of fostering demand, nurturing domestic industries, and creating favorable investment conditions; and
- Mandates, incentives, roadmaps, and collaborative initiatives were discussed as possible pathways to accelerate the development and deployment, as appropriate to national circumstances.

During Session 5, in the section titled **Part II – Roundtable discussion on Challenges and Opportunities on Policies and Looking Forward to CAAF/3**, the panelists discussed:

- The need for a **coordinated and inclusive approach amongst all relevant stakeholders**, highlighting the initiatives undertaken to enhance multi-stakeholders' cooperation and coordination between different ministries, through alliances or task-forces;
- A **no “one size fits all”** approach for policies and the need to consider local circumstances, and stability of such policies over time, particularly in terms of coherence with the defined objectives. A wide range of policies was presented, many of which are described in the ICAO Guidance on Potential Policies and Coordinated Approaches for the deployment of SAF and in the ACT-SAF Training Series presentation on the topic of policies;
- The need for recognizing all emissions reductions towards aviation decarbonization, and the **technology and feedstock neutral approach** for the effective realization of the LTAG;
- The importance of **harmonization on fuel sustainability criteria, certification and accounting methodologies at the global level under ICAO** was once again raised, with those already developed under CORSIA considered as the basis, with the need to further understand and discuss book and claim systems;
- The need for further analysis on **potential goals for aviation cleaner energy**, including metrics and projections, was expressed, as well as the need to **maintain the alignment with the sectoral and collective nature of the LTAG**.

FINANCING (SESSION 6)

Following the conclusions of the 41st Session of the ICAO Assembly and the adoption of the long-term aspirational goal (LTAG) of net zero carbon emissions by 2050 (Resolution A41-21, paragraph 7 refers), ICAO has been working to facilitate a better access to public and private investment capacities, as well as funding from financial institutions, such as development banks.

In the context of the LTAG implementation and the ICAO ACT-SAF Programme, ICAO has undertaken activities to connect with financing institutions across all regions with the objectives to:

- Raise their **level of awareness on the LTAG** of net-zero carbon emission in international aviation by 2050 and the **essential role of SAF as a key enabler** to achieve this objective, as well as the strong interest of aviation/fuel industries for immediate and **massive scale-up**;
- Inform them of the **significant investments needed to scale-up the production capacity of SAF and other cleaner energies** across all regions, in particular for developing countries; and
- Explore **existing and future financing instruments to support SAF and cleaner energy deployment**, inform financing institutions of ways in which they can best contribute to, and stimulate sharing of information on financing to aviation cleaner energies.

During Session 6, in the section entitled “**Part I - Overview of SAF, LCAF and cleaner energy financing and recent developments**”, the presenters discussed:

- The **role of blended finance** (e.g., public finance, institutional investors, and private financing) and support mechanisms on SAF initiatives which can progress from the initial stages of feasibility studies and de-risking to broader implementation across countries;

- **Examples of SAF financing mechanisms** such as airline climate funds for seed and project funding, long-term SAF offtake agreements and equity positions;
- The importance of **investing in the overall production value chain** – feedstocks, infrastructure, facilities and R&D and to work to synchronize supply and demand;
- Key issues for SAF bankability such as feedstock availability and price elasticity, arbitrage risk (food, energy, fertilizer, fuels, plastics, etc.), technological reliability, and logistic bottlenecks and existing infrastructure use; and
- **The key role of government funds to kickstart the SAF industry** in a given State, with the commercial deployment of innovative fuel production technologies that can significantly reduce near-term aviation emissions.

During Session 6, in the section entitled “**Part II - Implementation support as a means to facilitate financing**”, the presenters discussed:

- The importance for governments to fund capacity-building projects and **feasibility studies on SAF** and other cleaner energies;
- The **importance to have a SAF roadmap**, including mapping feedstock opportunities and benefits, and understanding the price, scaling, and policy risks;
- The **need for clear market signals** to build a domestic SAF Market in some States, and the need for the mobilization from industry stakeholders to develop a Roadmap to inform policy and market signal development;
- The importance of producing real SAF volumes now while creating conditions for scaling rapidly during the 2030s;
- The need for States to consider a net-zero aviation strategy, creating an enabling environment, together with the industry stakeholders; and
- The **importance of collaborative research networks** for global SAF supply chain development.

During Session 6, in the two roundtable discussions on “**Part III – Needs and challenges for States and investors on financing**” and “**Part IV – Looking ahead to CAAF/3 on financing**”, the panelists highlighted:

- Discussions with financial institutions and investors reaffirmed the **availability of private capital in sufficient quantity**;
- The need for ensuring the **profitability of projects**, including securing the demand as well as the need for a **harmonized framework** in particular on sustainable criteria;
- **Key role for States** to shape financing programmes of development banks in view of de-risking capital investments for SAF projects;
- Expectation for **ICAO to set clear guidelines to generate the necessary confidence and certainty to drive investments, scale up production, and thus lower prices, of SAF and other cleaner energies**;
- The **role of blended finance**, for public funding to be a first step to give confidence to private investors. All stakeholders should play respective roles to facilitate access to financing and investments for aviation cleaner energy projects.



Overall, the discussions during this pre-CAAF/3 Consultation emphasized the **critical importance of providing concrete means of implementation** to achieve the aviation energy transition, such as capacity-building, voluntary technology transfer and financing. A **will for solidarity between States was unanimously expressed**, especially to drive a tailored implementation support.

Figure 4 below shows a wordcloud generated by the most frequent words mentioned during the presentations and roundtable discussions from the ICAO Stocktaking and Pre-CAAF/3 Consultation event in July 2023.



FIGURE 4: Wordcloud generated from the frequency of words heard during Stocktaking and pre-CAAF/3 discussions in July 2023



FIGURE 5: The 2023 LTAG Stocktaking was an all woman moderator event

3.4 Pre-CAAF/3 Outcomes Consultation (September 2023)

The second pre-CAAF/3 consultation event was held at ICAO Headquarters in Montréal, Canada from 25 to 26 September 2023 as a hybrid event (State letter ENV 9/1 – 23/58 refers), with the following objectives:

- undertake consultation among States with a focus on possible CAAF/3 outcomes, i.e., draft ICAO global framework for SAF, LCAF and other cleaner energies; and
- seek convergence of views on as many issues as possible, and identify remaining differences of views with a possible way forward to bridge them, to pave the way for result-oriented discussions at CAAF/3, bearing in mind that the consultation is not a decision-making event.

In this regard, since early 2023, the **ICAO Council's Climate and Environment Committee (CEC)** and **its Small Group** have been leading the CAAF/3 process, including the preparation of such possible CAAF/3 outcomes.

Such consideration of **possible CAAF/3 outcomes, including a draft ICAO global framework**, took into account the feedback and input received from the previous outreach and preparatory activities, including the regional seminars (section 3.1 refers), the informal dialogues with banks, investors and energy companies (section 3.2 refers), the Stocktaking and first pre-CAAF/3 consultation (section 3.3 refers).

To structure the discussion on such possible CAAF/3 outcomes, the following **four Building Blocks for the ICAO draft framework** have been identified:

- 1) policy and planning;
- 2) regulatory framework;
- 3) implementation support; and
- 4) financing.



Consideration was also given to the technical inputs by the ICAO Council's Committee on Aviation Environmental Protection (CAEP).

Technical inputs by CAEP:

The ICAO Council in March 2023 requested CAEP to provide technical inputs in support to CAAF/3, as follows:

1. Identify **possible metrics for potential quantified goals for cleaner energy for international aviation** (e.g. percentages (%) or absolute values (mass/volume), in terms of the uptake levels of SAF, LCAF and other cleaner energies for aviation, or in terms of CO₂ emissions reduction levels), highlighting any advantages and disadvantages for each possible metric;
2. Using the possible metrics identified above, together with the CAEP LTAG Report, provide **projections on the global levels of cleaner energy use for international aviation, across intermediate milestones, such as 2030, 2040, through to 2050;**
3. Identify **possible parameters for fuel accounting and reporting methodologies for international aviation**, to ensure consistent application as part of monitoring the LTAG progress; and
4. In the context of the **short-term projections on SAF production**, identify **geographic distribution and trends of existing and planned SAF production facilities.**

Detailed information on these CAEP technical inputs is **provided in the following Chapter 4**, as part of the appropriate Building Blocks of the ICAO global framework.



A draft document on possible CAAF/3 outcomes, reflecting the progress made by the Council CEC's Small Group by end of August 2023, was made available on the [ICAO pre-CAAF/3 outcomes consultation event website](#).



2) possible parameters for fuel accounting and reporting methodologies for international aviation to ensure consistent application as part of monitoring the LTAG progress.

The subsequent sessions considered and exchanged views among participants on each Building Block, which was facilitated by Mr. Mauricio Ramirez, the Representative of Colombia to ICAO, and supported by the Chairperson of the Council CEC and its Small Group through his explanation on relevant parts of the draft framework.

During the consideration of **Building Block 1 – Policy and Planning**, a number of views were focused on possible ICAO Vision, in particular on possible quantification of collective goals and appropriate metrics for cleaner energy use by international aviation, as well as a number of concerns with such quantification, including the balance with other Building Blocks.

A good convergence of views was observed on the importance of a global and sectoral approach for the development and implementation of voluntary State Action Plans, reflecting appropriate policies on aviation cleaner energies in line with respective circumstances and capabilities of States.

During the consideration of **Building Block 2 – Regulatory Framework**, a good convergence of views was observed to support the CORSIA framework and its sustainability criteria, sustainability certification schemes, and life-cycle assessment, as the robust and continued basis for the eligibility of aviation cleaner energies.

Various views were expressed on the role of ICAO for harmonized accounting methodologies on the use of aviation cleaner energies and claiming of environmental benefits, without double-counting, as part of supporting the monitoring of progress toward the achievement of the LTAG, while highlighting the need for ICAO to undertake a further study on fuel accounting systems for international aviation.



Documentation - Possible CAAF/3 outcomes

Possible CAAF/3 outcomes for consideration by the event, including a draft ICAO global framework for aviation cleaner energy, is available below:

Possible CAAF/3 outcomes for consideration by pre-CAAF/3 consultation					
EN	FR	SP	RU	AR	CH

Views and inputs on possible CAAF/3 outcomes above can be expressed by Governments/Organizations in the form of 'submissions' which will be posted below. While such 'submissions' will not be considered official papers of the event and therefore not be tabled for consideration under any specific agenda item, they intend to facilitate in a transparent way the views and inputs from Governments/Organizations to the event participants.

The 'submissions' may be provided in any of the six ICAO working languages; however, they will not be translated by the Secretariat. You are kindly invited to provide the submissions by 19 September 2023, and only submissions received by the Secretariat by then will be posted on the event website.

In addition, submissions by ten individual States and groups of States and by five Organizations, were posted on the [event's website](#) aiming to facilitate the sharing of their views on the draft to the event participants in a transparent way.



The two-day event brought **over 600 participants from 95 States and 19 Organizations**, and they were able to fully engage in the consultation to understand each other's views and identify where the convergence and differences exist, and in which parts of the draft ICAO global framework.

The discussion and exchange of views during the event was undertaken in a positive environment with a good spirit of cooperation among States to further work together for bridging the remaining gaps toward the CAAF/3, recognizing that "nothing is agreed until everything is agreed as a package".



During the first session, the [Secretariat provided a setting-scene presentation](#) on the latest developments related to aviation cleaner energy and overall ICAO preparatory work for CAAF/3, which was followed by technical inputs by CAEP, regarding:

1) possible metrics for potential quantified goals and projections on the global levels of cleaner energy use by international aviation; and

During the consideration of **Building Block 3 – Implementation Support**, views were expressed regarding the critical need for various forms of support. This includes capacity-building, training, knowledge sharing, technology transfer, and feasibility studies.

These measures will be facilitated through programs such as the ICAO ACT-SAF program, the State Action Plans initiative, and other bilateral and multilateral partnerships and cooperation.

This aligns with the No Country Left Behind initiative, all working with the aim to achieve global efforts to develop and deploy SAF, LCAF and other aviation cleaner energies in all regions.

During the consideration of **Building Block 4 – Financing**, a good convergence of views was observed on the crucial role of private and public financing to scale-up production of SAF, LCAF and other aviation cleaner energies, while welcoming the progress by ICAO to engage with financial institutions and its ongoing work to establish a “Finvest Hub” for enhanced financial access through match-making between relevant stakeholders (e.g. public-private partnerships).

Various views were expressed on the need to start exploring the possibility of a fund and the role of CAAF/3 to respond to the Assembly request on this topic, and the relation of ICAO with other UN and international organizations, as well as the balance of the financial considerations with other Building Blocks in particular with Block 1.



PRE-EVENT OUTCOMES CONSULTATION

25 - 26 SEPTEMBER 2023 | ICAO HQ

4. Navigating CAAF/3

The successful Third Conference on Aviation and Alternative Fuels (CAAF/3), held from 20 to 24 November 2023, agreed on an **ambitious, robust and comprehensive ICAO Global Framework for SAF, LCAF and other aviation cleaner energies**.

The aim of this Chapter 4 is to **provide readers with a structured and comprehensive information on SAF, LCAF and other cleaner energy sources for aviation topics, facilitating their understanding of CAAF/3 discussions and outcomes**.

While also highlighting ICAO's initiatives to that end, this Chapter 4 delves into these themes following a structured approach aligned with the four Building Blocks of the ICAO global framework:

Building Block 1: Policy and planning

- Supporting policies to promote the development and deployment of cleaner energy for aviation
- Metrics and projections for potential quantified goals for cleaner energy for international aviation

Building Block 2: Regulatory framework

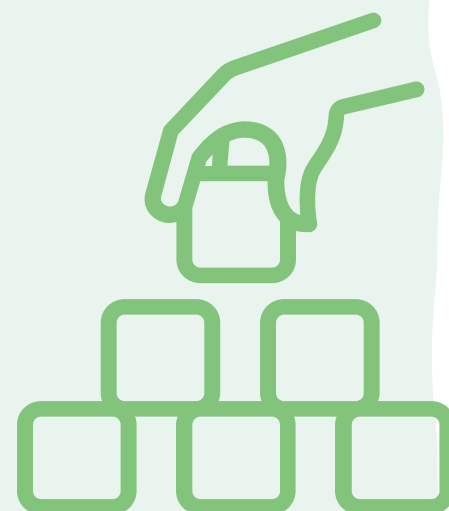
- Fuel sustainability certification
- Fuel accounting and reporting methodologies

Building Block 3: Implementation support

- Assistance and capacity-building for cleaner energy

Building Block 4: Financing

- Financing cleaner energy



These Building Blocks are interconnected, and they need to be considered together as a package to understand the framework's overall objectives.



THIRD ICAO CONFERENCE ON
AVIATION AND ALTERNATIVE FUELS

20 - 24 NOVEMBER 2023 | DUBAI



4.1 Policy and Planning

Why does the cleaner energy market need policy actions by States?

In order to develop and deploy SAF, LCAF and other cleaner energy sources **in all regions**, the introduction of appropriate policies and incentives to create a long-term market perspective is required. Thus, supporting policies for aviation cleaner energy form an important building block in enabling the definition of the ICAO global framework.

Encouraging the successful adoption of policies in States, the ICAO Committee on Aviation Environmental Protection (CAEP) developed the “Guidance on potential policies and coordinated approaches for the deployment of SAF”. This is in line with the Assembly Resolution A41-21 request to “continue to develop and keep up to date the guidance for Member States on the application of policies and measures aimed at reducing or limiting the environmental impact of emissions from international aviation”, and requesting States to “set a coordinated approach in national administrations for policy actions and investment, consider the use of incentives”, and “work with relevant stakeholders to accelerate the fuel research, certification and development”.

How can the ICAO guidance help States?

A diverse range of policies exist to promote the production, distribution and use of SAF, LCAF and other cleaner energies.



The **ICAO Guidance on potential policies and coordinated approaches for the deployment of SAF** is a useful tool to give States an overview of the various policies that exist and that could fit their own circumstances in view of conducting their aviation energy transition. It is a support reference or “**policy toolkit**” for States (without any endorsement of specific policy approaches), providing:

- a comprehensive assessment of what defines an effective SAF policy;
- qualitative metrics to assess the effectiveness of policies;
- policy options for creating a sustained market for SAF; and
- examples of existing policies around the world.

Categories of policies:

- **Stimulating SAF supply** through the increase in SAF feedstock, fuel production capacity and supply through research and development (R&D), investment, production incentives, and tax treatment. Such policies can include government funding for SAF R&D, demonstration, deployment, targeted incentives and tax relief to expand SAF supply infrastructure or SAF facility operation, and recognition and valorization of SAF environmental benefits.
- **Increasing SAF demand** with policies such as the creation of SAF mandates, which can take various forms (expressed in energy volume, or reduction of fuel carbon intensity), adapting pre-existing policies to include SAF as qualified fuels, or incorporating SAF into sub-national, regional, or local policies. States may also create demand signals through commitments to SAF procurement.



- **Enabling SAF markets** which include adopting clear and recognized sustainability standards and life cycle GHG emissions methods for certification of feedstock supply and fuel production, supporting the development/recognition of systems for environmental attribute ownership and transfer, and supporting SAF stakeholder initiatives.

The Guidance on potential policies and coordinated approaches for the deployment of SAF includes examples of policy packages adopted.



In addition, **the ICAO Tracker Tool on SAF policies** (Figure 1) monitors the policies already adopted or under development and enables each stakeholder to keep track of the SAF policies all around the world.

