

# AIRCRAFT EMISSIONS AND CLIMATE CHANGE

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Aircraft engines produce emissions that are similar to other emissions resulting from fossil fuel combustion. However, aircraft emissions are unusual in that a significant proportion is emitted at altitude. These emissions give rise to important environmental concerns regarding their global impact and their effect on local air quality at ground level.

The aviation sector recognizes the growing and urgent need for society to address the global challenge of climate change. It also emphasizes that aviation plays a vital role in promoting sustainable development and should remain safe, affordable and accessible in order to ensure mobility on an equitable basis to all sectors of society.

The international community has a common responsibility to ensure that aviation can continue to deliver vital social and economic benefits, while addressing the impact of its CO<sub>2</sub> emissions.

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## 1 INTRODUCTION

The exhaust fumes from jet and turbopropeller aircraft contain the same substances as emissions from other engines. These include, for example, carbon dioxide (CO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), unburned hydrocarbons (HC), carbon monoxide (CO), water vapour, sulphur oxides (SO<sub>x</sub>) and Particles.

Aviation petrol, i.e. kerosene, is used as the fuel in turbine engines. The amount of carbon dioxide and water vapour created in the combustion of fuel is directly proportional to the amount of fuel. In the combustion process, one kilogramme of kerosene yields 3.2 kg of carbon dioxide and 1.3 kg of water vapour. The amount of

other emissions varies at different stages of the flight, and are also affected by such factors as the type of aircraft and engines and the take-off weight of the plane.

The consumption of fuel by aircraft per seat has decreased by around 70 per cent over the last 40 years.

The International Civil Aviation Organization (ICAO) has developed a methodology to calculate the carbon dioxide emissions from air travel. Some airlines have also created similar type of calculations on their websites. Typically the results from different calculators are slightly different due to the type of the background data.

## 2 EMISSION TRENDS

It has been forecast that emissions from air traffic will increase. The consultation report of the EU used general estimates, according to which emissions from air traffic would increase 4 per cent per year up to 2012. The estimate mainly concerns Europe.

Air traffic in the US is increasing more slowly than in Europe. The most rapid growth in air traffic is in the Far East.

The new findings related to aviation emissions are:

- Due to developing scientific knowledge and more recent data estimates of the climate

effects of contrails have been lowered and aircraft in 2009 are now estimated to contribute about 3.0 % of the total of the anthropogenic radiative forcing by all human activities;

- Total CO<sub>2</sub> aviation emissions is approximately 2 % of the Global Greenhouse Emissions;
- The amount of CO<sub>2</sub> emissions from aviation is expected to grow around 3 - 4 per cent per year; and
- Medium-term mitigation for CO<sub>2</sub> emissions from the aviation sector can potentially come from improved fuel efficiency. However, such improvements are expected to only partially offset the growth of CO<sub>2</sub> aviation emissions.

## 3 A GLOBAL APPROACH FOR AVIATION

Aviation is the ultimate global activity: it provides an interconnected network of air services

spanning the entire globe, with aircraft - and their emission - crossing continents and national jurisdictions on a daily basis. Even flights that are purely within a State's boundaries can have

implications for international aviation, as domestic flights often serve as critical feeders for the international network. To avoid a patchwork of conflicting and potentially overlapping national and regional policies, a framework for measures addressing CO<sub>2</sub> emissions from aviation must be developed at a global level.

Further, although aviation is a relatively homogenous sector in terms of technology and efficiency levels, it is also a highly competitive, R&D-intensive sector, largely characterized by low entry barriers, thin revenue margins and high risk exposure. Policy measures applied in other sectors may not necessarily translate to aviation. While the aviation sector has many characteristics that make the development of policy mechanisms to further reduce emissions more challenging than for other fossil fuel consuming sectors, it has an unparalleled record of fuel and CO<sub>2</sub> efficiency improvements.

Given the nature of the aviation sector, plus the fact that its emissions cannot easily be attributed to any particular economy, it is recommended that multilateral collaborative action by all States through a global sectoral approach, encompassing all air transport operators, be endorsed by the HLM-ENV as the most appropriate mechanism to effectively address CO<sub>2</sub> emissions from aviation.

#### 4 TARGETS

Global sectoral agreement for aviation is based on the following targets and guided, by the following principles:

- **Targets** - In line with GIACC recommendations, a collective CO<sub>2</sub> efficiency target is established for the near-term through 2020. The aviation sector recommends that a target to improve CO<sub>2</sub> efficiency by an average of 1.5 per cent per annum (on a CO<sub>2</sub> emissions per revenue tonne kilometre (RTK) basis) be established. This target takes into account the effects of the current economic crisis on revenues and load factors, which has a direct impact on the rate at which airlines can replace their fleets. Furthermore, infrastructure and ATM efficiency improvements are dependent on direct

To be effective, however, regulatory efforts to limit or reduce CO<sub>2</sub> emissions from aviation should address all parts of the aviation supply chain. In addition to aircraft operators this includes for example aircraft manufacturers, fuel suppliers, air navigation service providers and airports, who directly influence aviation's environmental performance through the design and deployment of the products and services they supply.

Governments have a responsibility to establish the right legal and fiscal frameworks to facilitate and increase investment in cost-effective CO<sub>2</sub> emissions reduction measures, including new aircraft and engine technologies, more efficient ATM infrastructure and low-carbon sustainable alternative jet fuels, and to enable the full and unrestricted access of the aviation sector to the global carbon market and use of available mitigation measures outside the sector.

