2024

Committee on Aviation Environmental Protection – Topic 1

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[1] This paper reflects the author's personal views and cannot be considered as the views of ICAO.

Topic 1: The challenges of decarbonisation for aviation

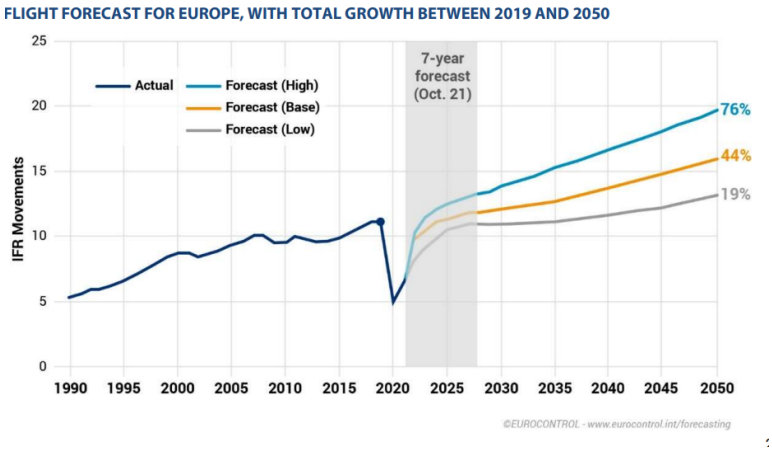
1. Setting the scene

The year 2023 was the warmest year on record, by a "huge margin" according to the World Meteorological Organisation (WMO). Emphasising that climate change is the biggest challenge for humanity, the Secretary General of the WMO made the following plea: "*We cannot afford to wait any longer. We are already taking action but we have to do more and we have to do it quickly. We have to make drastic reductions in greenhouse gas emissions and accelerate the transition to renewable energy sources.*"[2]

From the United Nations Framework Convention on Climate Change (UNFCCC), signed in 1992 to the 1997 Kyoto Protocol and the 2015 Paris Climate Agreement, States have established a global framework to address the most challenging environmental issues. The Paris Climate Agreement, at Article 2, set in particular the following objective: "*Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change*".

It is recognised that global aviation represents more than 2% of man-made CO2 emissions[3], and that its potential for global warming are even larger if we also consider non-CO2 emissions including contrails[4]. Actions at every level of the aviation ecosystem are needed as the impact of aviation on climate change will grow with the estimated traffic increase over the next years. In Europe (for 44 ECAC States), a forecast with different scenarios published in April 2022 foresaw – in the base-scenario – around 16 MEUR flights in 2050, an increase of 44% compared to the 2019 (pre-pandemic) figures.

[2] https://wmo.int/media/news/wmo-confirms-2023-smashes-global-temperature-record
[3] See EUROCONTROL Aviation Outlook 2050, Main Report, April 2022 at https://www.eurocontrol.int/publication/eurocontrol-aviation-outlook-2050
[4] See Concept of Operations for the Introduction of Electric, Hybrid-electric and Hydrogen-powered Zero Emission Aircraft, Alliance for Zero-Emission Aviation, 23 January 2024, page



These figures may be impacted[5] by the recent global events, related economic uncertainty and impact of climate change driven natural events, as well as regulatory actions in response to climate change, such as, in particular, the EU's measures under the Fit for 55 package and the possible future inclusion of non-CO2 effects in aviation under the EU's emissions trading scheme ETS[6], referred to below. Nonetheless, it remains safe to assume that traffic will continue to increase over the next decades and that in most parts of the world we are likely to see growth, particularly in those regions not (yet) concerned by regulatory climate change measures.

Reverting to 2023, the WMO datasets revealed a new annual temperature average of 1.45°C set against the pre-industrial era (1850-1900), meeting in one year the 1.5°C long term temperature goal set in the Paris Climate Agreement. While the Paris Climate Agreement does not refer to international aviation, aviation stakeholders have committed to sustainability goals in support of the Paris Climate Agreement,

2. Aviation Policies and Goals

The International Civil Aviation Organisation (ICAO) has made environmental protection one of its strategic objectives. Over the last few decades, the ICAO Assembly has addressed environmental protection, shaping policies supporting aviation sustainability. The *ICAO Special Environment Report on International Aviation Cleaner Energy Transition*, published in 2023, details these developments, looking at the key Assembly resolutions throughout the years dealing with climate change and emissions.

[5] EUROCONTROL is currently preparing a revised version of this forecast, to be published later in 2024.
[6] It is foreseen that in a pilot phase starting on 1 January 2025, each aircraft operator in the EU monitors and reports the non-CO2 effects from each aircraft, see https://climate.ec.europa.eu/system/files/2023-12/event_20231201_presentation_en.pdf.

The main latest relevant developments at ICAO level are set out below.

