ICCT **POLICY UPDATES** SUMMARIZE REGULATORY AND OTHER DEVELOPMENTS RELATED TO CLEAN TRANSPORTATION WORLDWIDE.

POLICY UPDATE

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ICAO's 2050 net-zero CO_2 goal for international aviation

Shraeya Mithal and Dan Rutherford

Governments, industry, and civil society representatives gathered in Montreal at the International Civil Aviation Organization's (ICAO) 41st Assembly in September and October 2022 to codify an international agreement on carbon reductions from aviation. On October 7th, ICAO adopted a long-term aspirational goal (LTAG) of net-zero carbon dioxide (CO_2) emissions by 2050.[1] The agreement is similar in structure to the International Maritime Organization's (IMO) 2018 Initial Greenhouse Gas Strategy, but with a more ambitious long-term reduction target.[2] Just as IMO's agreement catalyzed new policies for and investments in low- and zero-emission ships, the new ICAO policy could be an important catalyst for change in aviation.

The goal reinforces industry and government commitment to aviation's decarbonization as expressed in the 2016 Carbon Reduction and Offsetting Scheme for International Aviation (CORSIA). CORSIA established an offsetting program for growth in emissions beyond a 2020 baseline ("carbon-neutral growth").[3] The new agreement, on the other hand, establishes a goal of net-zero CO_2 emissions from aviation by 2050 and encourages states to develop State Action Plans (SAPs) for achieving this goal. It also encourages promotion of alternative fuels and development of alternative technology.

The agreement signals a clear turn away from merely offsetting emissions and toward measures to dramatically reduce CO_2 from planes and fuels. It reflects the organization's sense of urgency around aligning aviation with the 2015 Paris Agreement, and it invites and supports measures adopted by member states to

1 ICAO Assembly, "Consolidated Statement of Continuing ICAO Policies and Practices Related to Environmental Protection - Carbon Offsetting and Reduction Scheme for International Aviation," 2022, https://www.icao.int/environmental-protection/CORSIA/Documents/Resolution_A41-22_CORSIA.pdf.

2 Dan Rutherford and Bryan Comer, *The International Maritime Organization's Initial Greenhouse Gas Strategy*. April 2018, https://theicct.org/publication/the-international-maritime-organizations-initial-greenhouse-gas-strategy/ .

3 Rutherford and Comer, *The International Maritime Organization*, 2018; ICAO Secretariat, "Environmental Protection Report: Introduction to CORSIA," International Civil Aviation Organization, 2019, pp. 207–10, https://www.icao.int/environmental-protection/Documents/EnvironmentalReports/2019/ENVReport2019_pg207-210.pdf.

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control aviation emissions.[4] Still, the aspirational goal is a non-binding agreement, with no state- or airline-specific commitments or requirements, so further action will be needed to translate the agreement into binding national and international policies.

THE AGREEMENT

ICAO's agreement establishes a 2050 net-zero CO_2 goal and outlines a process for states to use to implement the accord. Net-zero implies deep cuts in emissions from planes and their fuels, supplemented as needed by out-of-sector measures like atmospheric removals of CO_2 to address residual emissions. The agreement turns away from offsetting in favor of measures that directly reduce aviation CO_2. The decision invites member states to adopt concrete measures to reduce emissions, and to steer private and public investments toward development of new technology. ICAO commits itself to coordinate and collate national best practices and to develop aviation technology and alternative aviation fuels in poorer countries.

The resolution delineates the roles of ICAO and member states in achieving net-zero CO_2, placing primary responsibility with member states and giving the ICAO Council (ICAO's main governing body) a coordinating role. It directs the Council, which implements the policies set by the ICAO Assembly, to take the following actions:

- Develop and update guidance on the application of control policies and measures for member states, including operational measures, and monitor progress in implementing SAPs
- Create finance mechanisms to support decarbonization initiatives in developing countries
- Further develop tools to quantify aviation's GHG emissions, including the ICAO Carbon Emissions Calculator, and
- Identify the potential impacts of climate change on international aviation and related infrastructure and determine appropriate adaptation measures.[5]

The agreement invites countries to take a central role in developing control measures for aviation emissions. The resolution requests that member states submit to ICAO by June 2024 a SAP detailing how they intend to control aviation emissions, and to update those plans every three years. States are invited to implement policies governing renewable jet fuels, notably sustainable aviation fuels (SAFs), along with measures to encourage the introduction of new, more fuel-efficient aircraft. Member states are also urged to accelerate investment in the development of zero-emission planes, and to work with industry to implement environmentally efficient use of airspace and of ground operations. Finally, countries are urged to integrate aviation adaptation measures into climate risk assessments and national climate policies.[6]