The aviation sector urges governments to give their full backing and explicitly state their support for ICAO as the appropriate United Nations body for setting and administering aviation-specific standards and targets to further address CO<sub>2</sub> emissions from aviation and for advocating these elements as part of a global sectoral approach for aviation in the Copenhagen climate negotiations.

government investments over which the industry has little visibility and little control.

- In line with concepts discussed at GIACC, a mid-term target to stabilize net CO<sub>2</sub> emissions from aviation from 2020 onward (carbon-neutral growth), subject to critical aviation infrastructure and technology advances achieved by the industry and government, should also be adopted. A longterm aspirational goal would be to reduce aviation net carbon emissions by 50 per cent in 2050, compared to 2005 levels.
- **Accounting for aviation emissions** - Aviation CO<sub>2</sub> emissions should be addressed through a global sectoral approach and accounted for in the global emissions inventory, not at a regional or national level. It is essential that emissions from aviation are accounted for only once, whether from domestic or international activities and that any market-

based measures addressing aviation emissions are not duplicative. The establishment of a global sectoral approach will ensure this by replacing local, national and/or regional measures with a single, global framework for aviation.

- **Geographic coverage** - due to the global, interconnected nature of air transport, the sectoral agreement should apply equally to both domestic and international aviation emissions, without distinction.
- **Interdependencies of measures** - The key CO<sub>2</sub> abatement opportunities for the aviation sector are the implementation of new technologies, including low fuel burn aircraft and engine technologies, alternative fuels with reduced life-cycle CO<sub>2</sub> emissions, and ongoing improvements in operational efficiency and ATM systems and processes. While the aviation sector continues to explore and exploit the full range of available abatement opportunities, it is important to consider the interrelationships between the various mitigation measures. For example, some actions to reduce flight track lengths in the vicinity of airports can adversely affect noise management procedures such as preferred runway usage, flight tracks that avoid populated areas and many other noise abatement procedures. Therefore regulators, when formulating actions to address CO<sub>2</sub> emissions from aviation, must carefully consider and balance the overall possible impacts of such actions. But whatever the approach, all adopted measures should be technologically feasible, economically reasonable, and environmentally beneficial. The aviation sector believes that ICAO is uniquely qualified to provide guidance and technical expertise to develop CO<sub>2</sub> mitigation measures and ensure that they do not adversely impact on other sensitive aviation environmental areas such as noise and local air quality.
- **Cost-effective economic measures** - Economic measures to address CO<sub>2</sub> emissions from aviation must be cost-effective and non-discriminatory. These measures should be implemented globally and on the basis of consensus. They should also provide full and

open access to the global carbon market and must be developed and agreed through ICAO. Further, economic measures must not create “carbon leakage” where emissions transfer between countries or carriers lead to market distortions and negate environmental benefits. The aviation industry reiterates that taxes, levies and charges targeted at air transport are environmentally ineffective and not cost efficient; they severely undermine the sector’s ability to invest in further emissions reduction technology, operations and infrastructure measures.

- **Use of revenues** - Any eventual revenues from economic measures under a global scheme to address aviation emissions should be clearly earmarked for aviation and environmental purposes. Such revenues should be prioritized for re-investment in additional measures to further improve the emissions profile of aviation, for instance by supporting the development and deployment of more fuel-efficient aircraft, engines, infrastructure, low carbon sustainable jet fuels and investment in ATM technologies.
- **Use of carbon market instruments** - For a sectoral approach for aviation to be effective it must have an open architecture, i.e. aviation should have unrestricted access to carbon market instruments to meet its obligations, on a par with other sectors. The full integration of aviation sector CO<sub>2</sub> emissions in the global emissions inventory should make this possible.
- **Administration** - Effective administration of the global sectoral agreement requires implementation, management and oversight of the following processes: target setting, CO<sub>2</sub> monitoring and reporting, compliance and enforcement. Administration should be undertaken by the organization(s) able to do so in the most efficient and cost-effective manner and could involve both government and industry bodies. As the designated United Nations body for international aviation, ICAO should have a central oversight role in this process. As is currently already the case with regard to aviation noise and non-CO<sub>2</sub> emissions, ICAO should create and maintain

a robust aviation CO<sub>2</sub> emissions inventory, available on an equal access basis.

- **Equal treatment and common but differentiated responsibilities** - It is believed that, with some political leadership and innovative solutions, the principles of equal treatment between airlines and differentiated responsibilities for States are completely consistent in the context of aviation. ICAO

has traditionally recognized and accommodated states with special needs that have difficulty complying with standards or recommended practices, either through technical and financial support or via differentiated timelines for the implementation of measures. A global sectoral approach is the best way of achieving this, bearing in mind the need to minimize competitive distortions.

## 5 CONCLUSION

In this article we have dealt the problem of emissions produced by aircraft engines and its influence on climate change. Some aspirational goal's and implementation options proposed on High-level meeting on International aviation and Climate change in Montreal 2009 have been mentioned as a contribution to global atmospheric problems.

Closing:

- It is not just about climate.
- It's critical we understand impacts, have robust metrics, and have integrated analysis of options.
- The issue is performance, not the approach.
- Trying to dictate to others will not produce success.
- ICAO has a crucial role to play.
- Intensity targets may offer a way forward.
- Multiple taxation is a non-starter.
- It's not just about airlines.
- Use opportunity that fuel prices have given us.
- Don't underestimate the role of technology to produce a positive future.

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