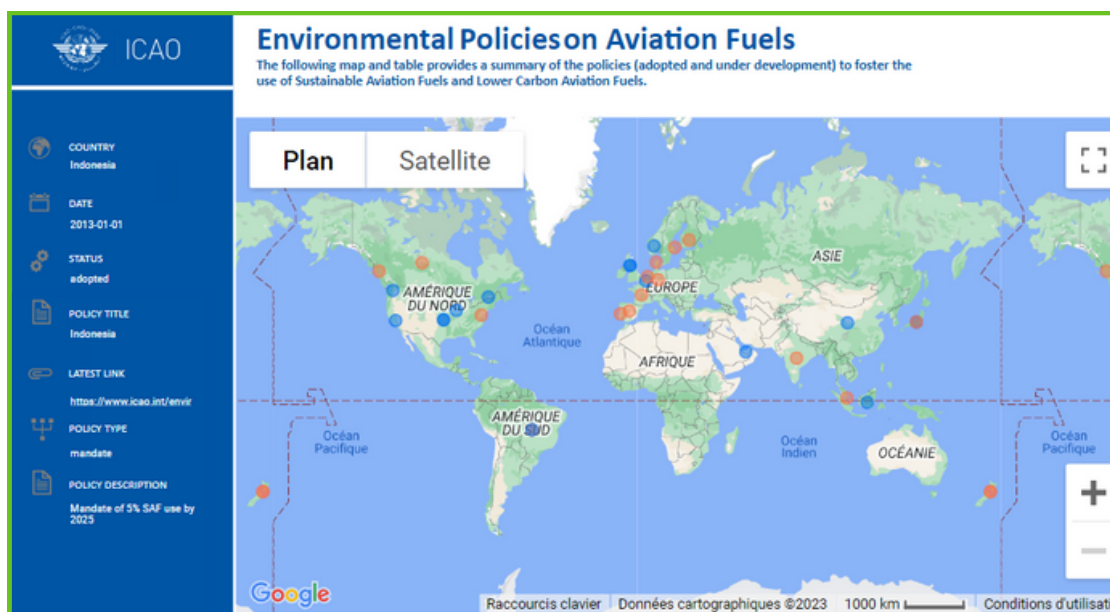


FIGURE 1: SAF Policies map from Tracker Tool



The Guidance also contains the **“Rules of Thumb”**, which provides order of magnitude estimations of SAF costs, investment needs and production potential; as well as discussions on SAF cost assessment concepts, on the basis of marginal abatement costs of CO₂, which can also apply to other forms of cleaner energy for aviation. The following illustrative example taken from the Guidance explains the process for determining the per tonne of CO₂ cost from using SAF under a set of assumptions.

Example:

Airline XYZ requires 10 tonnes of jet fuel per annum and decides to use SAF to reduce its emissions. The airline makes a decision to use 8 tonnes of conventional kerosene and 2 tonnes of SAF.

Assumptions:

Cost of 1 tonne of conventional kerosene = \$600
 Cost of 1 tonne of SAF = \$1100
 Jet fuel combustion CO₂ emissions factor = 3.16
 CO₂ emissions reduction factor of this SAF = 80%

Firstly, the amount of CO₂ reduced must be determined which is a function of the amount of SAF used, the jet fuel combustion factor and the SAF emissions reduction factor.

Net CO₂ emissions reduction = 2 tonnes * 3.16 * 80% = 5.06 tonnes CO₂

The cost per tonne of CO₂ reduced is found by calculating the cost difference between SAF and conventional kerosene divided by the amount of CO₂ reduced.

Cost per tonne of CO₂ reduced = 2 tonnes * (1100-600) / 5.06 = \$197.78 / tonne

Why should policy and planning include coordination among stakeholders?

Effective policy planning and implementation require collaborative effort, recognizing that many stakeholders (fuel producers, sustainability certification schemes, aircraft and engine manufacturers, airports, aircraft operators) should play important respective roles in the aviation fuel value chain.

Building and promoting multi-stakeholders cooperation is paramount and can be achieved through public-private partnerships, alliances or taskforces, that help in coordinating the whole value chain to boost the supply and demand for sustainable aviation fuels. These alliances could provide key support on R&D, availability of feedstocks, synergies among sectors and just transition, production pathways and value chain and access to public and private finance.

Examples of such partnerships:

- European Renewable and Low-Carbon Fuels Value Chain Industrial Alliance (European Union);
- International Advisory Panel on Sustainable Air Hub (Singapore);
- SAF Grand Challenge Partners (United States);
- Multidisciplinary Committee - Fuels for the Future (Brazil);
- Study Group on CO₂ Reduction in the Aircraft Operation Sector and public-private Councils (Japan); and
- SAF Committee (United Arab Emirates).

How to adapt to local circumstances?

There is no “one size fits all” solution and that is why each State needs to identify a policy package according to its own national or regional circumstances:

- The policy package should be stable, predictable and consistent, and link incentives to performance, among other characteristics. The mentioned “Guidance on potential policies and coordinated approaches for the deployment of SAF” highlights three key themes that influence policy effectiveness: **feasibility, effectiveness, and practicality**. It also provides a comprehensive assessment of what defines an effective SAF policy.
- Feasibility studies should help in gathering the necessary data to better understand the local circumstances and the policies that could be more efficient or more adequate, taking into account the national priorities and existing regulatory framework, as well as the local (national or regional) resources, economic, social and environmental circumstances.
- The Guidance describes a set of **qualitative metrics** used by experts to assess the effectiveness of policies. There are **eight identified metrics**, which include **flexibility, certainty, financial costs and benefits, price sensitivity to externalities, ease of implementation, contribution to sustainable aviation fuel deployment and GHG reduction, unintended consequences, and robustness of policy**. These metrics can be used as a checklist by a State to evaluate potential or existing policies.



State Action Plans

Why are State Action Plans an important tool to assist States and deploy cleaner energies worldwide?

State Action Plans are an ICAO initiative to encourage States to voluntarily develop and submit to ICAO, outlining their respective policies and actions, including long-term projections and roadmaps, and providing information to ICAO on the basket of measures considered, including SAF, LCAF and other cleaner energies, reflecting their respective national capacities and circumstances, financial requirements, including specific assistance needs.

Assembly Resolution A41-21, paragraphs 10 to 13 encouraged all States to prepare and update their State Action Plans (SAPs) to ICAO as soon as possible, preferably by the end of June 2024, encompassing innovations in technologies and cleaner energies, outlining respective policies, actions and roadmaps, including long-term projections and ensuring the use of best available data, supported by ICAO guidance and tools.

SAPs enable ICAO to assess States' needs, and tailor appropriate capacity-building and implementation support measures.

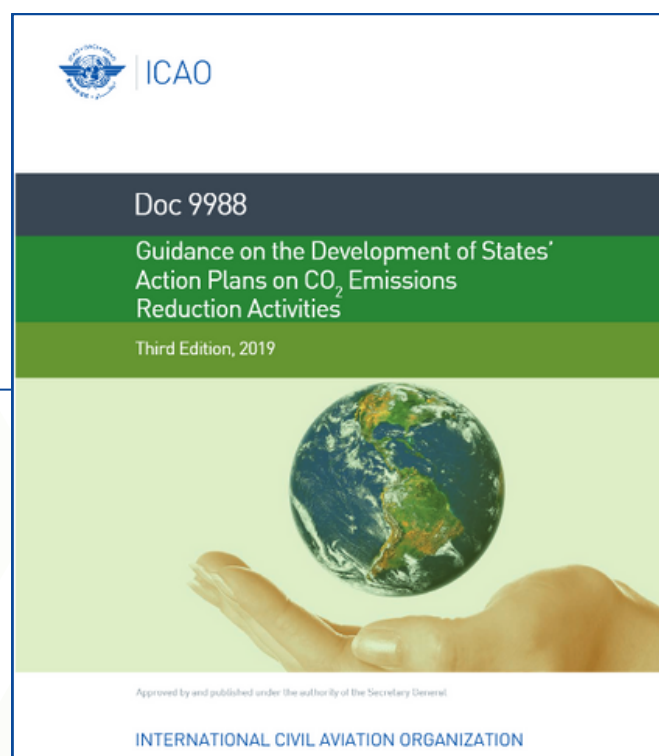
By leveraging LTAG integration into SAPs, States are expected to develop a clear roadmap for planning and investing in new technologies, cleaner energies and infrastructure to reduce aviation CO₂ emissions.

The SAPs with quantified information on CO₂ reduction benefits may be utilized as part of information to monitor the achievement of the LTAG.

ICAO is currently progressing on the update of ICAO Doc 9988, Guidance on the Development of States' Action Plans on CO₂ Emissions Reduction Activities.

The aim is to provide additional guidance for States to incorporate their long-term emissions reduction initiatives into SAPs and to report quantified data in a more harmonized manner to facilitate the monitoring of the LTAG progress.

This updated Guidance is expected to be available in early 2024.



As of November 2023, **144 States** representing more than 98% of global international aviation traffic in revenue tonne kilometres (RTK) have **voluntarily submitted SAPs to ICAO** (Figures 2 and 3), out of which 85 States have incorporated SAF as a measure to reduce aviation CO₂ emissions.

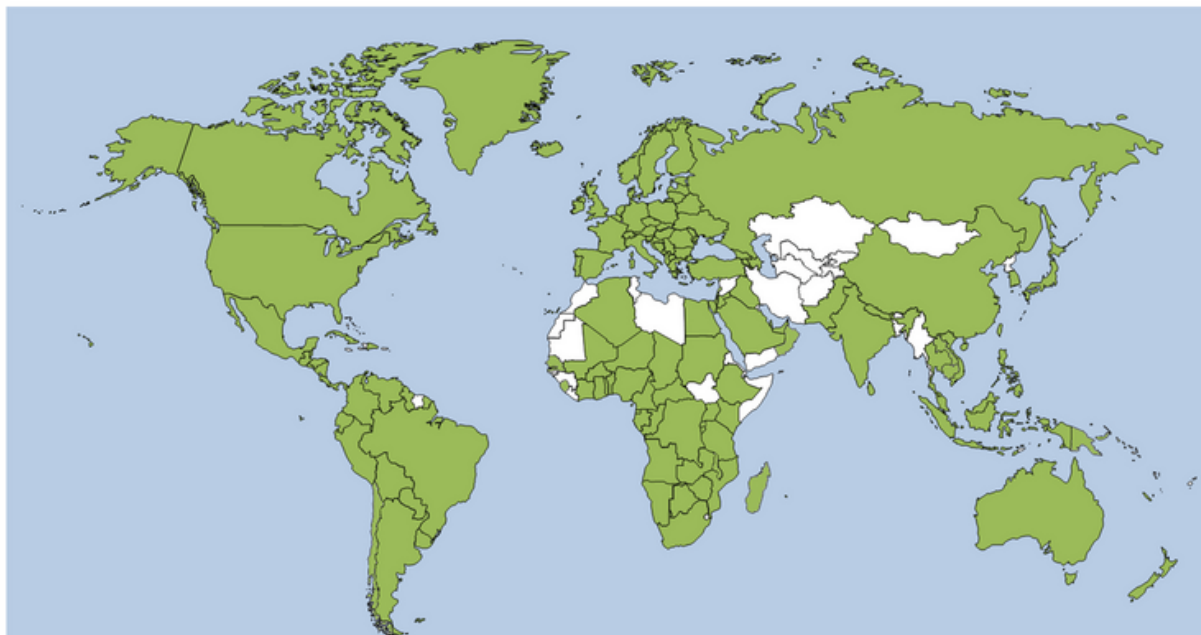


FIGURE 2: Map representing States that submitted their SAP to ICAO (in green)

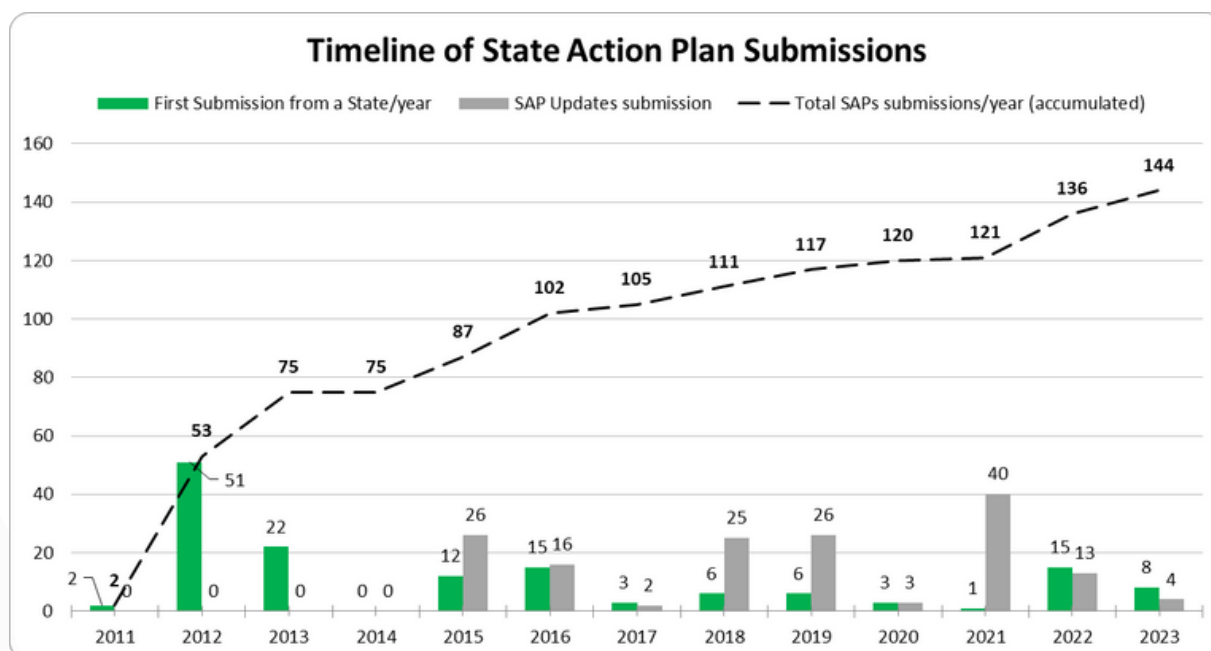


FIGURE 3: SAPs first submission and updates progress as of November 2023



More information on State Action Plans is available on the [ICAO website](https://www.icao.int/aviation/environment/state-action-plans), including other States' action plans and updated information.



Goals and Metrics

What work has been done to support the consideration of potential quantified goals for aviation cleaner energy?

Following a Council request, CAEP has identified possible metrics for potential quantified goals for cleaner energy use for international aviation, based on the analysis of different sources:

- metrics that are used in the CORSIA MRV system;
- metrics that are being used by aviation stakeholders in their net-zero commitments;
- metrics that are included in the LTAG report; and
- metrics associated with IPCC temperature goals.

In the context of these technical inputs, “cleaner energy” refers to the following fuel categories considered in the LTAG projections:

1) LTAG Sustainable Aviation Fuels (LTAG-SAF), which comprise:

- biomass-based fuels (vegetable oil crops, lignocellulosic energy crops, starchy energy crops, sugary energy crops);
- waste-based fuels; and
- atmospheric CO₂-based fuels.

2) LTAG Lower Carbon Aviation Fuels (LTAG-LCAF) – petroleum-based fuels that achieve a well-to-wake carbon intensity of < 80.1 gCO_{2e}/MJ with the use of greenhouse gas (GHG) mitigation technologies and best practices.

3) Non-drop-in fuels, comprising cryogenic Hydrogen (LH2).

Ten **possible metrics** were identified:

Metric 1: Total mass of cleaner energy use;

Metric 2: Mass proportion of total cleaner energy use to total fuel use;

Metric 3: Total mass of CO₂ equivalent emitted per year;

Metric 4: Mass proportion of total CO₂ equivalent emitted to total fuel use;

Metric 5: Total mass of CO₂ equivalent emissions reductions generated by cleaner energy use;

Metric 6: Percentage of CO₂ equivalent emissions reductions resulting from cleaner energy use compared to baseline scenario with zero cleaner energy use;

Metric 7: Carbon intensity of total fuel mix based on weighted sum of carbon intensities of cleaner energy and fossil jet fuel;

Metric 8: Cumulative total mass of CO₂ emissions from international aviation;

Metric 9: CO₂ emissions intensity, whilst accounting for changes in traffic volumes;

Metric 10: CO₂ emissions intensity, whilst accounting for changes in available capacity.

Table 1 provides the **projections** on the **global levels of cleaner energy use for international aviation**, based on the scenarios from the CAEP LTAG report, and utilizing the metrics options identified.