- The Assembly, at its 41th session in 2022, adopted in particular the following Resolutions:
  - Resolution A41-21: Consolidated statement of continuing ICAO policies and practices related to environmental protection - Climate change
  - Resolution A41-22: Consolidated statement of continuing ICAO policies and practices related to environmental protection - Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)

- Resolution A41-21, paragraph 7, refers to the 2050 long-term global aspirational goal for international aviation:
  - "*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."*

- Paragraph 8 of that same resolution underlines that: *"While recognizing 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, urges each State to contribute to achieving the goal in a socially, economically and environmentally sustainable manner and in accordance with national circumstances.'*

- With respect to CORSIA, and following on Resolution A41-22 referred to above, amendments were made in March 2023 to ICAO Annex 16 – Environmental Protection clarifying, inter alia, CORSIA monitoring, reporting, and verification requirements.

- At the third ICAO Conference on Aviation and Alternative Fuels (CAAF/3), held in Dubai, UAE, from 20 to 24 November 2023, another commitment was made to support decarbonisation, The new ICAO Global Framework for Sustainable Aviation Fuels (SAF), Lower Carbon Aviation Fuels (LCAF) and other Aviation Cleaner Energies, ICAO and its Member States have agreed to strive to achieve a "*collective global aspirational Vision to reduce international aviation CO_2 emissions by 5 per cent by 2030*".[7]

The actions taken by European Union provide a regional perspective:

[7] https://www.icao.int/Newsroom/Pages/ICAO-Conference-delivers-strong-global-framework-to-implement-a-clean-energy-transition-for-international- aviation.aspx#:~:text=By%20the%20adoption%20of%20a,aviation%20by%205%20per%20cent

- The European Commission's European Green Deal is the EU roadmap towards climate neutrality. To reach this goal, inter alia a package of legislation referred to as Fit for 55 in 2030 contains the revision of laws and proposals for new ones on climate and energy[8].

- As part of this package, the European Parliament adopted the European Climate Law[9] establishing the EU's target of reducing net greenhouse gas emissions at least 55% by 2030 and makes climate neutrality by 2050 legally binding.

- The EU also established the world first major carbon market, the Emissions Trading System (ETS) with the objective to reduce the industry's carbon emissions. To align it with the revised emission targets of the European Green Deal, the scheme was updated in April 2023. In 2025, a Monitoring, Reporting and Verification framework will be implemented for non-CO2 emissions including contrails in the scope of the revision of the EU-ETS.[10]

- In October 2023, Regulation (EU) 2023/2405 of the European Parliament and of the Council of 18 October 2023 on ensuring a level playing field for sustainable air transport (ReFuelEU Aviation) was adopted, with the main objective to increase both demand for and supply of sustainable aviation fuels (SAF), which have lower CO2 emissions than fossil fuel kerosene. Measures to avoid fuel ('tankering' i.e. deliberately carrying excess fuel to avoid refuelling with SAF) are also foreseen[11].

Other aviation stakeholders have committed to achieving net-zero carbon emissions from their operations. IATA, the international aviation transport association representing airlines, approved a resolution in October 2021 for the global air transport industry "*to achieve net-zero carbon emissions by 2050. This commitment will align with the Paris Agreement goal for global warming not to exceed 1.5°C.*"[12] The members of ACI, the Airport Council International, have also committed to this objective, which is supported as well as by CANSO, the Civil Air Navigation Services Organisation.

3. How to achieve these goals

Emissions must be reduced, with ambitious goals and targets set for aviation to achieve carbon neutrality, including binding ones. There is overall agreement that a range of actions needs to be

[8] European Commission, Fit for 55 package, July 2021.

[9] Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality

[10] See footnote 6 above.

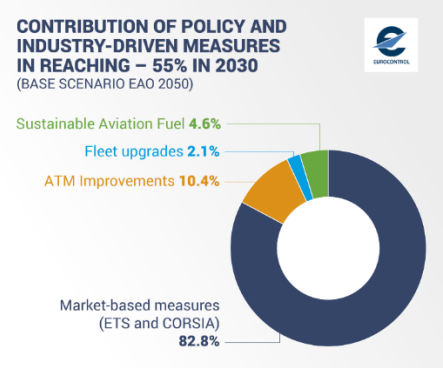
[11] https://ec.europa.eu/commission/presscorner/api/files/document/print/en/ip_23_2389/IP_23_2389_EN.pdf.

