



| ICAO

ENVIRONMENT

ON BOARD

A SUSTAINABLE FUTURE

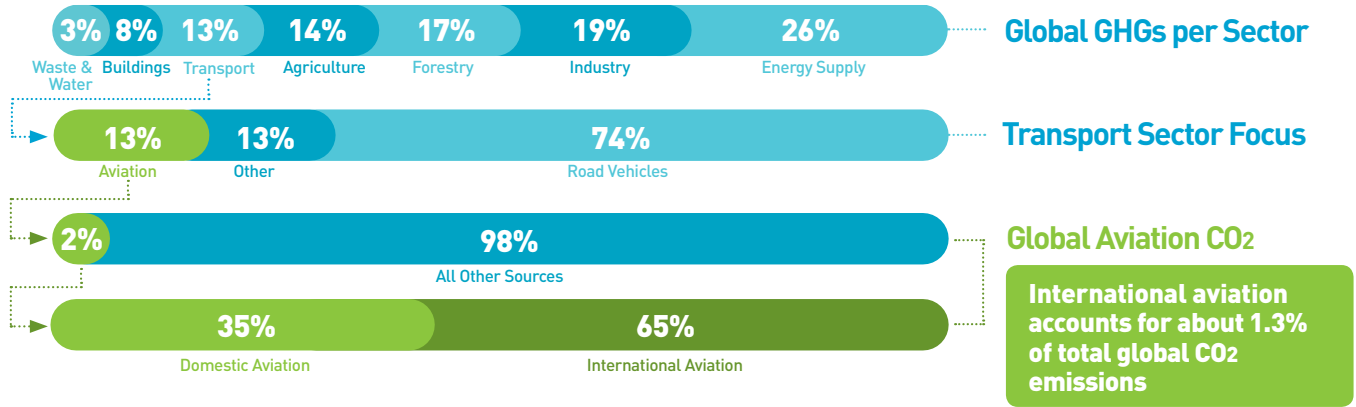




TRENDS & GOALS

INTERNATIONAL AVIATION IN GLOBAL GHG EMISSIONS

Total CO₂ emissions from aviation (domestic and international) account for approximately 2% of total global CO₂ equivalent emissions (IPCC 5th Assessment Report); international aviation accounts for about 1.3% of total global CO₂ emissions.



ICAO'S ASPIRATIONAL GOALS

ICAO has agreed on two aspirational goals for the international aviation sector:

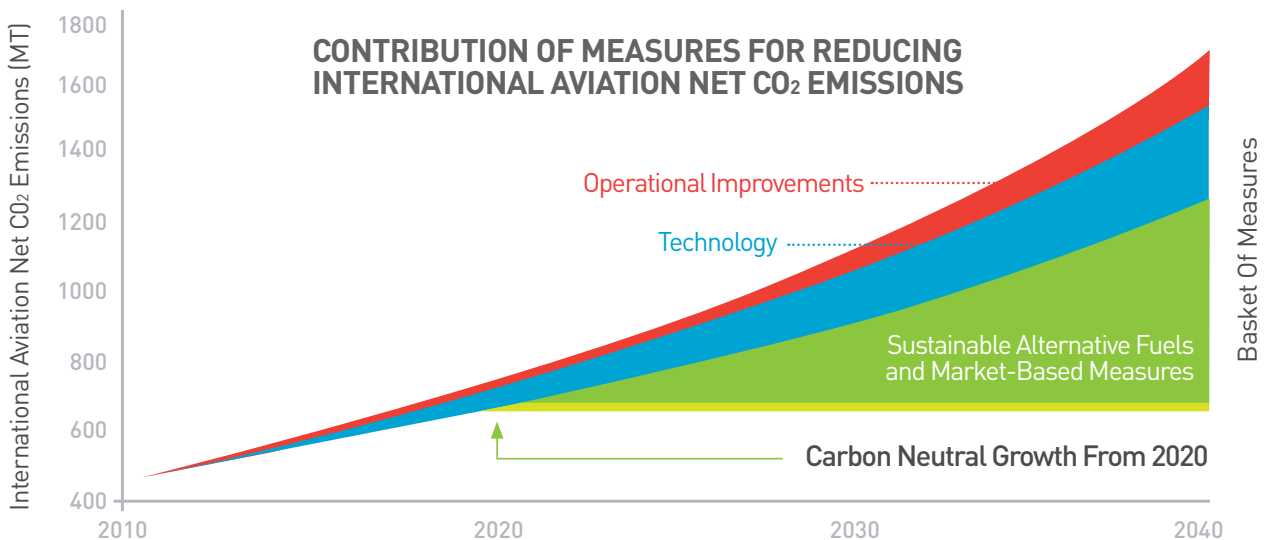
- **2% annual fuel efficiency improvement through 2050**
- **CNG2020 Carbon neutral growth from 2020 onwards**

ICAO is also exploring long-term goals.