	Metric Option	Unit	Scenario F1			Scenario F2			Scenario F3		
			2030	2040	2050	2030	2040	2050	2030	2040	2050
1	Mass of cleaner energy	kt	8292	51732	129354	36971	188802	357319	78493	275912	335619
2	Mass of cleaner energy/Total mass of fuel	%	3.81	17.73	34.45	17.13	65.94	100.00	36.97	100.00	100.00
3	Total CO _{2e} emitted	Mt	816.61	1024.25	1155.97	742.62	756.18	599.62	672.94	465.14	242.65
4	Total CO _{2e} emitted per year/Total mass of fuel	t CO ₂ /t of fuel	3.75	3.51	3.08	3.44	2.64	1.68	3.17	1.69	0.72
5	CO _{2e} reduction from the use of cleaner energy	Mt	15.95	92.68	280.91	83.24	339.66	767.84	139.53	590.77	1041.77
6	% CO _{2e} emissions reduction from the use of cleaner energy	%	1.92	8.30	19.55	10.08	31.00	56.15	17.17	55.95	81.11
7	Mass average carbon intensity (CI) of fuel (gCO _{2e} /MJ)	gCO _{2e} /MJ	87.30	81.62	71.60	80.03	61.41	39.03	73.72	39.21	16.81
8	Cumulative CO ₂ emissions over the period between 2020 and 2050	GtCO ₂	23			17			12		
9	gCO ₂ /RTK		Can't be obtained from LTAG fuels data								
10	gCO ₂ /ATK		Can't be obtained from LTAG fuels data								

TABLE 1: Projections on the global levels of cleaner energy use for international aviation (based on the LTAG report)



The following set of criteria were applied by CAEP to assess the advantages and disadvantages of each possible metric:

- metric is reported by aeroplane operators as part of CORSIA requirements;
- metric is made available by ICAO in the CORSIA Central Registry, or can be calculated/tracked with the use of available CCR information;
- allows to track progress toward the LTAG, e.g. can be used to assess short-, mid-, and long-term intermediate goals; and
- provides a benchmark for comparison; e.g. the metric compares against a reference value instead of being an absolute number.

A metric allows monitoring of performance on implementation of cleaner energy in civil aviation, and various metric options may impact the development of cleaner energy for the aviation sector differently. Metrics may also encourage an increase in cleaner energy volumes, drive a lowering of the emissions of the cleaner energy or influence both volume and emissions.

The CAEP assessment of the advantages of 10 possible metrics based on the four criteria above, is presented in Table 3. Meeting all of the criteria is not a prerequisite for the suitability of a metric. Indeed, some criteria may be relevant to certain metrics only. A combination of metrics may also be considered. Disadvantages of metrics are also noted in the last column of Table 3 and are summarized in Table 2.



Not reflecting ENV benefits of cleaner energies	Metrics 1 and 2
Lack of available data, such as through CORSIA Central Registry, to track progress	Metrics 9 and 10
Affected by other measures beyond cleaner energies (technology / operation)	Metrics 3, 5 and 8
Is an absolute number and do not compare against a reference value	Metric 1, 3, 4, 5, 8
Metrics 6 and 7 are not affected by these disadvantages	

TABLE 2: Summary of disadvantages of possible metrics



	Metric Option / Criteria	Metric is reported by aeroplane operators as part of CORSIA requirements ^a	Metric is made available by ICAO in the CORSIA Central Registry, or can be calculated/ tracked with the use of available CCR information	Metric Allows tracking progress toward the LTAG, e.g., can be used to assess short, mid, and long-term intermediate goals	Provides a benchmark for comparison, e.g., the metric compares against a reference value instead of being an absolute number.	Disadvantages
1	Mass of cleaner energy	✓	✓			Does not capture environmental benefits of cleaner energy or non-drop in fuels. Affected by factors beyond cleaner energy (e.g., Tech, Ops, Demand).
2	Mass of cleaner energy (<i>Metric 1</i>) / Total mass of fuel)		✓		✓	Does not capture environmental benefits of cleaner energy or non-drop in fuels.
3	Total CO _{2e} emitted per year	✓	✓	✓		Affected by factors beyond cleaner energy (e.g., Tech, Ops, Demand).
4	Total CO _{2e} emitted per year (<i>metric 3</i>) / per total mass of fuel		✓	✓		
5	CO _{2e} reduction from the use of cleaner energy	✓	✓	✓		Affected by factors beyond cleaner energy (e.g., Tech, Ops, Demand).
6	% CO _{2e} emissions reduction from the use of cleaner energy		✓	✓	✓	
7	Mass average carbon intensity (CI) of fuel (gCO _{2e} /MJ) ^b		✓	✓	✓	
8	Cumulative CO ₂ emissions over the period between 2020 and 2050		✓ ^b	✓		Affected by factors beyond cleaner energy (e.g., Tech, Ops, Demand).
9	gCO ₂ /RTK			✓	✓	Affected by factors beyond cleaner energy (e.g., Tech, Ops, Demand). Restricted to commercial aviation.
10	gCO ₂ /ATK			✓	✓	Affected by factors beyond cleaner energy (e.g., Tech, Ops, Demand).

TABLE 3: Possible Metric Options for Cleaner Energy for International Aviation

^a Information provided by CORSIA is not fully comprehensive due to the scope of CORSIA

^b CCR information covers up to 2035.

SAF production short-term scenarios for 2030

The **short-term scenarios for 2030** were originally developed by CAEP in 2021 and included five short-term scenarios, based on publicly available announcements of SAF production: “low”, “moderate”, “high”, “high+”, and “max”. Such information in 2021 was incorporated in the LTAG report in 2022, in which the three short-term scenarios “moderate”, “high” and “high+” were associated with the LTAG scenarios IS1, IS2 and IS3, respectively.

The results shown in Table 4 reflect a further update of the short-term projections for 2030, as compared to the LTAG scenarios IS1, IS2 and IS3. The updates to the short-term projections include further announcements of SAF production facilities by 31 January 2023. Therefore, fuel volumes from the short-term projections out to 2030 are not the same volumes reported in the LTAG report, given the different points in time in which the different analyses have been prepared.

Short-term production Scenario	Projected SAF production quantities (kilo tonne)	global projected fuel demand* (kilo tonne)	SAF Replacement ratio
LTAG IS1	7,608	347,440	2.19%
LTAG IS2	13,713	344,618	3.98%
LTAG IS3	16,973	338,974	5.01%

TABLE 4: Projected SAF production volumes in kt for the year 2030, based on announcements made up to 31 January 2023

Diffusion modelling was used to more accurately project later years’ production beyond the 4-5 years typical for project announcements. However, the diffusion approach does not yield world-region-specific projections but rather global projections. Therefore, the analysis rely on scenario-adjusted announcements from the database for reporting world-region-specific SAF volumes in 2030.

Although SAF activities are in its early stages and are evolving very rapidly in different parts of the world, when analyzing the current results by region of production, it is found that across all scenarios, the majority of SAF production is forecasted to be in the US, followed by the EU.

The following **essential aspects** are highlighted:

- The analysis used the SAF database that was frozen on 31 January 2023, and announcements made since then are not included in the data;
- Facility announcements made later, as well as policy developments that could support the SAF production scale-up, are not included in the regional breakdown;
- Updating the database is a continuous task with additional announcements being captured, and therefore the output from database analyses in the future will change;
- Given the relatively small global SAF volumes, small volume changes in one world region can have a significant impact on the share of this world region in total production;
- Many facility announcements have incomplete data, and assumptions had to be made with regard to product slate; and
- The regional breakdown is based on scenario-adjusted announcements and does not include any diffusion-modelling. The assessment results and methodology can be found in the **ICAO public website**.



Although the first assessment was done in the beginning of the year 2023, since then, there were so many more developments that it was appropriate to undertake an additional look on the progress to date in order to provide the most up-to-date information to States for CAAF/3.

From February to the beginning of November 2023, **90 additional facility announcements have been identified through publicly-available sources.**

Short-term Scenario	Additional SAF production capacity (kilo tonne)	global projected jet fuel demand* (kilo tonne)	Additional SAF Replacement ratio (only considering SAF announcements described in 3.2 a))
LTAG IS1	12,014	347,440	3.5%
LTAG IS2		344,618	3.5%
LTAG IS3		338,974	3.5%

TABLE 5: Additional SAF production capacity announced since 31 January 2023

The additional announcements (Figure 5) refer to facilities that could produce SAF and/or other hydrocarbons that could eventually be directed to SAF production (e.g. Renewable Diesel).

- 41 of the announcements include specific SAF capacity numbers, summing up to 12,014 kT of SAF production capacity and 2,884kT of other hydrocarbons capacity on the same facilities.
- 16 announcements refer to SAF production and include total capacity numbers, which include SAF, LCAF and other hydrocarbons (e.g. renewable diesel). These announcements sum up to an additional 6,825 kT of fuel production capacity.
- 12 announcements do not refer to SAF production, but include specific production capacity of hydrocarbons that could be eventually directed to SAF production. These announcements sum up to 2,457 kT of hydrocarbons production capacity.
- 20 announcements refer to potential SAF production but do not include any capacity numbers, and one (1) announcement refers generally to renewable fuel production, without any specification on which fuels. Therefore, no production capacity from these facilities was added to the total capacity numbers described above. Nevertheless, this indicates a clear interest in SAF production, including expected levels of investment in the sector.
- 43 out of the 90 announcements refer to more mature SAF production technologies: ATJ, HEFA, and Fischer-Tropsch. 21 announcements refer to “Power to liquid” facilities that plan to convert CO₂ and renewable energy into hydrocarbons.

The most robust CAEP assessment based on the announcements until 31 January 2023, as reflected in Table 4, and the additional SAF production announcements since 31 January 2023 as reflected in Table 5, results in **a potential SAF replacement ratio ranging from 2.2% (0% success rate of additional announcements) to 8.5% (100% success rate of additional announcements) in 2030**. It is worth noting that this only encompasses the 41 additional announcements which include specific SAF capacity numbers (representing 46% of the 90 additional announcements).

4.2 Regulatory framework

Why do we need a globally harmonized regulatory framework?

In general, a globally harmonized framework and the role of ICAO to promote SAF, LCAF and other cleaner energies have been a key request from all CAAF/3 preparatory events. Many stakeholders, such as States, industry and financial sector, requested ICAO to provide a regulatory certainty and confidence, including for attracting funding and investments.

The importance of using and building upon the existing ICAO agreements and tools was also highlighted by States in order to avoid additional administrative burden. In this context, the **Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)** was referred to, as the ICAO regulatory framework that is already in place, providing harmonized sustainability certification as well as fuel monitoring and accounting parameters.

Harmonized fuel sustainability certification

ICAO achieved tremendous progress to harmonize the approaches to sustainability, through the **adoption of sustainability criteria, sustainability certification processes, and methodologies for assessment of life cycle emissions of such fuels**, as part of the implementation of the CORSIA, which allows an airline to claim the reduction of its offsetting requirements through the use of such fuels. Of note is that aviation is the only sector that was successful in establishing global, harmonized criteria for assessing the sustainability of fuels.

Following the CORSIA agreement in 2016, Annex 16, Volume IV (SARPs) to the Chicago Convention was adopted in 2018, with the definition of **CORSIA Eligible Fuels (CEF)**, which include **Sustainable Aviation Fuels (SAF)** and **Lower Carbon Aviation Fuels (LCAF)**, provided that such fuels meet the applicable **CORSIA Sustainability Criteria** and are produced by fuel producers that are certified by **approved Sustainability Certification Schemes (SCSs)**.

Emissions reductions from the use of CEF are calculated on the basis of **ICAO-approved life-cycle emissions values** for various fuel pathways, obtained as part of the sustainability certification process by SCS. Such **life cycle emission values are obtained with the use of default values, or the calculation of actual values by the methodologies, defined by ICAO**, and the values consider the emissions associated with the full supply chain of CEF, as well as emissions associated with land use changes associated with the production of CEF.

CORSIA sustainability criteria

In June 2019, the ICAO Council approved the CORSIA Sustainability Criteria applicable to CEF during the pilot phase of CORSIA (i.e. from 1 January 2021 to 31 December 2023), covering two Themes related to carbon reduction: Theme 1 (Greenhouse Gases (GHG)) and Theme 2 (Carbon stock).

Further work led to the approval of the CORSIA Sustainability Criteria applicable after the pilot phase (i.e. from 1 January 2024), following decisions by the ICAO Council in November 2021 (applicable to SAF) and November 2022 (applicable to LCAF). These decisions, which are reflected in the third edition of the ICAO document CORSIA Sustainability Criteria for CORSIA Eligible Fuels, expanded the scope of the sustainability certification to 14 Themes that encompass not only carbon reduction, but also aspects related to environmental and socio-economic sustainability (Figure 5).

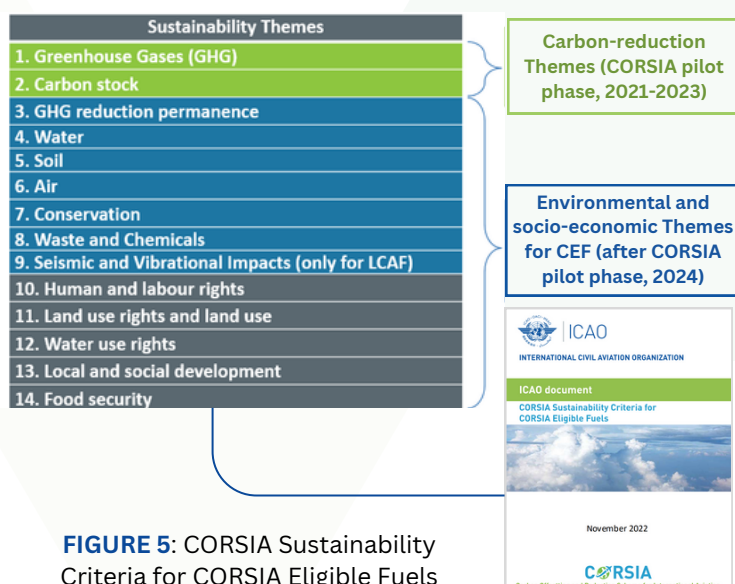


FIGURE 5: CORSIA Sustainability Criteria for CORSIA Eligible Fuels

Sustainability Certification Schemes (SCSs)

Sustainability Certification Schemes (SCSs) are also approved by ICAO to be eligible to perform the certification of CEF, based on their eligibility evaluation to meet the ICAO-defined requirements, “CORSIA Eligibility Framework and Requirements for Sustainability Certification Schemes”. The eligibility evaluation of SCSs under CORSIA is undertaken by the Sustainability Certification Schemes Evaluation Group (SCSEG), a subgroup of CAEP and submitted for ICAO Council approval.



In June 2023, **for the first time** a sustainable aviation fuel (SAF) was **certified under CORSIA**, making use of the two ICAO-approved **Sustainability Certification Schemes** designed for this purpose.

More details are available at [ICAO website](https://www.icao.int/corsia).

Accounting and Reporting

Why do we need fuel accounting and reporting?

In general, accounting and reporting of fuels enables the monitoring of the progress towards the implementation of all elements of the basket of CO₂ reduction measures for international aviation.

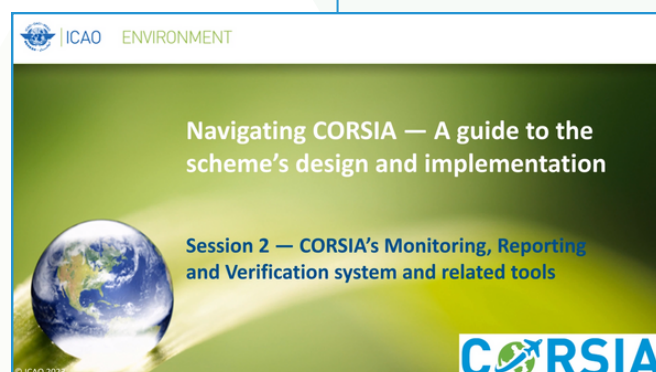
In light of the Assembly's request to **monitor the progress toward the achievement of the LTAG** (Resolution A41-21, paragraph 9 refers) and the subsequent request of the Council (March 2023), CAEP initiated its technical work on the methodologies for LTAG Monitoring and Reporting (LMR).

Does ICAO have a fuel accounting and reporting system?

CORSIA already provides a robust harmonized fuel accounting and reporting system, which States and other stakeholders expressed during the CAAF/3 preparatory events, as a good basis for the consideration of how to monitor the use of cleaner energies for international aviation.

The successful implementation of CORSIA relies on the availability of verified, reliable data on annual CO₂ emissions for all years of the scheme's duration (2019-2035).

The collection and processing of this data is based on the **CORSIA Monitoring Reporting and Verification MRV system** that is defined by the SARPs in Annex 16, Volume IV. Aeroplane operators on international routes are required to monitor, report and verify their CO₂ emissions annually. Verifications are undertaken by a third party independent from the airplane operator.



For each year in the period 2021-2035, States are required to calculate the annual offsetting requirements for each operator attributed to them.

This is done by multiplying an operator's annual CO₂ emissions subject to offsetting requirements, as reported in its verified Emissions Reports, by an annual growth factor (Step 1 in Figure 6 below) that takes into account the annual sector's growth factor and, for the years 2033-2035 only, the operator's individual growth factor together.

Under CORSIA, an **aeroplane operator can claim the reduction of its CO₂ offsetting requirements through the use of CORSIA eligible fuels (CEF).**

Operators that wish to claim emissions reductions from the use of CEF must monitor the use of these fuels and calculate the resulting emissions reductions (in tonnes) based on the CORSIA life-cycle methodology.

It should be noted that the implementation of the CORSIA SARPs in Annex 16, Volume IV provides a **means for the avoidance of double claiming of fuels' environmental benefits**, through the comparison of information reported to ICAO by States through the MRV system, with information reported to ICAO by the Sustainability Certification Schemes (SCS).

The CORSIA SARPs also allow **aeroplane operators that purchase SAF and LCAF to claim environmental benefits of those fuels, even if they are not physically used in the operator's aeroplanes.**

At the end of each 3-year compliance period, the State deducts the verified emissions reductions from the use of CEF from the total annual offsetting requirements for the period (Step 2 in Figure 6) to calculate an operator's total final CO₂ offsetting requirements (in tonnes) for the compliance period (Step 3 in Figure 6), which have to be met through the purchase and cancellation of an equivalent amount of CORSIA eligible emissions units.