The agreement represents a significant shift away from previous ICAO climate governance in several respects. First, it favors action to reduce CO_2 from planes and fuels directly, rather than mitigating emissions through the purchase of emissions credit or offsets from other sectors. Second, it envisions deep cuts in aviation CO_2, to

4 ICAO, "Consolidated Statement of Continuing ICAO Policies and Practices Related to Environmental Protection - Climate Change," 2022, https://www.icao.int/environmental-protection/Documents/Assembly/Resolution_A41-21_Climate_change.pdf

5 ICAO, "Consolidated Statement," 2022.

6 ICAO, "Consolidated Statement," 2022.

near-zero levels by 2050, which ICAO estimates will cost up to $4 trillion US.[7] Third, it invites member states to regulate aviation emissions themselves, rather than relying on ICAO to develop minimum global standards covering all countries.

Despite these strengths, the agreement is missing significant elements. It does not assign individual targets to states, so neither countries nor airlines have a direct obligation to reduce emissions. Nor does it set intermediate goals (e.g., 2030 and 2040 targets) that would ensure that airlines do not consume their share of the global carbon budget too quickly. Finally, short-lived climate pollutants like nitrogen oxides, black carbon, water vapor, and contrail/cirrus are not included. These non-CO_2 elements could warm the planet by twice as much as CO_2 alone;[8] near-term action to reduce their presence in the atmosphere could halt further warming from aviation.[9]

WHAT'S NEXT

The onus of action now shifts from ICAO to its member states. Countries will develop national strategies to cut emissions consistent with the 2050 goal, as summarized in the SAPs submitted to ICAO.

Achieving the 2050 goal will require rapid action. Technology roadmaps developed by government, industry, and civil society in the run-up to the decision suggest that countries will need to peak emissions around 2025 to achieve near-zero CO_2 emissions in 2050. Figure 1 shows the possible temperature outcomes implied by ICAO's agreement, ranging from 1.6 C (linear reductions from 2022) to 2.3 C (business-as-usual growth through 2049, followed by a sudden "crash" to 2050). Figure 1 assumes a 66% probability of success and that aviation does not increase its share of global carbon above 2019 levels. The thin colored lines indicate the trajectories of the most aggressive scenario of each roadmap, normalized to 2019 emissions in the market analyzed (e.g., European aviation in Destination 2050, international aviation in ICAO's LTAG report, etc.). Most net-zero roadmaps posit a 1.75 degree C pathway (see Graver et al. 2022) by peaking aviation CO_2 by 2025, typically below 2019 levels.[10]

7 Committee on Aviation Environmental Protection, (CAEP), "Report on the Feasibiliity of a Long-Term Aspirational Goal," ICAO, 2022, https://www.icao.int/environmental-protection/LTAG/Documents/REPORT%20ON%20THE%20FEASIBILITY%20OF%20A%20LONG-TERM%20ASPIRATIONAL%20GOAL_en.pdf.

8 D.S. Lee, D. W. Fahey, A. Skowron, M.R. Allen, U. Burkhardt, Q. Chen, S.J. Doherty, S. Freeman, P.M. Forster, J. Fuglestvedt, A. Gettelman, R.R. De León, L.L. Lim, M.T. Lund, R.J. Millar, B. Owen, J.E. Penner, G. Pitari, M.J. Prather, R. Sausen, L.J. Wilcox, "The Contribution of Global Aviation to Anthropogenic Climate Forcing for 2000 to 2018," *Atmospheric Environment*, July 2021, https://reader.elsevier.com/reader/sd/pii/S1352231020305689?token=7688AF011EB68F718CBF265C969C4EC3A081EE08A92DF5D90A1224F9F731FB400ABE4104C10AAA583110F92D22C9F610&originRegion=us-east-1&originCreation=20221028200027.

9 M. Klöwer, M. R. Allen, D. S. Lee, S. R. Proud, L. Gallagher, A. Skowron, "Quantifying Aviation's Contribution to Global Warming," *Environmental Research Letters*, June 2021, https://iopscience.iop.org/article/10.1088/1748-9326/ac286e.

10 Brandon Graver, Xinyi Sola Zheng, Daniel Rutherford, Jayant Mukhopadhaya, and Erik Pronk, *Vision 2050: Aligning Aviation with the Paris Agreement*, (ICCT: Washington, DC: 2022), https://theicct.org/wp-content/uploads/2022/06/Aviation-2050-Report-A4-v6.pdf.