ICAO'S BASKET OF MEASURES

ICAO has identified the following areas that can contribute to reductions of CO₂ emissions. They are known as ICAO's basket of measures:

- **Aircraft related technology and standards**
- **Improved air traffic management and operational improvements**
- **Development and deployment of sustainable alternative fuels**
- **Market-based measures**



SUSTAINABLE DEVELOPMENT GOALS

ICAO's environmental work contributes to 10 out of the 17 United Nations SDGs





TECHNOLOGY & STANDARDS



ICAO'S ROLE

ICAO has more than 50 years of experience in bringing the international community together working on stringent regulations for aircraft noise and emissions.

In 2016, two new global certification standards were developed:

- Standard for CO₂ emissions from aeroplanes
- Standard for non-volatile Particulate Matter from engines

AEROPLANE CO₂ EMISSIONS STANDARD

This is the first global technology Standard for CO₂ emissions for any sector and aims to encourage the introduction of more fuel efficient technologies into aeroplane designs. It will apply to:

- New aeroplane type designs from 2020
- Aeroplane type designs that are already in-production in 2023, with a 2028 production cut-off date for non-compliance

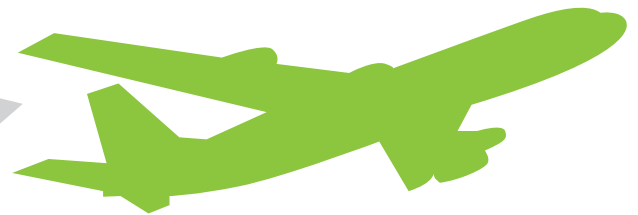
AIR TRANSPORT
OPERATIONS
TODAY
VS 50 YEARS AGO

=

80%
MORE FUEL
EFFICIENT

+

75%
QUIETER



OPERATIONS

OPERATIONAL IMPROVEMENTS

The aircraft operations consist of a broad range of activities related to all stages of air travel, e.g. on the ground before passengers and cargo are loaded, taxiing to and from the runway, departure, climb, cruise, descent and landing.

EMISSION REDUCTION OPPORTUNITIES

Optimization of operational procedures have the potential to reduce emissions through the minimization of the amount of fuel used in each flight by:

- Taxiing and flying the most fuel-efficient route
- Operating at the most economical altitude and speed
- Maximizing the aircraft's load factor
- Loading the minimum fuel to safely complete the flight
- Minimizing the number of non-revenue flights
- Maintaining clean and efficient airframes and engines



ICAO'S ROLE

ICAO has developed the Global Air Navigation Plan (GANP) to reduce fuel consumption, thus CO₂ emissions from aircraft operations.

ICAO has developed tools and is undertaking the assessment of the environmental benefits of the Aviation System Block Updates (ASBUs), which is a major initiative to improve global air operations efficiency.

CORSIA

CARBON OFFSETTING AND REDUCTION SCHEME FOR INTERNATIONAL AVIATION

CORSIA is a market-based measure designed to assist the achievement of ICAO's aspirational goal of carbon neutral growth from 2020 onwards.

Offsetting or reduction of CO₂ emissions will be achieved through the acquisition and retirement of emissions units from the global carbon market by aircraft operators.

WHY JOIN CORSIA?

The more States join CORSIA, the more emissions are covered increasing the environmental integrity of the scheme.

States that voluntarily participate in the pilot phase of CORSIA will be given priority for capacity building and assistance, under the spirit of the "No Country Left Behind" initiative of ICAO.

Participation in CORSIA will increase the demand for emissions units to be purchased by aircraft operators, thus increasing incentives to invest in emissions reduction projects, particularly in developing States.



ICAO'S ROLE

ICAO is currently working on the development of Standards and/or related guidance material for:

- Monitoring, reporting and verification system
- Criteria for emissions units to be purchased by aircraft operators; and
- Registries (national registries and a centralized registry under the ICAO auspices)

All of these are necessary for the implementation of CORSIA.