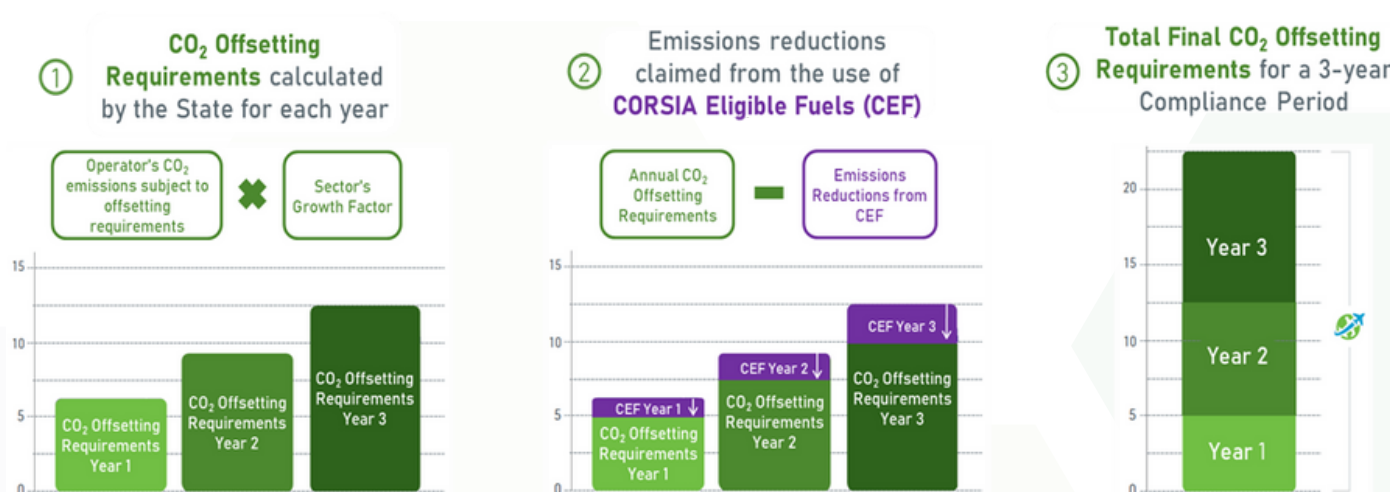


FIGURE 6: Determination of CORSIA offsetting requirements

Which technical principles could be used for the global estimation/measurement and reporting of GHGs?

The CAEP technical work also identified possible parameters for fuel accounting and reporting methodologies for international aviation, to ensure consistent application as part of monitoring of the LTAG progress.

From a technical perspective, in the context of greenhouse gas (GHG) emissions methodologies, there are specific principles that apply to the estimation/measurement and reporting of GHGs such as transparency, accuracy, consistency, comparability and completeness. For the purposes of aviation fuels, such technical principles could be defined as follows:

Transparency: Assumptions and methodologies used for the estimation of emissions and emissions reductions are clearly reported and explained;

Accuracy: Estimates are systematically neither over nor under true emissions, so far as can be judged, and that uncertainties are reduced so far as is practicable;

Consistency: Estimates are internally consistent over a period of years (for example, using the same estimation methodologies over time);

Comparability: Reported estimates are comparable among countries by using agreed estimation methodologies and reporting formats; and

Completeness: Estimates cover all international routes from all civil aircraft.

In light of the technical principles mentioned above, the following parameters could be used for fuel accounting and reporting methodologies for international civil aviation, to ensure consistent application as part of monitoring of the LTAG progress:

- Ensuring **global coverage** of emissions from international civil aviation, **as part of monitoring of the LTAG progress**
- Supporting **consistent application** of methodologies amongst States, in a transparent manner
- Enabling **accurate emissions reporting**, including the use of cleaner energy for international civil aviation
- Ensuring **environmental integrity through the avoidance of double-counting**, including between domestic and international civil aviation
- Preferring **verified emissions information** that could be supported with other information for the verification or validation of reported emissions
- Promoting cost-effectiveness by using **simple** accounting and reporting methodologies and procedures
- **Avoiding excessive administrative burden** on States and aeroplane operators; and,
- Leveraging (to the extent possible) existing methodologies and procedures under the **CORSIA Monitoring, Reporting and Verification (MRV) system** for international civil aviation.

In the context of the LTAG monitoring, CAEP considers that **fuel accounting and reporting methodologies for international civil aviation are not expected to have negative effects** (e.g. increased costs or administrative burden) to the sustainable development of international civil aviation. Since the LTAG is a collective goal from ICAO and its Member States, any emission reductions captured by fuel accounting and reporting methodologies will be accounted equally for achieving the LTAG, independently from where the cleaner energy is produced and/or accounted for.

It should be noted that **CAEP consideration of these possible parameters for fuel accounting and reporting methodologies is in the context of monitoring the LTAG progress** – it is separate and distinct from the current industry-led SAF book and claim systems, with its own methodologies.



4.3 Implementation support

As mentioned in Chapter 2, Assembly Resolution A41-21, paragraph 17 recognized that “**means of implementation commensurate to the level of ambition**, including financing, will promote the achievement of the LTAG”.



In that regard, and in line with ICAO’s **No Country Left Behind** initiative, ICAO is taking action to assist its Member States towards the achievement of the “**collective long-term global aspirational goal for international aviation (LTAG) of net-zero carbon emissions by 2050, in support of the Paris Agreement’s temperature goal, recognizing that each State’s special circumstances and respective capabilities**” (A41-21, paragraph 7 refers) by providing implementation support for the development and deployment of Sustainable Aviation Fuels (SAF), Lower Carbon Aviation Fuels (LCAF) and other cleaner energies for aviation, with the main objective of assisting States and the international aviation industry on its energy transition.

As previously mentioned, the 41st ICAO Assembly requested the Council to “promote the voluntary transfer of technology, in particular for developing countries and States having particular needs, to enable them to adapt to cutting-edge technology and to enhance their contribution to achieve the LTAG” (A41-21, paragraph 18 d) refers).

ACT»SAF

In June 2022, prior to the 41st Session of the Assembly, the ICAO **Assistance, Capacity-building and Training for Sustainable Aviation Fuels (ACT-SAF)** programme was launched to provide tailored support for States in various stages of SAF development and deployment, and serve as a platform to facilitate knowledge sharing and recognition of all SAF initiatives around the globe.



The Assembly welcomed the ACT-SAF programme, and required the programme to be “extended to add support to the implementation of other emissions reduction measures in an ICAO ACT-LTAG programme (e.g. aircraft technologies, operational improvements, infrastructural changes, LCAF and other cleaner energy sources for aviation)” (A41-21, paragraph 18 c) refers).

ICAO is considering the extension and means to effectively incorporate all aviation emissions reduction measures in the ACT-LTAG programme, bearing in mind the further efforts and resources required.



ACT-SAF Partners

The ACT-SAF programme operates based on in-kind contributions and financial support received from supporting States and organizations. In line with that, the 41st Assembly “urges ICAO Member States to make regular and substantial contributions to the ICAO Environment Fund, to address specific activities on the LTAG, including the ACT-SAF programme, aiming at assisting developing States and States having particular needs” (A41-21, paragraph 18 e) refers).

ACT-SAF partners contributed to the ICAO Secretariat human resources (i.e., secondments by Brazil, France, Singapore and the European Union) and also provided relevant knowledge and expertise for the programme activities, such as for the ACT-SAF Training Series, and the development of feasibility studies’ template and guide. As of November 2023, financial resources to the ICAO Environment Fund were also received from Cote d’Ivoire, France, the Netherlands, the United Kingdom and the European Union, including for the conduct of SAF feasibility studies.



The map below in Figure 7, shows the ACT-SAF partners, as of November 2023.

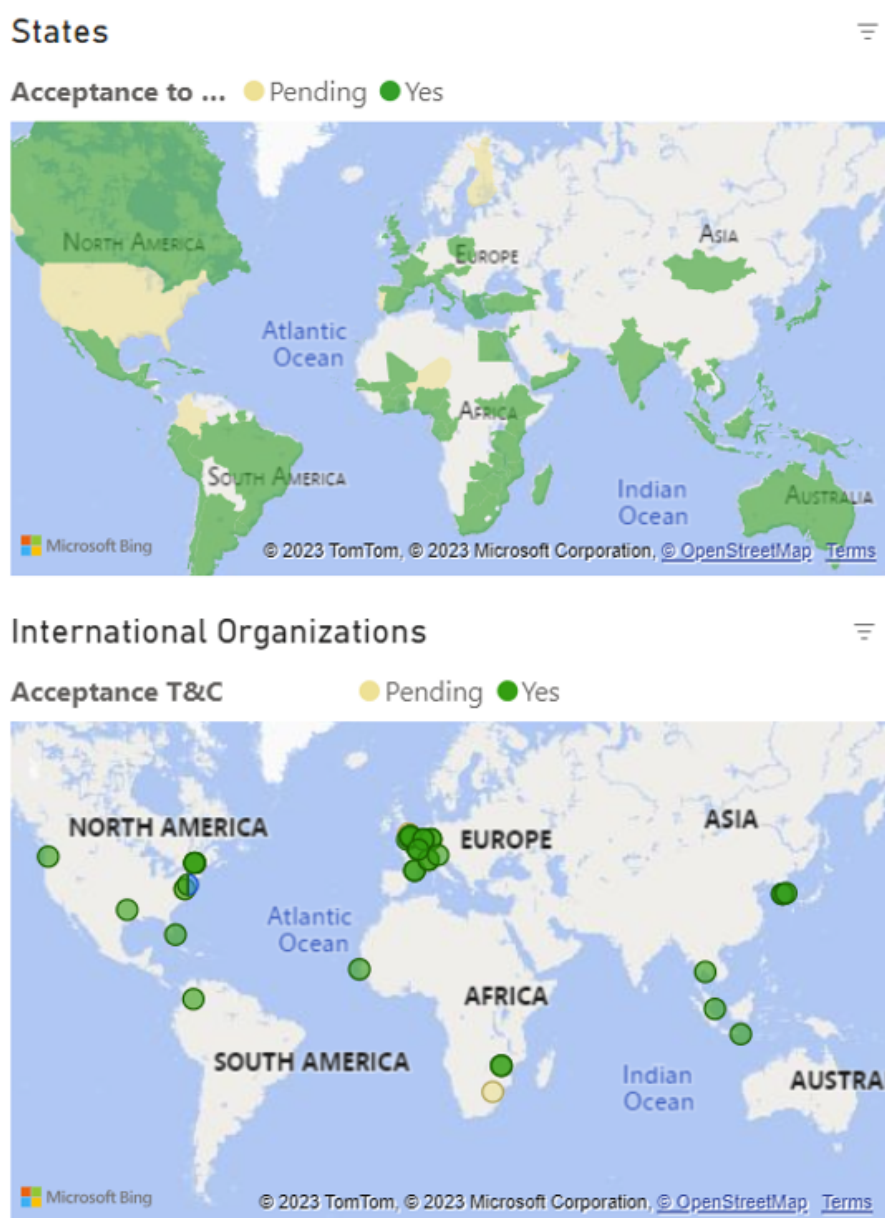


FIGURE 7: ACT-SAF partners map (as of November 2023)

As of November 2023:

- **89** States
- **51** Organizations

Have joined ACT-SAF!

ACT-SAF Terms and Conditions

Terms and Conditions are made available for acceptance by electronic means on the ICAO website, encouraging all States and other stakeholders to participate in the ACT-SAF programme.

Once a partner signs the Terms and Conditions, ICAO contacts the partner to identify needs and/or available offer of support, and starts engaging the partner in the activities of the programme.



CLICK AND JOIN!

STATE/ORGANIZATION/INSTITUTION (NAME OF STATE, ORGANIZATION OR INSTITUTION) *

Your answer

10.2 The Partner shall keep ICAO duly informed of all measures which it adopts for the fulfilment of these Terms and Conditions or which may affect these Terms and Conditions.

11. Acceptance *

11.1 IN WITNESS WHEREOF, the Partner hereto, acting through its duly authorized representative, has accepted these Terms and Conditions in the English language on the date indicated below.

Name and designation of duly authorized representative

Your answer

FOR [NAME OF STATE, ORGANIZATION OR INSTITUTION] *

Your answer

Date

Date

mm/dd/yyyy 

I accept the [Terms and Conditions for the ACT-SAF programme](#) *

☐ Yes

Submit

Clear form

FIGURE 8: Section of the ACT-SAF Terms and Conditions

ACT-SAF Web-based Platform



The **ACT-SAF Platform** is the primary ICAO web-portal, recognizing all activities being undertaken under the programme. It is continuously updated including information on the initiatives implemented by ACT-SAF partner States and organizations.



Activities under ACT-SAF

The activities envisaged under ACT-SAF include training programmes, feasibility studies, support for SAF certification and for policy development, as well as the implementation of specific SAF projects, and includes the establishment of partnerships amongst States and other stakeholders, with due consideration of languages and geographical aspects, and availability of resources.

ACT-SAF Training Series



Since November 2022, ICAO has been conducting the **ACT-SAF Training Series**, where experts from the ACT-SAF partners deliver presentations and answer live questions from the participants on various subject matters, such as fuel sustainability, fuel certification, fuel production technology, fuel-policies, logistics, market, and feasibility assessment. All the ACT-SAF partners are invited to attend the training sessions, which are recorded and made available on the ACT-SAF Platform (Table 6) along with the presentations delivered.



ACT-SAF Series	Date	Topics	Contributor(s)	Abstract	Video and Presentation
#1	25 November 2022	An introduction to SAF	ICAO	<ul style="list-style-type: none"> Introduction to ACT-SAF Basics of SAF 	 Download Presentation
#2	25 January 2023	SAF sustainability and reporting under CORSIA	ISCC RSB Verifavia	<ul style="list-style-type: none"> process for sustainability certification of SAF Reporting and verification of SAF Claims under CORSIA 	 Download Presentation
#3	23 February 2023	SAF technology and certification	Airbus US FAA Safran	<ul style="list-style-type: none"> specifications for aviation turbine fuels process for approval for new production pathways 	 Download Presentation
#4	23 March 2023	SAF policies	Brazil, European Commission, France, Japan, Singapore, United Arab Emirates, United States	<ul style="list-style-type: none"> Practical experiences from States that are developing a policy for SAF Sharing of knowledge in the policy development process 	 Download Presentation

ACT-SAF Series	Date	Topics	Contributor(s)	Abstract	Video and Presentation
#5	31 August 2023	SAF conversion processes	<ul style="list-style-type: none"> Neste Gevo Sasol Topsoe SAF+ Consortium 	Conversion processes available to produce SAF: <ul style="list-style-type: none"> - HEFA - hydroprocessed esters and fatty acids - ATJ - Alcohol to Jet - Fischer-Tropsch - Power to Liquids (PIL) 	Download Presentation
#6	12 October 2023	SAF accounting and book and claim systems	IATA IBAC COSABA RMI/SABA RSB ISCC	Basic concepts on SAF accounting and an overview of ICAO work and ongoing industry initiatives on Book & Claim systems	Download Presentation
#7	TBC	Feasibility Assessment	TBC		

TABLE 6: ACT-SAF Training Series

Template and Guide for SAF Feasibility Studies

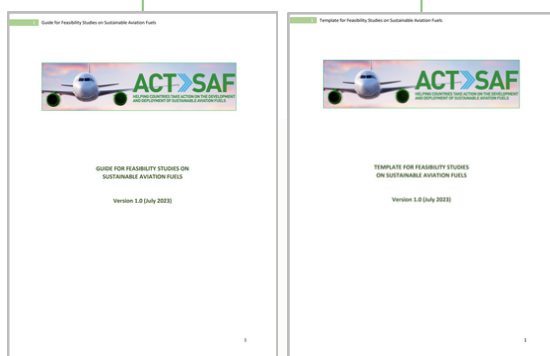
ICAO developed a **template for feasibility studies on SAF**, in consultation with the ACT-SAF partners, to facilitate the preparation of standardized feasibility studies on SAF.

This can be used to assess the feasibility of SAF development and deployment at the State and regional (e.g., group of States) levels.

An **accompanying guide** was also developed, which is consistent with the structure defined in the template, and incorporates examples from a selection of publicly available feasibility studies, as well as resources on SAF published by ICAO, to show in a practical manner varying approaches in support of the development of a SAF feasibility study.



The template and guide are available on the ACT-SAF Platform, aiming to stimulate in-depth discussions between States and consultancies performing feasibility studies, and facilitate next steps in SAF development and deployment, which may also facilitate financing.



SAF Feasibility Studies

With the funding provided to the ICAO Environment Fund to support the ACT-SAF programme, **ICAO is working to deploy feasibility studies in the various States.**

For example, the contribution from the European Union to ACT-SAF will be employed to develop **SAF feasibility studies in ten partner States (Cameroon, Egypt, Equatorial Guinea, Ethiopia, India, Gabon, Mauritania, Mozambique, Senegal, and South Africa)**. This will constitute a crucial step towards developing a SAF market in these partner States, through the identification of viable SAF feedstock/conversion technologies, estimates on costs for SAF production facilities, policy options, and long-term roadmaps, which may be incorporated into their State Action Plans.

The funds provided by the other ACT-SAF supporting entities might be employed in similar projects, and preliminary discussions have been underway regarding the scope of support under the ACT-SAF programme, and other projects are expected to be deployed in the near future.