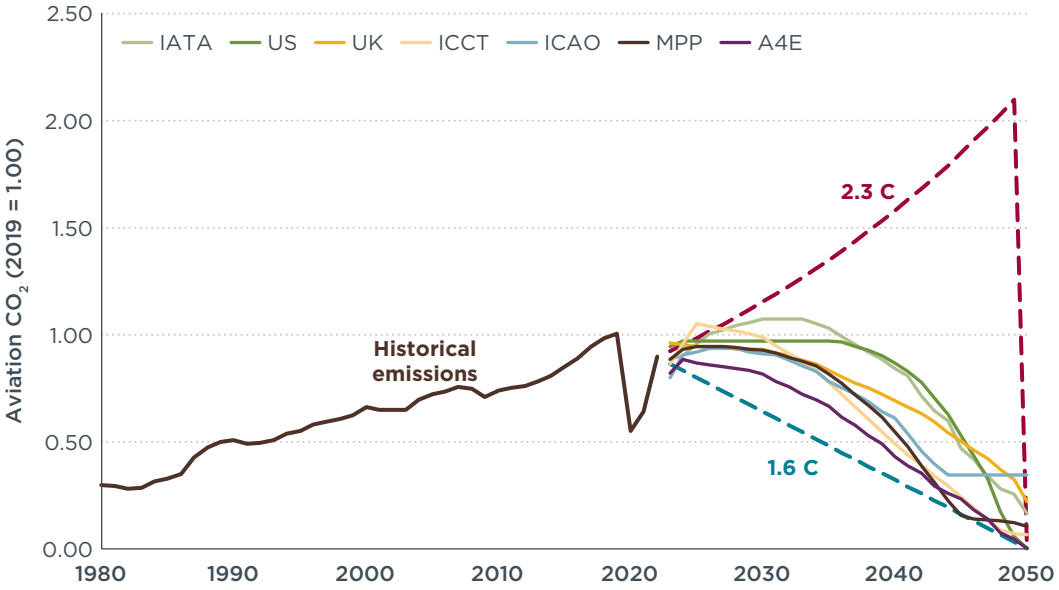

Figure 1. Historical and projected CO_2 emissions from aviation, 1980 to 2050, normalized to 2019[11]

Meeting these targets will require aggressive policies to drive new investments in lower-carbon aircraft and fuels. Graver et al. (2022) outlines three scenarios for future aviation emissions of varying ambition, ranging from Action (least ambitious) to Breakthrough (most ambitious), along with a Baseline case (far left of Figure 2).[12] As shown, the scenario of highest ambition would achieve a 1.75C "Well Below 2 Degree" (WB2D) pathway using a combination of low-carbon fuels (~60% of total mitigation) and fuel efficiency measures (about one-third), supplemented by demand reduction plus some modal shift to high-speed rail.

11 Air Transport Action Group, Waypoint 2050, 2021, https://aviationbenefits.org/media/167417/w2050_v2021_27sept_full.pdf; Airlines for Europe, Destination 2050: A Route to Net Zero European Aviation. Feb. 2021, https://www.destination2050.eu/wp-content/uploads/2021/03/Destination2050_Report.pdf; Graver, et al., Vision 2050, 2022; Department for Transport, Jet Zero Strategy: Delivering Net Zero Aviation by 2050, 19 July 2022, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1095952/jet-zero-strategy.pdf; Federal Aviation Administration, United States 2021 Aviation Climate Action Plan, November 2021, https://www.faa.gov/sites/faa.gov/files/2021-11/Aviation_Climate_Action_Plan.pdf; Mission Possible Partnership, Making Net-Zero Aviation Possible: An Industry-Backed, 1.5C-Aligned Transition Strategy, July 2022, https://missionpossiblepartnership.org/wp-content/uploads/2022/07/Making-Net-Zero-Aviation-possible.pdf.