✓ INCLUSIONS

All States are encouraged to participate.

- Participation in the pilot phase and first phase is voluntary
- For the second phase, all States with an individual share of international aviation activities in year 2018 above 0.5% of total activities or whose cumulative share reaches 90% of total activities, are included.

✗ EXEMPTIONS

- Least Developed Countries, Small Island Developing States and Landlocked Developing Countries are exempt unless they volunteer to participate.
- Very small emitting operators, new entrants and special operations (e.g. firefighting and search and rescue flights).

ROUTE-BASED APPROACH



State in CORSIA



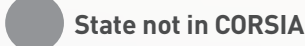
Route included in CORSIA

Emissions from international flights where both the origin and destination States are included in CORSIA



Route not included in CORSIA

Emissions from international flights where the origin and/or destination States are not included in CORSIA

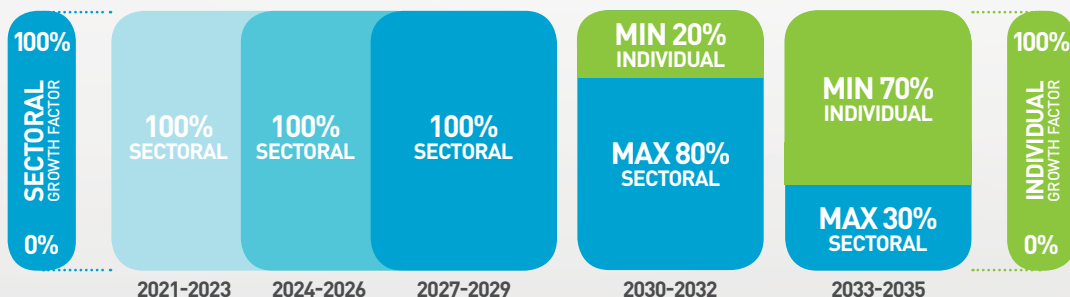


State not in CORSIA

HOW TO CALCULATE CO₂ OFFSET REQUIREMENTS?

Operators' annual emissions **X** Growth Factor = CO₂ offset requirements

The Growth Factor changes every year taking into account both the sectoral and the individual operators' emissions growth.

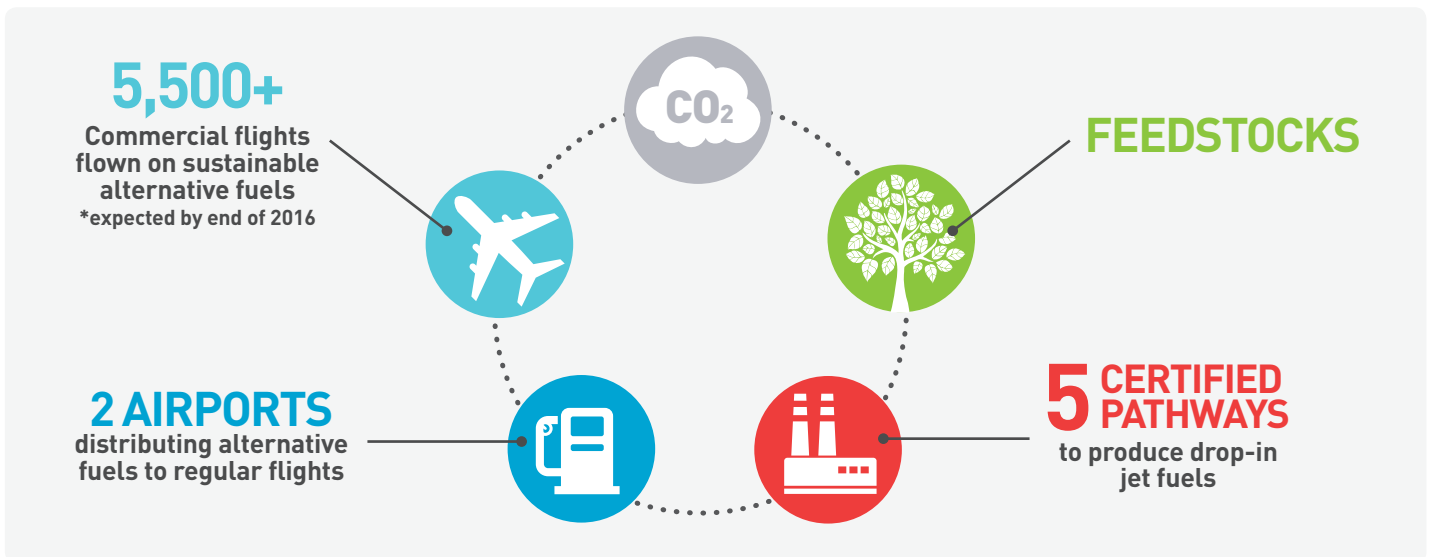




SUSTAINABLE ALTERNATIVE FUELS

Sustainable alternative fuels have the potential to be sustainably produced and to generate lower carbon emissions than conventional aviation kerosene from production to consumption.