All SAF feasibility studies above will make use of the ACT-SAF template for feasibility studies, as is the case for the **three feasibility studies recently completed for Cote d'Ivoire, Rwanda, and Zimbabwe**, under the **ICAO assistance project with EU funding, Phase II**.



ACT-SAF Trackers



The ACT-SAF Platform includes several **trackers related to aviation cleaner energies**, including the list of feasibility studies conducted all around the globe (including those supported by ICAO), as well as the list of relevant events, and training and outreach initiatives related to aviation cleaner energies. The ICAO ACT-SAF trackers (Figure 9) are regularly updated, facilitating the exchange of information and sharing of best practices for all stakeholders.

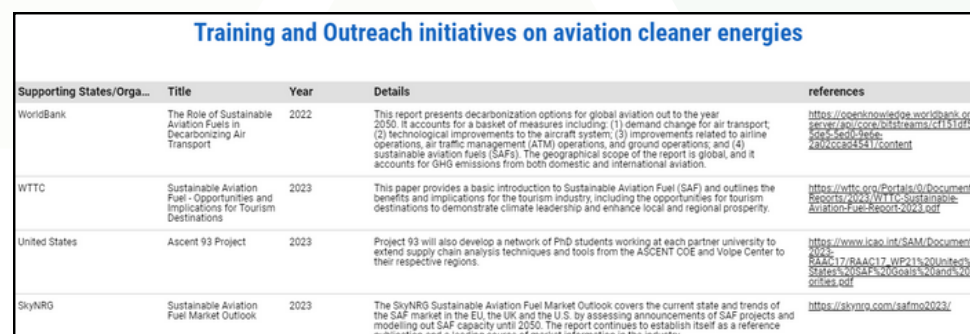
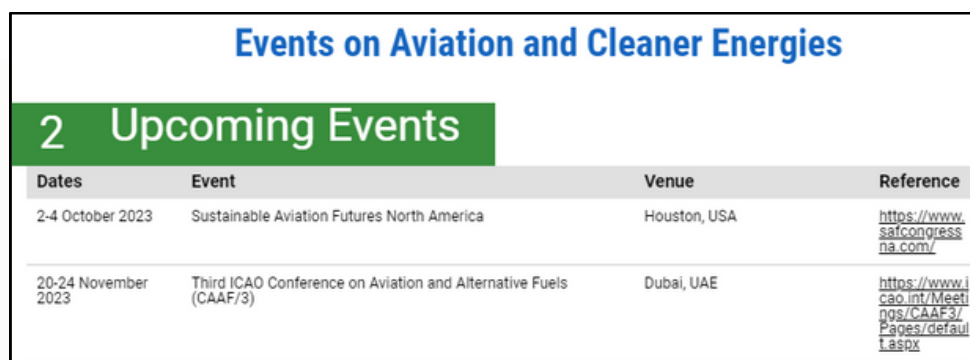
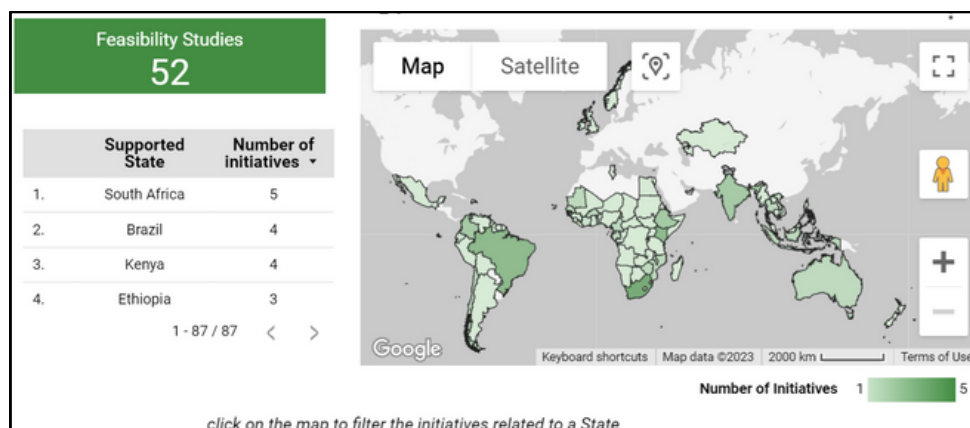


FIGURE 9: ACT-SAF Trackers

4.4 Financing

Following the outcomes of the 41st Session of the ICAO Assembly and the adoption of the long-term aspirational goal (LTAG) of net zero carbon emissions by 2050, ICAO has been engaged in fostering facilitated access to both public and private investment capacities, as well as funding from financial institutions, including development banks.

Part of this work is pursued under the ICAO Assistance, Capacity-building, and Training for Sustainable Aviation Fuels (ACT-SAF) programme, as well as the ICAO Council's dialogues with financial institutions and investment companies (see details in Chapter 3, section 3.2).

How much financing is needed for aviation cleaner energies?

Securing financial resources is of paramount importance for the successful deployment of SAF, LCAF and other clean energy solutions in aviation. This significance arises from the fact that the expansion of “fuel-related” resources, aligned with the LTAG's objectives, **would require cumulative investment amount of USD 3,200 billion for fuel suppliers for 2020-2050**, according to the LTAG Report. Figure 10 shows a breakdown of estimated investment needs for fuel suppliers across various types of fuels.

Stakeholders	Costs/investments
States	\$160b
Air Navigation Service Providers	\$20b
Aircraft manufacturers	\$350b
Fuel suppliers	\$3,200b
Airports	\$125b

Breakdown of fuel suppliers	Costs/investments
SAF biomass-based fuels	\$950b
SAF from gaseous waste	\$1,700b
SAF from atmospheric CO ₂	\$460b
LCAF	\$60b
Hydrogen	\$55b

Note: Some costs incurred by upstream stakeholders may be passed on to downstream stakeholders in the form of incremental price increases.

FIGURE 10: Projected cumulative costs and investments needs associated with the LTAG Report's highest-ambition scenario (IS3). The estimated cumulative investment needs of \$3,200b from 2020-2050 (top table) breaks down to the figures shown in the lower table, across the various fuel categories.

SAF are **currently more costly to produce than conventional aviation fuels by a factor 1.5 to 5 depending on the SAF technology considered**. This is because the SAF industry is in its early stages compared to the conventional aviation fuels industry.

However, with the right amount of investment and supportive policies, production costs are expected to go down as the industry develops, due to the economies of scale and competition in the market (Figures 11 and 12), toward a possible convergence of production costs (and hence market prices) of SAF and conventional fuels in the future.



Source: Waypoint 2050 Factsheet #15 / Jun 2022. Based on ICAO/CAEP data

FIGURE 11: Unit fuel costs across categories of fuel

The LTAG plays a key role to stimulate investments for aviation. Policy signals at global, regional and national level help establish a virtuous cycle that fosters market creation and expansion, which in turn, can help unleash investments and support the financial needs to scale up SAF, LCAF and other clean energies.

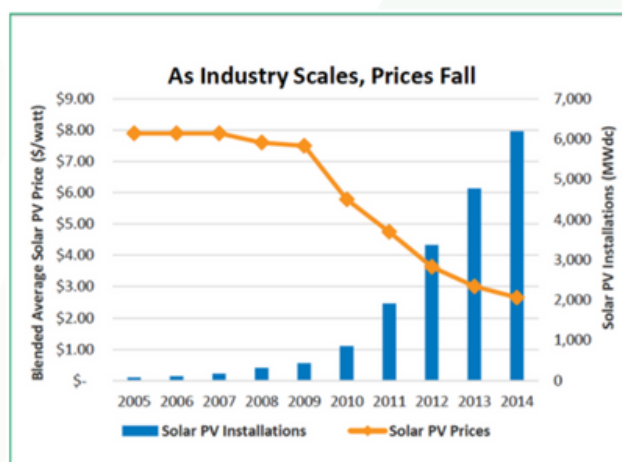


FIGURE 12: Example showing the evolution of prices versus solar PV installations in the US from 2005 to 2014.

Main challenges to overcome

SAF and cleaner energy production capacity is currently limited by a number of challenges related to financing as follows:

- Higher costs of production for SAF in comparison to conventional kerosene;
- Limited availability of cost effective and sustainable SAF feedstock;
- Limited SAF production infrastructure;
- Limited investment and high costs of financing of SAF fuel production infrastructure;
- Competition for resources and incentives with other sectors (e.g. road transport, renewable power); and
- Perceived high risks and costs to finance SAF infrastructure.

To overcome these challenges, a policy intervention will be required to develop SAF production beyond a small scale.

Key drivers for investments in SAF

Elements driving investment in SAF projects include:

- High technology maturity;
- Feedstock availability;
- Certified sustainability of the feedstock;
- Market demand for SAF; and
- Credible project sponsors

In turn, hurdles and possible ways of overcoming them include:

- Low TRL level: Research and development and ASTM certification;
- Sustainability concerns: sustainability certification and close collaboration with sustainability certification schemes;
- High-risk investments - financial support from States and multilateral development banks (e.g., blended finance);
- Price gap with conventional fuel - financial incentives, funding schemes, mandates; and
- Regulatory uncertainty - long-term, harmonized and reliable regulatory standards.

De-risking investments

De-risking cleaner energy investments is a key step towards market development. It requires a combination of factors to increase the confidence of investors, including:

- Regulatory certainty: harmonized, long-term and globally accepted frameworks defining the sustainability of SAF and other cleaner energies, and the methodologies on the calculation of lifecycle values;
- A high level of confidence in sustainability certification processes;
- Certainty in the existence of a large market signals that airlines are willing to purchase SAF (e.g. offtake agreements);
- Public policies pushing the market to supply and uptake SAF through incentives and/or obligations;
- Involvement of financing institutions to underpin public policies and support investments; and
- Examples of successful SAF demonstration projects and/or profitable commercial-size plants.



Where does the money come from?

Public and **private** financing are both important in developing SAF and cleaner energy projects.

The amount of public financing depends on the maturity of the project. Too much public financing may crowd out private sector investment, and insufficient public financing may not suffice to attract private sector investments.

- **Public financing** is initially required to create markets. As markets mature, the role of public financing should decrease, and private sector financing should match the investment needs; and
- **Private financing** is easier mobilized when projects are forecast to produce sufficient revenue to repay outstanding obligations and provide a return on investment.

Regarding public financing, an example of a strategy to address the existing price gap is implementing government-backed price floors during the initial stages of SAF, LCAF and other aviation cleaner energies production.

Price floors can help support investor confidence and solve the “chicken or egg” conundrum, which prevents demand and supply from effectively stimulating each other.

Scaling up production will inevitably mitigate this elevated cost, and similar strategies becomes imperative to render nascent production facilities financially tenable and attract vital investments, particularly during the preliminary developmental phases, prior to the establishment of regulatory frameworks that might stimulate demand (e.g., blending mandates necessitating a specific SAF percentage in aviation fuel blends).

In principle, governments and multilateral development banks (MDBs) appear well-equipped to navigate the array of risks inherent in long-term infrastructure investments.

However, limitations in resources and misalignments between incentives and constraints often limit their ability to mobilize the necessary investment volume required for the substantial scaling-up of SAF, LCAF and other aviation cleaner energies.

However, they possess the potential to facilitate the expansion of private sector investments in SAF through various avenues. Their involvement can aid in mitigating the intricate balance between risk and returns, potentially through mechanisms like blended finance.

Figure 13 exemplifies public and private sources of financing for SAF, LCAF and other cleaner energies sources.

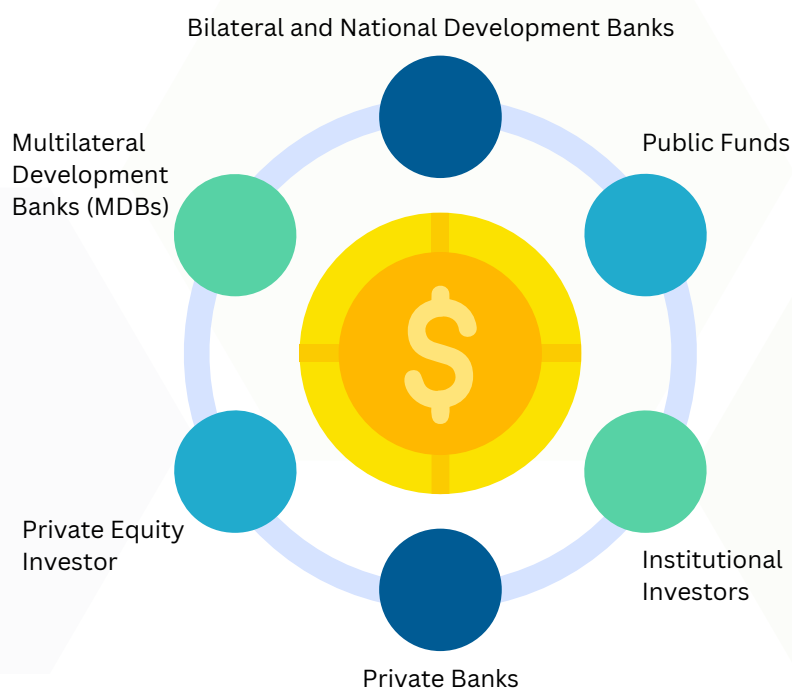


FIGURE 13: Examples of public and private sources of financing for SAF, LCAF and other cleaner energies sources.

Blended Finance (public and private)

Blended finance combines public and private funds to encourage investment in projects that might not attract purely commercial funding. This approach uses a small portion of public funds to rebalance risk and attract larger private investments, acting as a catalyst to de-risk SAF projects.



Both **public** and **private** investments are currently needed to scale up SAF production!

Blended finance particularly suits SAF production projects where high perceived risks require substantial returns. Blended finance employs various funding types, seniority levels, and risk mitigation to ease investor concerns.

It can also address foreign exchange risk and create diverse risk-modifying instruments. In that sense, blended finance is key to help implementing decarbonization strategies, as funding for the required investment may come from public and private sources, in various forms, such as accumulated profits, government contributions, commercial debt financing (including loans and leasing), bond issues and equity financing.

Possible financial instruments

- **Grants** are sums of money given by a government/organization for a specific purpose, which do not have to be paid back. Grants can be used to support a SAF project, e.g. to cover project development costs. Grants can also serve to fund capacity-building programmes (e.g. feasibility studies under the ACT-SAF programme) or to support policy development.
- **Loans** are a crucial component to finance a SAF project. Banks may be reluctant to agree a loan if they identify too big a risk regarding the ability of the project to pay back. Public entities (governments, multilateral development banks, others) can assume some of the risk of such loans, thereby protecting the bank from the risk and reducing the cost borrowing money.



- **Bonds** (including **green bonds**) provide a stable source of long-term financing for large-scale projects. They can be structured to match the expected cash-flow of the project (thus reducing risks for investors and minimizing financing costs), and can be traded in financial markets.

By adopting green loans or bonds, the aviation industry can reap substantial benefits once these financial instruments can offer low-cost funding for sustainable aviation projects. Furthermore, the sustainability-linked loans or bonds which directly correlate interest rates with ESG performance, presents enticing financial incentives for companies to elevate their sustainability practices.

Green and sustainable finance can play a pivotal role in tackling these challenges by offering crucial financial backing for the research and development of innovative technologies and infrastructure. This entails directing investments towards projects that yield both financial returns and substantial environmental advantages.

Industry actors (airlines, SAF producers, others) resort to various financing strategies to invest in SAF

On August 7, 2014, Cathay Pacific Airways, a Hong Kong-based airline, announced that it has made a strategic equity investment in Fulcrum BioEnergy Inc., a U.S.-based leader in the development and commercialization of converting municipal solid waste into sustainable aviation fuel. Cravath represented Cathay Pacific in connection with this transaction.

United Airlines Launches \$100 Million Investment Vehicle for SAF

3 June 2022
Neste signs a green term loan agreement
 Published in Releases and news under Investors
 Neste Corporation, Press Release, 3 June 2022 at 11:45 a.m. (EET)
 Neste has signed today a EUR 500 million green term loan agreement. The proceeds of the loan will be used to finance Eligible Assets and Projects in accordance with Neste's Green Finance Framework. The loan has a tenor of 3 years with two 1-year extension options.

Governments and organisations also deploy financing instruments to kick-start their domestic market

How LPO Can Support the Sustainable Aviation Fuel Grand Challenge
 The Department of Energy today announced the Sustainable Aviation Fuel Grand Challenge, a government-wide effort to reduce the cost, enhance the sustainability, and expand the production and use of Sustainable Aviation Fuel (SAF). The effort is part of the Biden-Harris Administration's overall strategy to decarbonize the aviation sector by 2050. Read more in the White House fact sheet.

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 the LPO's Title 17 Innovative Energy Loan Guarantee Program. LPO has received strong interest from SAF project developers about the potential for DOE financing of SAF production facilities.

Australian government launches SAF funding initiative
 The funding will go towards projects across the SAF supply chain as the country looks to develop its ability to produce the low-carbon biofuel.

Advanced Fuels Fund (AFF) competition winners
 Each organisation will receive a share of £165 million for the development of sustainable aviation fuel (SAF) production plants in the UK. The following projects have been awarded funding.