12 Graver et al., *Vision 2050*, 2022.

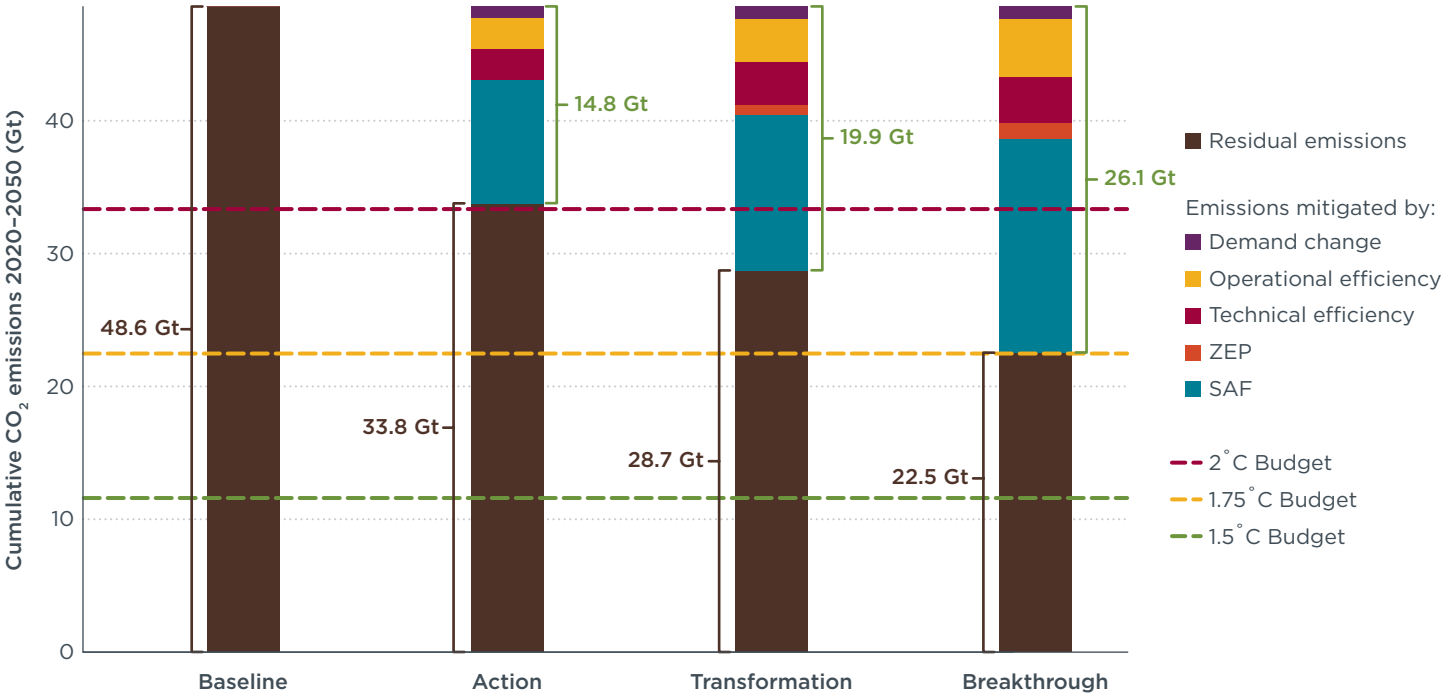

Figure 2. Cumulative global aviation CO_2 emissions by scenario and measure, 2020-2050[13]

These pathways apply to aviation at the global level; different levels of ambition are anticipated from country to country. Implementing a net-zero target also raises equity concerns. Developing countries have called for extra time to achieve net-zero emissions due to their need to continue expanding their aviation industries and because they have less access to low-carbon technologies. Developing countries also argue that developed countries should decarbonize first because they have a greater responsibility for historical CO_2 emissions. Meeting a global aviation WB2D pathway will be challenging if developed countries, like the United States, exceed their 2019 emissions.

International equity concerns are also relevant to financing decarbonization. Currently, the LTAG agreement positions the ICAO as a fund "matchmaker" through which ICAO will assist developing countries in identifying sources of funding for decarbonization. ICAO has also encouraged developed and developing countries to partner to facilitate the transfer of technology and resources. Even with this program, developing countries are calling for greater action from developed countries, suggesting a multilateral fund to facilitate the development of new technologies, including SAFs. One financing source for such a fund could be a frequent flying levy.[14]

13 Graver, et al., *Vision 2050*, 2022.

14 Xinyi Sola Zheng and Daniel Rutherford, *Aviation Climate Financing Using a Global Frequent Flyer Levy*, (ICCT: Washington, DC, 2022), https://theicct.org/wp-content/uploads/2022/09/global-aviation-frequent-flying-levy-sep22.pdf.

CONCLUSION

ICAO's agreement is a potentially significant shift for the aviation industry. In principle, it could spur the industry to address ongoing growth in aviation emissions, but only if member states make early, strong, and stringent commitments. Indeed, achieving the net-zero agreement will require new investments in lower carbon aircraft, fuels, and atmospheric removals like direct air capture (DAC). The challenge is especially great if decarbonization is to be pursued in an equitable way that doesn't price developing countries out of aviation. Nevertheless, the LTAG agreement represents a departure from earlier policy and, if vigorously implemented by member states, could help to put the aviation industry on a sustainable path toward 2050.