These are fuels that function the same way as traditional jet fuel, so they do not require any changes to aircraft or infrastructure – avoiding logistical, safety and cost issues.



FEEDSTOCKS



Oils and fats

Largely from oil crops, animals fats and used cooking oil. Production from micro-algae is an additional promising pathway that is currently in the research and development stage.



Sugars and starch

From sugar crops and cereal starch that do not compete with food supply. Mainly associated with fermentation routes that generally produce alcohols, which are further upgraded into hydrocarbons.



Lignocellulose

Found in the wall of plants' cells and in wood, various energy crops, as well as from agriculture or forest residues and from macro-algae. Can be directly converted into hydrocarbons using thermochemical processes, pyrolysis or catalytic cracking.



GFAAF

GLOBAL FRAMEWORK FOR AVIATION ALTERNATIVE FUELS (GFAAF)

The GFAAF is a database maintained and updated by ICAO that presents multiple initiatives for the development and deployment of alternative fuels in aviation and news related to alternative fuel use in the aviation industry.



ICAO'S ROLE

Alternative fuels are recognized as a key part of the efforts for CNG2020 in the 39th Assembly Resolution on international aviation and climate change.

ICAO is actively engaged in activities to promote and facilitate the emergence of sustainable alternative fuels in aviation by exchanging and disseminating of information (e.g. through the GFAAF), fostering dialogue among States and stakeholders, and carrying out dedicated work as requested by ICAO Member States to inform decision making.

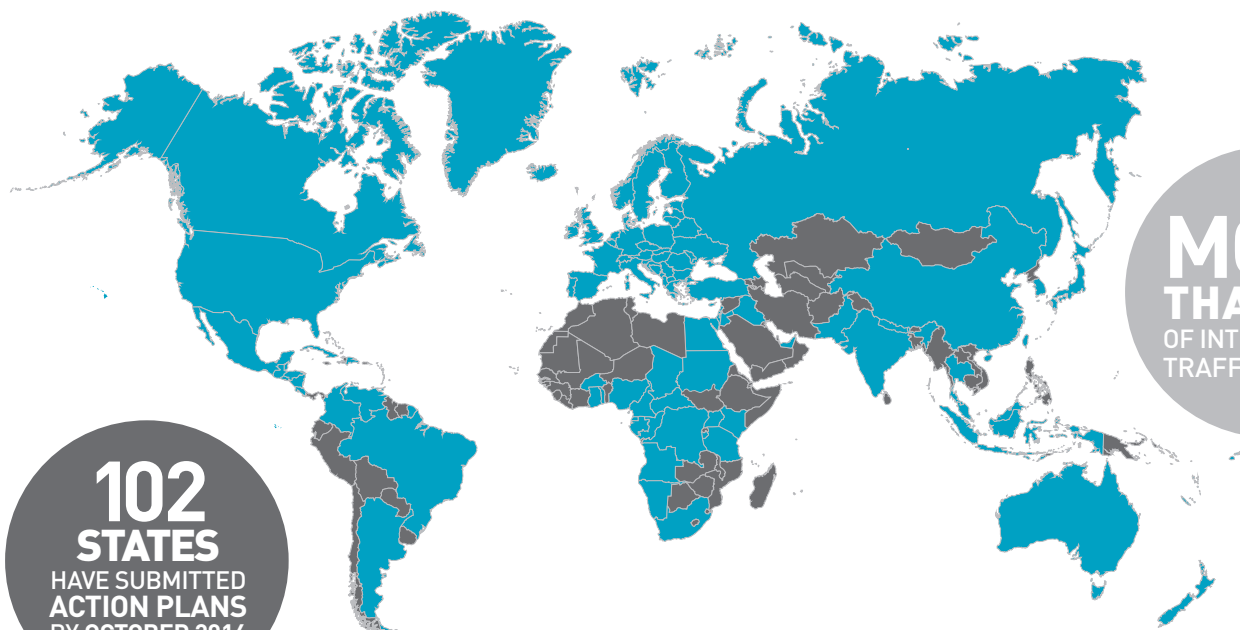
In 2017, ICAO will organize a seminar and a high-level conference on aviation alternative fuels to develop the "ICAO Vision on International Aviation Alternative Fuels".