FIGURE 14: Examples of public and private financing

Guidance document: Financing Aviation Emission Reductions



In 2017 (and updated in 2018), the guidance document on “**Financing Aviation Emissions Reductions**” was produced within the framework of the joint ICAO-UNDP-GEF assistance project, *Transforming the Global Aviation Sector: Emissions Reductions from International Aviation*. The purpose of this document is to inform ICAO Member States on how to finance projects that can be deployed to reduce CO₂ emissions from international aviation activities. The guidance includes an initial overview of project financing, barriers to climate financing in developing States, the roles of the public and private sectors, types of financing instruments, and the types of organizations that are active in climate financing programmes. While focusing on renewable energy projects, the document supports an understanding of financing mechanisms that may apply to projects for SAF, LCAF and other aviation cleaner energy projects.

Financing aspects of the ICAO State Action Plan (SAP) initiative

ICAO has been developing and updating **Doc 9988, “Guidance on the Development of States’ Action Plans on CO₂ Emissions Reduction Activities”**, which aims to support Member States as they develop and implement their Action Plans. The voluntary preparation of States’ action plans helps States to identify their concrete actions to deploy SAF, LCAF and cleaner energy, as well as the specific assistance needs to implement such measures, notably financing. In turn, it allows ICAO to understand and, where possible, support States’ specific needs in terms of financing.

The guidance document is currently under revision, with the objective, among others, to provide more detailed information to Member States on the assessment of their financial needs, so that States will be able to communicate their financing needs to investors and hence attract the necessary funds to the deployment of SAF, LCAF and cleaner energy contained in the State Action Plans.



Based on the ICAO Guidance Doc 9988, States could fully use the potential of the State Action Plan as a tool to support the funding and financing process, specially within the first stages of the process such as the scoping stage. Figure 15 exemplifies how SAPs can be used as a financing facilitation tool.

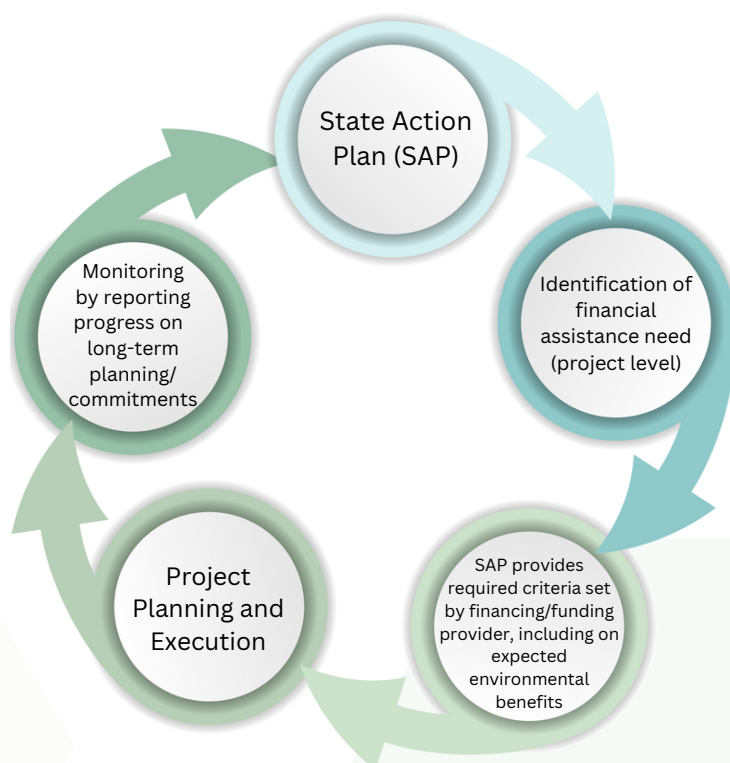


FIGURE 15: Example of how a State Action Plan can be used as a financing facilitator tool

To respond to the request by Assembly Resolution A41-21, paragraph 18 on financing, ICAO is also considering the establishment of the **ICAO “Finvest Hub”** initiative to facilitate enhanced access to public and private investment capacities and funding from financial institutions, with a focus on developing countries and States with particular needs, for projects that contribute to the decarbonization of international aviation.

5. CAAF/3 Discussions and Outcomes

The CAAF/3 was held from 20 to 24 November 2023 in Dubai, United Arab Emirates, in response to the Assembly request for reviewing the 2050 ICAO Vision for SAF, including LCAF and other cleaner energy sources for aviation, **in order to define an ICAO global framework** in line with the No Country Left Behind (NCLB) initiative and taking into account national circumstances and capabilities (Assembly Resolution A41-21, paragraph 28 f) refers).

The conference was convened on 20 November 2023 to accommodate the ministerial and high-level statements of States, while the election of the Chairperson and consideration of agenda items started on 21 November 2023 onwards.

Over 1000 participants registered for the week long conference, and 40 working papers were discussed by the Member States. Documentation by the ICAO Secretariat was published well before the conference, allowing States/Organizations proper time to review them and submit their documentation for the conference. Subsequently, these submissions were also published and are available at the [CAAF/3 documentation website](#).



The aim of this Chapter 5 is to **provide readers with the highlights of the discussions during CAAF/3 and to emphasize its main outcomes.**

At the Third ICAO Conference on Aviation and Alternative Fuels (CAAF/3), the international aviation sector has taken a giant leap to accelerate its decarbonization.

Through the **ICAO Global Framework for Sustainable Aviation Fuels (SAF), Lower Carbon Aviation Fuels (LCAF) and other Aviation Cleaner Energies**, ICAO and its Member States strive to achieve a **collective global aspirational Vision to reduce CO₂ emissions in international aviation by 5 per cent by 2030, compared to zero cleaner energy use.**



Check next page for an explanation on the adopted Vision!

Key elements of the Framework include a collective Vision for the clean energy transition, harmonized regulatory foundations, supporting implementation initiatives, and improved access to financing for related initiatives so that “No Country is Left Behind.”

The role of the Framework is to facilitate the scale-up of the development and deployment of SAF, LCAF and other aviation cleaner energies on a global basis, and mainly by **providing greater clarity, consistency and predictability to all stakeholders**, including those beyond the aviation sector.

ICAO’s Framework will support the cleaner energy transition of the aviation sector needed to achieve net-zero carbon emissions by 2050.



FIGURE 1: CAAF/3 convened at Dubai, UAE.



CAAF/3 adopted the ICAO Global Framework for SAF, LCAF and other Aviation Cleaner Energies (the “Framework”), which includes a **“collective global aspirational Vision to reduce CO₂ emissions in international aviation by 5 per cent by 2030 through the use of SAF, LCAF and other aviation cleaner energies (compared to zero cleaner energy use)”**.

The achievement of such a Vision will depend on two factors:

5%

of CO₂ emissions reductions in international aviation by 2030 through the use of SAF, LCAF and other aviation cleaner energies (compared to zero cleaner energy use)

- 1 The quantity of SAF, LCAF and other aviation cleaner energies used in international aviation; and
- 2 The life cycle emissions value associated with these fuels and cleaner energies.



How to **quantity of the fuel/energy demand** ?

The ICAO LTAG Report forecasts around 212 Mt of global fuel demand by international aviation for the year 2030.

Actual use of global fuel by international aviation can be quantified by the Monitoring, Reporting and Verification (MRV) system, such as the CORSIA MRV system.

The phrase “compared to zero cleaner energy use” in this context means that the Vision of 5% CO₂ emissions reductions by 2030 is measured against a baseline scenario where no cleaner energy sources (SAF, LCAF and other aviation cleaner energies) are used at all.

How to **quantify the life cycle CO₂ emissions reductions**?

Paragraph 12 of the Framework (see Appendix I) states that the assessment methodology for life cycle emissions of CORSIA eligible fuels should be used as the accepted basis for the eligibility of SAF, LCAF and other aviation cleaner energies used in international aviation.

The life cycle emissions of CORSIA eligible fuels are measured in terms of grams of CO₂ equivalent per megajoule (gCO₂e/MJ), which should be compared with the baseline life cycle emissions for conventional aviation fuels of 89 gCO₂e/MJ, to obtain the life cycle CO₂ emissions associated with the use of a given fuel.



In practice, the life cycle emissions of SAF and LCAF used in international aviation will depend on various aspects such as the feedstock, conversion process, and production region. The ICAO document “CORSIA default life cycle emission values for CORSIA eligible fuels” provides a list of life cycle emission values for various types of SAFs, ranging from -22.5 gCO₂e/MJ (that is, a 125% CO₂ emission reductions) to 100.6 gCO₂e/MJ (meaning an *increase* of 13% on CO₂ emissions when compared to aviation fuel baseline emissions).

How the **progress** of the Vision and Framework implementation will be **monitored**?

As per paragraph 2 of the Framework (see Appendix I), the Vision will be continually monitored and periodically reviewed, including through the convening of CAAF/4 no later than 2028, with a view to updating the ambition on the basis of market developments.

As per paragraph 11 of the Framework (see Appendix I), the implementation of the Global Framework should be continually monitored and periodically reviewed on the progress of emissions reductions and means of implementation support, aspiring to have production sites in all regions before the convening of CAAF/4.

As per paragraph 23 of the Framework (see Appendix I), the progress and effectiveness of the capacity-building and implementation support efforts should be regularly monitored.



Further information on the Conference documentation and summary of discussions are provided at the [CAAF/3 website](#).



The Conference began with a welcome address by His Excellency Abdulla Bin Touq Al Marri, Minister of Economy and Chairman of the General Civil Aviation Authority of the United Arab Emirates, followed by an opening address from Mr. Salvatore Sciacchitano, President of the ICAO Council, **encouraging the delegates to demonstrate a collective determination in reviewing the 2050 ICAO Vision for Sustainable Aviation Fuel (SAF), including Lower Carbon Aviation Fuel (LCAF) and other cleaner energy sources for aviation**, and to work towards defining an ambitious and robust ICAO global framework, in the spirit of consensus and goodwill.

The opening continued with the opening keynotes (see Figure 2 below), and a high-level panel with high-level representatives from Member States and International Organizations to exchange their views on the importance of cleaner energy for the future of aviation, the sector's efforts in aviation cleaner energy development and deployment, and the need for cooperation among States and industry.

The Conference elected the following **Chairperson and Vice-Chairpersons**:

- The Honourable Mr. Viliame Gavoka, Deputy Prime Minister and Minister for Tourism and Civil Aviation for Fiji, was elected Chairperson of the Conference.
- Ms. Paule Assoumou Koki, Director General of the Cameroon Civil Aviation Authority, was elected first Vice-Chairperson.
- Mr. Mauricio Ramirez, Representative of Colombia to ICAO, was elected second Vice-Chairperson of the Conference.

High-level statements from several States marked the end of the first day of CAAF/3.

All CAAF/3 sessions are available to watch in the [ICAO.TV](#) streaming platform.



FIGURE 2: Opening Keynotes from Mr. António Guterres, Secretary General of the United Nations (left), Mr. Ban Ki-moon, former Secretary-General of the United Nations (center) and Ambassador Majid Al Suwaidi, Director General and Special Representative to the COP28 Presidency (right).

On 24 November 2023, CAAF/3 adopted by acclamation the ICAO Global Framework on SAF, LCAF and other Aviation Cleaner Energies (see Appendix I)¹.



Some key features of the ICAO global framework include the following:

Building Block 1 – Policy and Planning (paragraphs 1 to 11 of the global framework):



- To support the achievement of the LTAG, ICAO and its Member States strive to achieve a **collective global aspirational Vision to reduce CO₂ emissions in international aviation by 5 per cent by 2030 through the use of SAF, LCAF and other aviation cleaner energies** (compared to zero cleaner energy use);
- In pursuing the Vision, **each State's special circumstances and respective capabilities** will inform the ability of each State to contribute to the Vision within its own national timeframe, without attributing specific obligations or commitments in the form of emissions reduction goals to individual States;
- The Vision and global framework will be **continually monitored and periodically reviewed** on the progress of emissions reductions and means of implementation support, aspiring to have production sites in all regions before the convening of **CAAF/4 no later than 2028**, with a view to updating the ambition on the basis of market developments;
- Achieving the Vision will rely on **means of implementation including financing, technology transfer and capacity-building**, and the Vision should follow other points, e.g., contributing to a level playing field among all States and avoiding market distortion;
- Development and implementation of **aviation leaner energy policies and State Action Plans** in accordance with their special circumstances and respective capabilities, as well as related actions by **aviation and fuel stakeholders**, in support of the Vision;



Building Block 2 – Regulatory Framework (paragraphs 12 to 16 of the global framework):



- **CORSIA sustainability criteria, sustainability certification, and the methodology for the assessment of life cycle emissions** should be the accepted basis for the eligibility of SAF, LCAF and other aviation cleaner energies used in international aviation;
- Acceleration for the development and approval of **new Sustainability Certification Schemes** for aviation cleaner energies, analysis and approval of **life cycle values for new fuel sources and pathways**, and certification of **additional fuel production pathways**, without excluding any particular fuel source, pathway, feedstock or technology;
- **Accounting methodologies and reporting frameworks** on the use of aviation cleaner energies and their environmental benefits for international aviation should take into account various **parameters**, including the avoidance of double-counting, and leveraging on the CORSIA Monitoring, Reporting and Verification (MRV) system;
- ICAO will undertake **a study of fuel accounting systems to determine any possible role of ICAO** to facilitate access to environmental benefits of cleaner energies for international aviation, with a view to fostering the global production, in particular in developing countries;



¹China, Iraq, the Russian Federation and Saudi Arabia expressed their reservations to certain aspects of the global framework. The United States expressed its view that the global framework was not legally binding in nature.

Building Block 3 – Implementation Support (paragraphs 17 to 23 of the global framework):

3

- Delivery of a **robust, targeted and tailored capacity-building and implementation support** for the global scale-up in production of SAF, LCAF and other aviation cleaner energies, taking into account various stages of readiness in different States and regions, and **building upon the success of ICAO ACT-CORSIA and ACT-SAF programmes**, with the contributions of resources by States and the industry;
- Implementation support should facilitate **partnerships, alliances and cooperation** between States and all relevant stakeholders, including regional collaborations, as well as the **exchange of information, sharing of best practices** under ICAO's platform;
- Support for States' policy development and implementation, and the regular update of the **ICAO guidance for States' consideration of policies** that are appropriate to their circumstances, noting that the guidance does not endorse specific policies;
- Support for **feasibility studies, pilot projects, and proof of concept plans**, which may facilitate access to investment, including training on financial aspects of project development, financial planning and investment promotion, as well as support for **State Action Plans and roadmaps** which may also facilitate access to investment;
- **Support access to technology** related to aviation cleaner energy development and deployment, in particular to developing countries and States with particular needs, such as comprehensive technical skills, manufacturing, processing and equipment;

Building Block 4 – Financing (paragraphs 24 to 42 of the global framework):

4

- Recognition of the Assembly Resolutions in particular A41-21, paragraphs 18 a) and b), and the **primary objective for ICAO and its Member States on financing** is to support developing countries and States with particular needs, to improve access to low-cost financing and funding, and further **de-risking of projects to develop and deploy SAF, LCAF and other aviation cleaner energies**;
- ICAO, States and the industry should **advocate and outreach for greater investment in SAF, LCAF and other aviation cleaner energy projects**, by increasing understanding amongst the international finance community, regarding the collective commitment of States and the industry, environmental and other benefits of aviation cleaner energies, and opportunities for potential investments;
- Welcoming the establishment of the **ICAO Finvest Hub initiative**, which delivers on A41-21, paragraph 18 a) to facilitate enhanced access to public and private investment capacities and funding from financial institutions, as well as encourage new and additional funding for this purpose, **ICAO should urgently put in place the necessary structure and capability, toward its operationalization**, while identifying how it complements broader aviation decarbonization capacity-building and implementation efforts, including the **ACT-SAF programme**;
- Private capital alone will not be enough to fully scale-up the development and deployment of SAF, LCAF and other aviation cleaner energies, and public investment will be also required to support aviation cleaner energy projects. Underscoring the importance of A41-21, paragraph 18 b), **ICAO should expedite its work to further consider the establishment of a climate finance initiative or funding mechanism under ICAO**, while addressing the possible financial, institutional and legal challenges, recognizing the recent decision of the ICAO Council to undertake a study in this regard; and
- ICAO and its Member States should actively identify, analyse gaps and **monitor developments in the UN and across the international financing community**, to pursue opportunities to increase the allocation or earmarking of public and private capital devoted to aviation decarbonization projects, particularly on aviation cleaner energies.