[12] https://www.iata.org/en/pressroom/pressroom-archive/2021-releases/2021-10-04-03/

combined to achieve these objectives in aviation, often referred to as a basket of measures. These actions include:

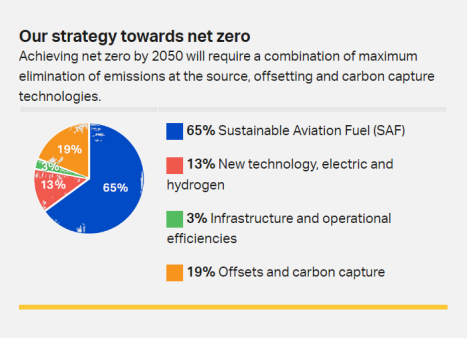
- Market based measures (MBMs) carbon offsetting and carbon removal technologies
- Sustainable aviation fuel (SAF, bio and synthetic) and possibly also other, to some extent, more climate friendly types of fuel such as Low Carbon Aviation Fuels LCAF (still kerosene but produced with less CO2 consumption)[13]
- Fleet upgrades / renewals
- ATM / operational efficiency improvements
- Aircraft electrification / disruptive technology (Hydrogen and Hybrid)

Looking at the 2030 horizon, it is expected that decarbonisation will mainly come from market-based measures (CORSIA, ETS) as SAF is currently hindered by low supply and prices higher than for fossil fuels (% set for Europe)[14]:



Considering the 2050 targets, MBMs should be the last option, with the other 'in sector' measures referred to above contributing jointly to meet the net zero objective. The airlines' strategy for 2050 (IATA), reflects this approach, counting on increasing availability of SAF[15]:

[13] To note: the FAA, for instance, refers to the term of Alternative Fuels to cover both SAF and LCAF.
[14] Objective SkyGreen 2022-2030, The Economics of aviation decabornisation towards achieving the Green Deal Milestone, EUROCONTROL, https://www.eurocontrol.int/publication/objective-skygreen-2022-2030
[15] https://www.iata.org/en/programs/environment/flynetzero/



Percentage will vary, and can at this stage only be estimated, not least as developments for SAF and other new technology are still ongoing. It is clear that substantial investments will be required from both States and the industry, as forcefully highlighted by the last ICAO Assembly.

An additional and possibly very big challenge will be to ensure that the aviation sector will have access to sufficient quantities of clean/renewable energy considering also the likely high demand from other sectors and capacity constraints to be expected. A particular bottleneck in this context may prove green hydrogen, as clean energy (green hydrogen and green electricity) is needed both to produce SAF and mainly E-SAF and to use in hydrogen-powered aircraft and electric aircraft.

Efforts should also continue on changes that can already now have an impact on decarbonisation. Air Traffic Management (ATM) improvements can trigger airspace optimisation and result in fuel efficiency at every steps of a flight[16]. The best emissions are the ones not emitted. Therefore, reducing our fuel consumption by increasing our fuel efficiency should be the first step and ATM has an important to play on the short term. Through increased collaboration between all actors (policy-makers, airlines, airports, aircraft, manufacturers, ANSPs and passengers), every flight should be flown in the most environmentally-friendly way possible. R&D in the ATM domain will also be an important part to reach these targets.[17]

4. Non-CO2 emissions

Focus in public debate and policy making has been on *decarbonisation*, as demonstrated by the policies and goals referred to above. The urgency to tackle climate change and push for sustainable aviation has, as mentioned above, however also resulted in increased consideration of, and

[16] Idem

[17] See EUROCONTROL Think Paper # 10, 20 April 2021, "Flying the 'Perfect Green Flight': How Can We Make Every Journey as Environmentally-friendly as Possible?" and EUROCONTROL, Objective Skygreen, Think Paper #16 - 12 May 2022, "Reducing Aviation Emissions by 55% by 2030: Can It Be Done – And If so, What Are the Extra Costs of Decarbonisation Measures?"

regulatory reaction to, the industry's impact on *non-CO_2 emissions*, in particular with respect to contrails, which formation can also impact the climate.[18]

In addition to reaching carbon neutrality, there is also a need to integrate climate considerations into aviation operations.

5. Non-exhaustive list of potential questions to be addressed by the delegates

- Would you State support additional measures to accelerate decarbonisation and more binding commitments? Are the aspirational goals sufficient from the point of view of your State?
- Are achieving these goals a priority for your State?
- Do you consider that other instruments should be developed to support sustainability targets?
- Does your State consider that the measures already in place adequate to face the challenges faced by the aviation industry with respect to sustainability?
- Has your State been faced with public policy challenges resulting from the diverging interests of the industry seeking continued growth and your State's environmental agenda?
- What is the view of your State with respect to more stringent regional measures? Should all measures be harmonised at the global level considering the global nature of aviation?
- What should be the role of State in financing measures that will support developments of SAF and other clean technologies?
- Focus has been on decarbonisation – should more attention be paid to non-CO2 impacts, such as contrail avoidance?

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- ICAO Doc 10184, Assembly Resolutions in force (as of 7 October 2022)
- ICAO Special Environment Report on International Aviation Cleaner Energy Transition, 2023, 1st Edition
- ICAO Annex 16,

[18] See report of, and presentations made at, the Sustainable Skies Conference: Contrails in Focus, 7-8 November 2024 published at https://www.eurocontrol.int/event/sustainable-skies-conference-contrails-focus

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