STATE ACTION PLANS AND ASSISTANCE

WHAT IS AN ACTION PLAN ON CO₂ EMISSIONS?

A planning tool, prepared by a State to communicate information on its activities to address CO₂ emissions from international civil aviation.



MORE THAN 90%
OF INTERNATIONAL TRAFFIC COVERED

102 STATES

HAVE SUBMITTED ACTION PLANS BY OCTOBER 2016

CONTENTS OF AN ACTION PLAN

- Initial fuel consumption and traffic estimates
- List of selected measures proposed to address CO₂ emissions from international aviation
- Expected results (fuel consumption and traffic with the selected measures)
- Information on assistance needs (financial, technological, training, etc.)



ICAO'S ROLE

ICAO assists States to prepare their action plans by:

- Developing guidance documents (Doc 9988)
- Providing training
- Developing tools
- Assisting States to get access to funding
- Partnering States
- Supporting implementation and providing technical assistance

ICAO PARTNERSHIPS FOR ACTION ON CLIMATE CHANGE

To facilitate the development and implementation of States' action plans, ICAO established partnerships with international organizations, for example:

- **ICAO assistance project with European Union (EU) funding that supports 14 selected States in Africa and in the Caribbean to develop and submit robust action plans, establish a CO₂ emissions monitoring system for their aviation sector, and pilot the implementation of mitigation measures**
- **ICAO assistance project with UNDP and GEF funding, which includes piloting the installation of solar panels at two airports in Jamaica**

During the 39th ICAO Assembly, new partnerships were announced including with the EU (2nd phase of the project), the World Bank, and the Government of Germany to build capacity on action plans and ensure preparedness for CORSIA.

RECYCLING

ICAO'S WORK ON RECYCLING

The ability of the aviation sector to re-use and recycle aircraft parts and to adapt these practices to aircraft manufacturing, have been recognized as equally valuable as new technological developments.

As a contribution to strengthening the full lifecycle approach to aircraft manufacturing, ICAO will consider environment-related issues related to aircraft end-of-life, without compromising safety and other issues.

ADAPTATION

ICAO'S WORK ON ADAPTATION

Recent extreme weather events have highlighted the importance of preparedness of the aviation sector for climate change. ICAO has included a new chapter on Climate Adaptation in the Airport Planning Manual, Part 2. This aims to raise awareness on possible risk-assessment and adaptation actions amongst airport planners and developers.

Future work includes the identification of potential impacts of climate change on international aviation operations and related infrastructure and adaptation measures to address the impacts.

SUITE OF ICAO TOOLS



Aviation Environmental System (AES): A Monitoring, Reporting and Verification (MRV) tool to help States collect and monitor CO₂ and fuel data.



ICAO Environmental Benefits Tool: Automates calculation of the baseline for CO₂ emissions in international aviation, and the estimation of expected results obtained through the implementation of mitigation measures.



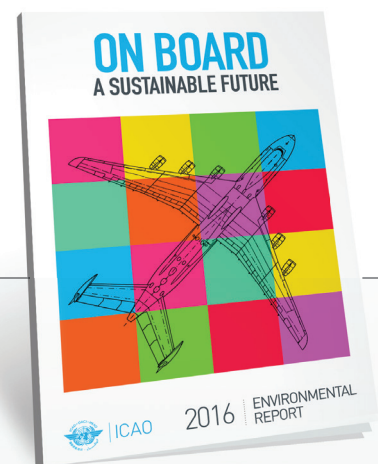
ICAO Carbon Emissions Calculator: Allows States to estimate the CO₂ emissions attributed to air travel, using only a limited amount of input information.



ICAO Fuel Savings Estimation Tool: Can be used to estimate fuel savings obtained through operational measures in a manner consistent with approved models.

2016 ENVIRONMENTAL REPORT

A Comprehensive and reliable information guide on aviation and climate change. This guide focuses on recent aviation achievements, policies on international aviation and climate change.



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