Appendix I - ICAO Global Framework for SAF, LCAF and other Aviation Cleaner Energies

(Adopted by CAAF/3 on 24 November 2023)

Whereas the 41st Session of the Assembly resolved under Resolution A41-21, paragraph 7 that “ICAO and its Member States are encouraged to work together to strive to achieve a collective long-term global aspirational goal for international aviation (LTAG) of net-zero carbon emissions by 2050, in support of the Paris Agreement’s temperature goal, recognizing that each State’s special circumstances and respective capabilities (e.g. the level of development, maturity of aviation markets, sustainable growth of its international aviation, just transition, and national priorities of air transport development) will inform the ability of each State to contribute to the LTAG within its own national timeframe”;

Whereas the Assembly Resolution A41-21, paragraph 8 further recognizes that “the LTAG is a collective global aspirational goal, and it does not attribute specific obligations or commitments in the form of emissions reduction goals to individual States, and urges each State to contribute to achieving the goal in a socially, economically and environmentally sustainable manner and in accordance with national circumstances”;

Whereas the Assembly Resolution A41-21, 17th preamble “recalls the UNFCCC and the Paris Agreement and acknowledges its principle of common but differentiated responsibilities and respective capabilities, in light of different national circumstances”;

Whereas the Assembly Resolution A41-21, 18th preamble “also acknowledges the principles of non-discrimination and equal and fair opportunities to develop international aviation set forth in the Chicago Convention”;

Recognizing that achieving the LTAG requires a comprehensive approach consisting of a basket of measures, including technology, sustainable fuels, operational improvements, and market-based measures. Sustainable Aviation Fuels (SAF), Lower Carbon Aviation Fuels (LCAF) and other aviation cleaner energies are expected to have the largest contribution to aviation CO₂ emissions reduction by 2050 and, whilst there are increasing initiatives to develop and deploy these fuels, current production levels of these fuels are still extremely low at only 0.2 per cent of all aviation fuel use;

Accordingly, there is a need for urgent global action to accelerate the global scale up in development and deployment of SAF, LCAF and other aviation cleaner energies in order to achieve the LTAG and thus provide ICAO’s continuous leadership in addressing emissions from international aviation;

Recalling that the Assembly Resolution A41-21, paragraph 28. f) requested to “convene the CAAF/3 in 2023 for reviewing the 2050 ICAO Vision for SAF, including LCAF and other cleaner energy sources for aviation, in order to define a global framework in line with the *No Country Left Behind* (NCLB) initiative and taking into account national circumstances and capabilities”;

Recognizing that there is significant potential for States to economically, socially and environmentally contribute to, and benefit from, the value chain for the development, production and deployment of SAF, LCAF and other aviation cleaner energies, including as new economic streams and alternative sources for the energy security;



Recognizing that SAF, LCAF and other aviation cleaner energies need to be developed and deployed in an economically feasible, cost-effective and socially and environmentally acceptable manner and in accordance with national circumstances;

Recognizing that means of implementation commensurate to the level of ambition, including financing, will promote the achievement of the LTAG and, by extension, the development and deployment of SAF, LCAF and other aviation cleaner energies;

Recalling that ICAO, through the ICAO Council Industry Consultative Forum; the ICAO Council's dialogues with energy and financial institutions; and the 2023 ICAO Stocktaking on Aviation in Sector CO₂ Emissions Reductions, have heard the industry calls to help reduce risk and attract investment by providing greater regulatory certainty governing SAF, LCAF and other aviation cleaner energies and better access to financing, and by establishing better collaboration and coordination between all stakeholders;

Recognizing that the production of SAF, LCAF and other aviation cleaner energies is currently concentrated in a small number of States. The global framework intends to emphasize the benefits for States and ICAO in working toward the decentralization of such fuel production across all States and regions, providing a fair and equal opportunity to participate across the value chain, from feedstock to fuel production and use;

Recognizing that no single fuel source will be produced at a level necessary to achieve the LTAG. Accordingly, the global framework needs to be flexible and not exclude any particular fuel source, pathway, feedstock or technology that meets the CORSIA agreed criteria;

Recognizing that aviation is part of a global effort to address climate change, and the intent to accelerate the global scale up in development and deployment of SAF, LCAF and other aviation cleaner energies is consistent with recent international commitments in accelerating clean, sustainable, just, affordable and inclusive energy transitions and, in doing so:

- a) recognizes the needs, vulnerabilities, priorities and different national circumstances, particularly of developing countries; and
- b) supports strong enabling environments to foster innovation, technology transfer, building on and consistent with Assembly Resolution A41-21, paragraph 18. d), and access to low-cost financing;

Recognizing that no country should have to choose between fighting poverty and fighting for our planet. In this regard, efforts to decarbonize aviation need to work alongside efforts to sustainably develop the sector, particularly in developing countries.

Acknowledging that the role of this global framework is to facilitate the global scale-up in development and deployment of SAF, LCAF and other aviation cleaner energies by providing greater clarity, consistency and predictability to all stakeholders, including those beyond the aviation sector, on the policies, regulations, implementation support, and financing and investments required, to ensure all States have equal opportunities to contribute to, and benefit from, the expected emissions reductions from such aviation cleaner energies;

Also acknowledging that the global framework is built across four building blocks: policy and planning; regulatory frameworks; implementation support; and financing. These building blocks are interconnected and need to advance and work together to achieve their intended purpose;



Further acknowledging that throughout this global framework, the support for developing countries and States with particular needs, exists along a continuum, from the first step of the process to the last. Comprehensive capacity-building and implementation support and financing activities, are intended to work hand-in-hand to achieve this outcome and broader aviation decarbonization efforts in a sustainable manner;

Building Block 1 – Policy and Planning:

1. ICAO and its Member States will work together to strive to achieve a Vision of implementing the elements of this global framework in order to globally scale-up the development and deployment for SAF, LCAF and other aviation cleaner energies, as such fuels are expected to have the largest contribution to aviation CO₂ emissions reductions in the ‘basket of measures’ to achieve the LTAG. To support the achievement of the LTAG, ICAO and its Member States strive to achieve a collective global aspirational Vision to reduce CO₂ emissions in international aviation by 5 per cent by 2030 through the use of SAF, LCAF and other aviation cleaner energies (compared to zero cleaner energy use). In pursuing this Vision, each State’s special circumstances and respective capabilities will inform the ability of each State to contribute to the Vision within its own national timeframe, without attributing specific obligations or commitments in the form of emissions reduction goals to individual States.
2. This Vision will be continually monitored and periodically reviewed, as described in paragraph 11 below, including through the convening of CAAF/4 no later than 2028, with a view to updating the ambition on the basis of market developments in all regions.
3. Increasing the production of SAF, LCAF and other aviation cleaner energies across all regions will be integral to achieving the Vision and will rely on means of implementation including financing, technology transfer and capacity building.
4. In addition, the Vision should:
 - a) enable the increased production and supply of SAF, LCAF and other aviation cleaner energies across all regions;
 - b) be flexible, attainable and feasible;
 - c) be continually monitored and periodically reviewed (refer to paragraph 11 below);
 - d) be ambitious, in order to send a positive market signal to induce demand, trigger supply and attract significant additional investment, taking into account special circumstances and respective capabilities of States;
 - e) not negatively impact the growth of air transport, especially in developing countries;
 - f) contribute to a level playing field among all States and avoid market distortion;
 - g) be supported by the appropriate means of implementation including financing, technology transfer and capacity building;
 - h) not exclude any particular fuel source, pathway, feedstock or technology, as long as it meets the CORSIA sustainability criteria;
 - i) take account of the projections included in the LTAG report and subsequent analysis by CAEP;
 - j) note national fuel-related emissions reduction goals and roadmaps by States and any other industry commitments;
 - k) not give rise to any mandatory measures to achieve this Vision and the objective of this framework; and
 - l) contribute to mitigating air pollution, maximising both public health and climate benefits.



5. States are encouraged to implement policies in support of the Vision, in a socially, economically and environmentally sustainable manner and in accordance with their special circumstances and respective capabilities.
6. In developing these policies, States are invited to consider the usefulness and benefits of the non-exhaustive and non-prescriptive list of potential policy components contained within the ‘toolkit’ in paragraph 18 below, noting that ICAO guidance provides further detail on these potential policy components and the guidance does not provide any endorsement of specific policies.
7. In developing and implementing their policies, States are encouraged to recognize:
 - a) the need for, and benefits of, a combination of policies under a coherent and coordinated national plan for the scale-up in production and deployment of SAF, LCAF and other aviation cleaner energies, noting that no one single policy is likely to deliver the best and most efficient outcomes and that the appropriate policy-mix will differ between States due to different national circumstances;
 - b) the need for policies to take into account cost impacts and affordability, and to avoid extraterritorial measures;
 - c) the need for policies to take into account the latest scientific and technological developments;
 - d) the importance of the policy’s transparency, certainty and stability, for aircraft operators, feedstock producers, fuel producers, financial institutions and other relevant stakeholders; and
 - e) the need for policies to be applied in accordance with the Chicago Convention and its relevant instruments and any appropriate bilateral and multilateral agreements in place between States, with particular regard for the fundamental principles of non-discrimination, fair and equal opportunity; and the avoidance of market distortion.
8. States are encouraged to work together towards the harmonization of policies, to the extent possible and appropriate to circumstances, across States and regions as a longer-term objective.
9. The Vision is a collaborative effort with action required from different stakeholders, and States are to encourage relevant stakeholders (i.e. aircraft operators, airports, aircraft and engine manufactures, fuel producers, ICAO’s approved Sustainability Certification Schemes, and fuel standards bodies) to plan, develop and implement their own actions to help achieve the Vision, as appropriate, including:
 - a) *Aircraft operators* to prioritize the negotiation, cooperation and commercial procurement of SAF, LCAF and other aviation cleaner energies; facilitate access for travellers, air cargo shippers and businesses who wish to voluntarily reduce their air travel footprint through access to the purchase of SAF, LCAF and other cleaner fuels; and implement measures to increase SAF compatibility within their fleets;
 - b) *Airports* to plan and deliver changes in airport infrastructure necessary to ensure efficient supply and access to drop-in fuels and, in collaboration with aircraft operators, fuel producers and other stakeholders, explore innovative ways to share the cost of such infrastructure changes across the value chain;



- c) *Aircraft and engine manufactures and fuel producers* to accelerate work to ensure 100 per cent SAF compatibility is feasible in new, in-production and existing aircraft, as soon as it is considered safe to do so and in line with their announced commitments, and innovate to understand and maximize the opportunities offered by other cleaner energy sources in the longer term;
 - d) *Fuel producers* to foster innovation and investment into SAF, LCAF and other aviation cleaner energies and demonstrate technological readiness, scalability and sustainability of these fuels in line with the CORSIA requirements;
 - e) *ICAO's approved Sustainability Certification Schemes* to accelerate the sustainability certification of qualifying SAF, LCAF and other aviation cleaner energies in line with the CORSIA requirements; and
 - f) *Fuel standards bodies*, particularly ASTM, to work with all stakeholders to accelerate the qualification and approval of additional fuel production pathways.
10. States are encouraged to include their respective policies, actions and roadmaps for the development and deployment of SAF, LCAF and other aviation cleaner energies, in their State Action Plans, and where possible, to:
- a) identify resources, capacity and other factors (e.g. capacity assistance and access to technology) required;
 - b) help ICAO to tailor capacity building and implementation support measures, including facilitating access to financing and funding, in line with the State's needs; and
 - c) to quantify their Plans, to support ICAO's work in monitoring progress towards achieving the LTAG.
11. The implementation of the global framework should be continually monitored and periodically reviewed, including through annual ICAO stocktaking, and the convening of CAAF/4. In this regard, ICAO, with the technical contribution of CAEP, should identify and develop methodologies for monitoring the:
- a) progress on emissions reductions from SAF, LCAF and other aviation cleaner energies toward the achievement of the LTAG, including through the gathering, compiling and analyzing, by ICAO, of actions undertaken by States according to their State Action Plans and other relevant State reporting mechanisms;
 - b) progress, at a global and regional level, on means of implementation support, including financing, provided to achieve the emissions reductions from SAF, LCAF and other aviation cleaner energies toward the achievement of the LTAG, including through the gathering, compiling and analyzing, by ICAO, of actions undertaken by States, industry, and other stakeholders; and
 - c) impacts on the sustainable growth of the aviation industry, the geographical distribution of SAF production, cost impacts (including airfares and the price of SAF, LCAF and other cleaner



energies), and the maintenance of fair and equal opportunities for the development and deployment of SAF, LCAF and other aviation cleaner energies, aspiring to have production sites in all ICAO regions before CAAF/4.

Building Block 2 – Regulatory Framework:

12. In the interests of providing regulatory transparency, certainty, stability and assurances of environmental integrity to feedstock producers, fuels producers and financial institutions, the CORSIA sustainability criteria, sustainability certification, and the methodology for the assessment of life cycle emissions used for 'CORSIA eligible fuels', should be used as the accepted basis for the eligibility of SAF, LCAF and other aviation cleaner energies used in international aviation.
13. ICAO, States and industry are encouraged to enhance efforts to increase the number of ICAO approved Sustainability Certification Schemes, in all regions, to accelerate the sustainability certification of qualifying SAF, LCAF and other aviation cleaner energies in line with the CORSIA requirements, without excluding any particular fuel source, pathway, feedstock or technology. In this regard, ICAO, with technical and neutral contributions of CAEP, is encouraged to accelerate the development and approval of new Sustainability Certification Schemes for SAF, LCAF and other aviation cleaner energies and to accelerate the analysis and approval of life cycle values for new fuel sources and pathways.
14. ICAO, States, industry and other relevant stakeholders are encouraged to work with fuel standards bodies, such as ASTM, to accelerate the certification of additional fuel production pathways, with a view to maximizing the number of certified sources of SAF, LCAF and other aviation cleaner energies.
15. Accounting methodologies on the use of SAF, LCAF and other aviation cleaner energies for international aviation, such as the CORSIA MRV, provides confidence in the use of such fuels and the claim of their environmental benefits by aeroplane operators, noting that such accounting methodologies could help support the monitoring of progress towards the achievement of the LTAG. Accounting methodologies and the associated reporting frameworks should take into account the following parameters, which seek to promote transparency, accuracy, consistency, comparability and completeness:
 - a) ensure the global coverage of emissions from international civil aviation, as part of the monitoring of the LTAG;
 - b) support consistent application of methodologies amongst States, in a transparent manner;
 - c) enable accurate emissions reporting, including the use of cleaner energy for international civil aviation;
 - d) ensure environmental integrity through the avoidance of double-counting, including between domestic and international civil aviation;
 - e) use verified emissions information, supported with other information for the verification or validation of reported emissions;
 - f) promote cost-effectiveness by using simple accounting and reporting methodologies and procedures;
 - g) avoid excessive administrative burden on States and aeroplane operators; and
 - h) leverage, to the extent possible, existing methodologies and procedures under the CORSIA MRV.



16. ICAO should, with technical contributions of CAEP, undertake a study of fuel accounting systems for international aviation currently used in the open market. This study would include preliminary exploration of the so-called ‘book and claim’ concept to assess its relevancy and applicability, and taking into account relevant developments in other UN bodies, including the Article 6 of the Paris Agreement. The intent of the study would be to better understand these accounting systems and concepts and identify potential areas for further investigation. This work can help determine what, if any, role ICAO could have in supporting these systems to facilitate access to environmental benefits of SAF, LCAF and other aviation cleaner energies for international aviation and ensure environmental integrity, with a view to fostering without disincentivising the global production of such fuels, in particular in developing countries.

Building Block 3 – Implementation Support

17. All States should have access to the means to participate across all stages of the development and deployment of SAF, LCAF and other aviation cleaner energies, and all States and regions are encouraged to work together in a spirit of solidarity to ensure there is a truly global effort to contribute to, and benefit from, the work to reduce emissions from such aviation cleaner energies.
18. The global scale-up in production of SAF, LCAF and other aviation cleaner energies requires a robust and substantial capacity-building and implementation support programme. States, ICAO, industry, academia and other relevant stakeholders are encouraged to work together to deliver such a programme that:
- a) recognizes the need for an expanded, robust, targeted and tailored support to account for the various stages of readiness across the entire SAF/LCAF value chain, taking into account different circumstances across States and regions;
 - b) facilitates partnerships, alliances and cooperation between States and all relevant stakeholders, including regional collaborations that may result in regional solutions that produce fuels efficiently;
 - c) includes exchange of information, sharing of best practices and technological developments among States, for which ICAO should provide a platform to facilitate this exchange and track progress;
 - d) supports States in their planning, development and implementation of national and regional policies that can be applied across all stages of fuel supply-chain, including the following potential policy components that form part of a non-exhaustive ‘toolkit’ (referred to paragraph 6 above):
 - i. foster multi-stakeholder partnerships, alliances and cooperation, including with (as appropriate) aeroplane operators, airports, aircraft and engine manufacturers, energy producers and financial institutions;
 - ii. government incentives, including loans, grants, tax credits, regulatory support and other mechanisms for:
 - research and development, including determination of the technology readiness level;
 - sourcing of potential feedstock;
 - development and acceleration of feedstock production; and



- development and acceleration of fuel production;
 - iii. targets and/or mandates for:
 - emissions reduction levels;
 - uptake of SAF, LCAF and other aviation cleaner energies; and
 - fuel blending levels;
 - iv. where beneficial, identify SAF, LCAF and other aviation cleaner energies as priorities for financing for economy-wide decarbonization efforts;
 - v. promote increasing the number of ICAO approved Sustainability Certification Schemes for SAF, LCAF and other aviation cleaner energies;
 - vi. promote feasibility studies for potential SAF, LCAF and other cleaner energy pathways;
 - vii. promote necessary changes in airport and energy supply infrastructure; and
 - viii. promote the use of Public Private Partnerships to deliver SAF and LCAF projects.
- e) regularly updates the ICAO detailed guidance on the ‘policy toolkit’ and the ‘Rules of Thumb’, where applicable, to estimate the costs, investment needs and production potentials, to help inform States’ consideration of the selection of national and regional policies that are appropriate to their circumstances, noting that the guidance does not provide any endorsement of specific policies;
- f) supports the delivery, in a continuum, of feasibility studies, pilot projects, and ‘proof of concept’ plans, which may facilitate access to investment for their implementation;
- g) develops and provides training to enhance State’s awareness and readiness, as well as to support the SAF and LCAF project’s readiness to attract investment, including training on financial aspects of project development, financial planning and investment promotion; and
- h) assists in the development of relevant aspects of State Action Plans and roadmaps, including ICAO guidance and tools, and State-to-State support partnerships, noting that State Actions Plans may also include information on specific assistance needs for the implementation of measures to reduce aviation CO₂ emissions, which may facilitate access to investment and technology.
19. Access to technology is imperative for States to contribute to, and benefit from, cleaner energy development and deployment. Accordingly, States and industry shall promote and facilitate, in accordance with 14th preamble above, the effective transfer of technology, in particular to developing countries and States with particular needs, in line with the *No Country Left Behind* (NCLB) initiative, through comprehensive technical skills, manufacturing, processing and equipment, and noting the global benefits that come from increasing the supply of cleaner energy.
20. The ICAO capacity-building and implementation support should be delivered in an efficient, effective and coordinated manner under the ‘one-ICAO’ approach, incorporating support for all stages of SAF, LCAF and other aviation cleaner energies development and deployment, and building upon the success of the ACT-CORSIA and ACT-SAF programmes. States are also encouraged to develop specific projects under the ICAO Technical Cooperation Programme.
21. In line with the *No Country Left Behind* initiative, States are urged to make regular and substantial contributions to the ICAO Voluntary Environment Fund and other in-kind contributions (e.g.



secondments) to support delivery of the substantial ICAO capacity building and implementation support programme, aimed at assisting developing countries and States with particular needs, including, as a priority, for feasibility studies and technology adaption.

22. Industry is also urged to provide expertise and financial support to support delivery of the substantial capacity building and implementation support programme including, as a priority, for feasibility studies and technology adaption.
23. ICAO should regularly monitor the progress and effectiveness of the capacity-building and implementation support efforts, including ensuring there are sufficient resources to deliver its support programme, as part of the broader means of implementation. In this regard, ICAO should consider developing necessary methodologies for monitoring and reporting back to States, including information on where its support efforts are located and the cost of those efforts.

Building Block 4 – Financing

24. As recognized in Assembly Resolution A41-21, paragraph 17, “means of implementation commensurate to the level of ambition, including financing, will promote the achievement of the LTAG. It requires substantial investments for States, according to their national circumstances, and that various possible modalities and/or funding mechanisms could be used by ICAO to facilitate financing and investment support for implementation of specific aviation CO₂ emissions reduction measures”.
25. According to the LTAG report, fuel suppliers will need to invest up to 3.2 trillion USD in producing aviation cleaner energies through to 2050, and additional investments will be needed for other aviation CO₂ reduction measures such as aircraft technologies and operational improvements. The scale of this task presents both challenges and opportunities for ICAO, States and other stakeholders, including the financing community.
26. Specific to financing and funding, Assembly Resolution A41-21, paragraphs 18. a) and b), request the Council to:
 - a) “initiate specific measures or mechanisms so as to facilitate, in particular for developing countries and States having particular needs, better access to private investment capacities, as well as funding from financial institutions, such as development banks, for projects contributing to the decarbonization of international aviation, as well as encourage new and additional funding to this purpose”; and
 - b) “further consider the establishment of a climate finance initiative or funding mechanism under ICAO, while addressing the possible financial, institutional and legal challenges, and report to the 42nd Session of the ICAO Assembly”.
27. These two paragraphs of the Assembly Resolution must be urgently progressed, in parallel, if the challenge of scaling-up SAF, LCAF and other aviation cleaner energies is to be addressed at the global level in a sustainable manner, including economic, social and environmental concerns.
28. With a view to achieving the LTAG, the primary objective for ICAO and its Member States with respect to financing should be to support countries in particular developing countries and States with particular needs, to improve access to low-cost financing and funding, and further de-risking of projects to



develop and deploy SAF, LCAF and other aviation cleaner energies in order to promote sustainability and stimulate investment, in line with the *No Country Left Behind* initiative.

29. Measures to attract greater investment in SAF, LCAF and other aviation cleaner energies from development banks and other capital markets are integral to ICAO efforts under Assembly Resolution A40-22, particularly paragraph 8, to “continue fostering ICAO’s partnership with financial institutions seeking the prioritization or inclusion of aviation in their agendas and work programmes in order to facilitate States’ access to fund or finance their aviation development projects”.
30. Some financing instruments (e.g. blended finance and Public-Private Partnerships) require significant cooperation and collaboration between stakeholders, including States, industry and public and private financial institutions, to mitigate the investment risk. There is a role for ICAO and its Member States to engage in this cross-stakeholder collaboration as appropriate, on possible measures to de-risk investments.
31. ICAO, States and industry have a key role to play in advocating for greater investment in SAF, LCAF and other aviation cleaner energy projects by increasing awareness and understanding amongst the international finance community on:
 - a) the collective commitment of States and the industry to achieve the LTAG;
 - b) the importance of the sustainable growth of the international aviation sector including the economic and social connectivity and trade flows;
 - c) the benefits of the use of SAF, LCAF and other aviation cleaner energies to address aviation’s contribution to climate change;
 - d) the strong action from ICAO, States and industry to the global scale-up of SAF, LCAF and other aviation cleaner energies;
 - e) the direct and indirect economic and social benefits to States across the value chain of SAF and LCAF production;
 - f) the scale of the demand for SAF, LCAF and other aviation cleaner energies;
 - g) the challenges to accessing affordable and needed financing for projects for SAF, LCAF and other aviation cleaner energies; and
 - h) potential investment opportunities and returns.
32. As part of this advocacy and outreach, States and ICAO should enhance and deepen their engagement and dialogue with the international finance community and other relevant stakeholders, including:
 - a) public and private financial institutions, including sub-national, national, regional and multilateral banks;
 - b) private capital markets, including investors and insurers;
 - c) capital and banking alliances;
 - d) State donors;
 - e) UN, and other internationally-recognized funds and investment vehicles; and
 - f) energy producers.
33. ICAO, in cooperation with States, should develop a series of case studies of successful SAF, LCAF and other aviation cleaner energies projects, drawing from examples in regions with different characteristic and investment risk. Such case studies could assist both project developers and prospective investors by providing examples of ‘tried and tested’ pathways for investment and instill confidence that investment opportunities can be realized.



34. States acknowledge and welcome the establishment of the ‘ICAO Finvest Hub’, which delivers on Assembly Resolution A41-21, paragraph 18. a), and look forward to its work to facilitate enhanced access to public and private investment capacities and funding from financial institutions, with prioritization of allocation to developing countries and States with particular needs, for projects contributing to the decarbonization of international aviation, including for the scale-up in development and deployment of SAF, LCAF and other aviation cleaner energies, as well as encourage new and additional funding for this purpose.
35. As a first step, ICAO should urgently put in place the necessary structure and capability, toward the operationalization of the proposed ‘ICAO Finvest Hub’ initiative. Such work should clearly identify how the Finvest Hub initiative complements broader aviation decarbonization capacity building and implementation efforts, including the ACT-SAF programme.
36. Key activities that the ICAO Finvest Hub could undertake include:
 - a) developing a platform to connect aviation decarbonization projects with potential public and private investors, including a ‘matchmaking’ function, thus helping investors to identify and assess projects;
 - b) working with various stakeholders to explore innovative funding and risk mitigation mechanism adapted to the decarbonisation of aviation, incentivizing investments, and promoting collaboration among stakeholders to mobilize financial resources effectively (e.g. fostering Public Private Partnerships);
 - c) collaborating with financial institutions, such as development banks, to create pathways for the funding of projects;
 - d) developing a database of funding and financing sources, together with their terms and conditions, for project developers to be able to draw on; and
 - e) developing a toolkit of term sheets templates (basic conditions to satisfy investors) for SAF, LCAF and other aviation cleaner energies.
37. Private capital alone will not be enough to fully address the challenge of scaling-up the development and deployment of SAF, LCAF and other aviation cleaner energies. Sizable public investment, including concessionary funding, as appropriate, will be required to support some SAF, LCAF and other aviation cleaner energy projects, particularly in developing countries and in States with particular needs.
38. States recognize the important role that ICAO can play in encouraging scaled up funding flows, including new and additional funding flows, as appropriate, and their transparent and effective disbursement. ICAO and its Member States need to ensure ‘no stone is left unturned’ in exploring avenues to support these objectives.
39. To this end, States underscore the importance of Assembly Resolution A41-21, paragraph 18. b) and agree that ICAO should expedite its work to further consider the establishment of a climate finance initiative or funding mechanism under ICAO, while addressing the possible financial, institutional and legal challenges. Recognizing the recent decision of the Council to undertake a study regarding the consideration of the establishment of a climate finance initiative or funding mechanism under ICAO, this work must be completed for consideration by the 42nd Session of the ICAO Assembly, in accordance with A41-21, paragraph 18. b).



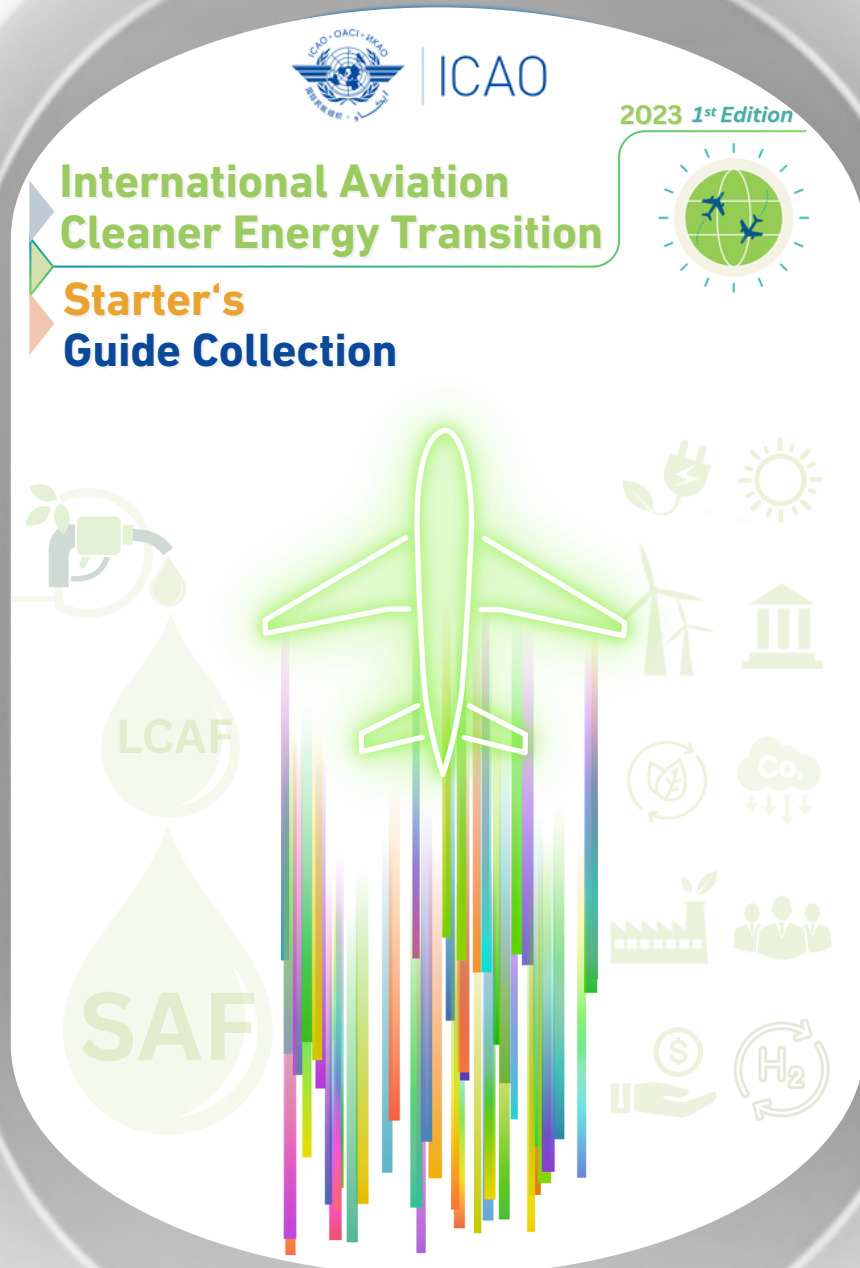
40. States recognize that, in its work preparing the report under A41-21 paragraph 18. b), the ICAO Council should consider, among others, the following aspects:
- a) achieving the LTAG in a fair and sustainable manner;
 - b) the role that a climate finance initiative or a funding mechanism could play in reinforcing and complementing the work of the Finvest Hub, and other mechanisms of the Organization, such as the ACT-SAF programme, the ICAO Technical Cooperation Program and the ICAO Voluntary Environment Fund;
 - c) the need for a gap analysis to identify where there are specific needs with attention to developing States and States having particular needs; and
 - d) the objective of promoting the increase of SAF production worldwide and concomitant economic, social and environmental benefits across all regions.
41. Globally, there are ongoing efforts to mobilize climate finance and maximize resources, including concessional financing, as appropriate, in order to support clean energy transitions. Aviation must have a role in these efforts to support its own transition and the achievement of the LTAG.
42. ICAO and its Member States should initiate a work stream to actively identify, analyse gaps and monitor developments in the UN and across the international financing community, including *inter alia* the Green Climate Fund and its upcoming replenishment, the Net Zero Asset Owner Alliance, and the Multilateral Development Banks Vision Statement, to identify and aggressively pursue opportunities to increase the allocation or earmarking of public and private capital devoted to aviation decarbonization projects, particularly on SAF, LCAF and other aviation cleaner energies.

— END —



COMING SOON!

Stay tuned at the ICAO website for the new
International Aviation Cleaner Energy Transition Starter's Guide Collection!



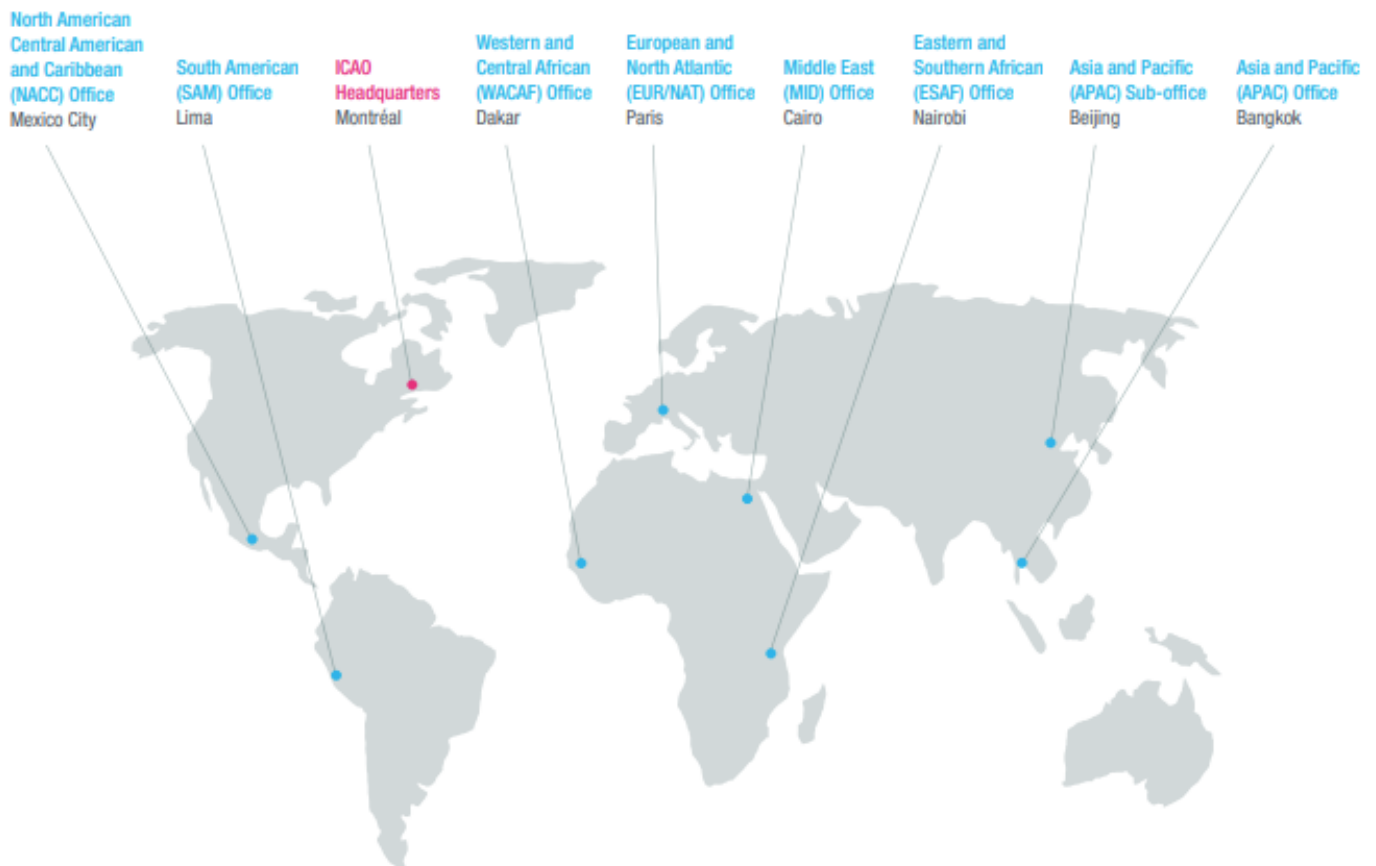


ICAO

INTERNATIONAL CIVIL AVIATION ORGANIZATION

999 Robert-Bourassa Boulevard
Montreal, QC, Canada
H3C 5H7

Tel. +1 (514) 954.8219
Fax. +1 (514) 954.6077
Email. info@icao.int



www.icao.int

