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IATA Net Zero Roadmaps

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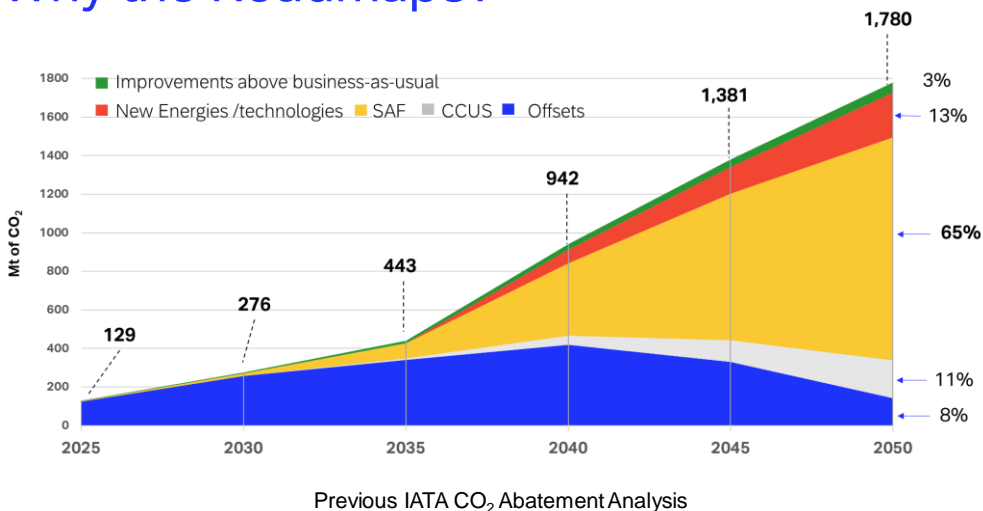


IATA Roadmaps:

Providing a strategic vision to achieve Net Zero CO₂ emissions by 2050



Why the Roadmaps?



At the 77th AGM in 2021, IATA's airline members committed to Net Zero by 2050, relying on a four-pronged strategy to abate as much CO₂ as possible from their operations (SAF; development of hydrogen and/or electric propulsion; operational improvements and; out-of-sector solutions like offsetting and carbon capture). With the adoption of LTAG, governments now share the same net zero by 2050 goal under which some 21 gigatons of CO₂ will need to be mitigated in the intervening 27 years.

This graph shows amount of carbon that will need to abated by each lever of action in the next 27 years.

But there were a lot of unknowns about the way forward, and how to implement the industry's ambition. The levers of action are known (better aircraft, SAF, hydrogen and electric propulsion, Operational improvements, offsetting and carbon capture as out-of-sector solutions...) but we, as an industry, were lacking a detailed approach, or were missing knowledge and realistic timelines. In addition, there were questions around how to track progress on the road to Net Zero, but also interim milestones to aim for from now till 2050.

This is why IATA has been working on a series of Net Zero Roadmaps aimed at providing details of critical actions and dependencies for aviation to achieve net zero carbon emissions by 2050.

Roadmaps Scope

The roadmaps are

- **A strategic tool to unify direction and provide a sheet for common action**
- **A more tangible way to track progress**
- **5 steps to a comprehensive Net Zero roadmap**

The roadmaps are not

- **A recipe**
- **A specific fixed scenario of what will happen**
- **A "fixed" static document**



It's important to highlight that these Roadmaps are:

- A strategic tool to provide a unified sense of direction and advocacy efforts for the industry. All stakeholders of the industry have "skin in the game"
- The Roadmaps will provide a more tangible way to track progress against the net zero by 2050 goal
- All the areas covered by the Roadmaps are interconnected, and, together, form a comprehensive picture of the road ahead - tying all the disparate elements together and give our stakeholders a complete understanding of everything that needs to happen.

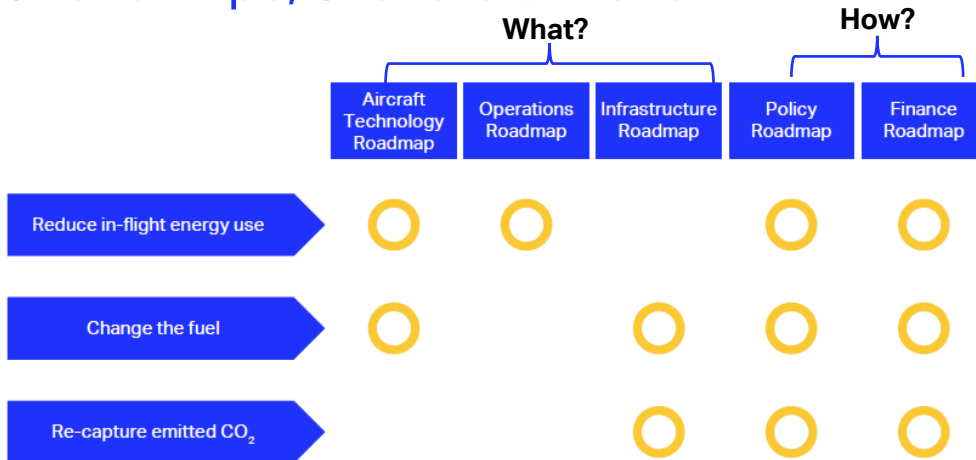
Also critical to remember is that these Roadmaps are not:

- A point by point "recipe" to reach net zero. They are an analysis of the possible scenarios that we see as feasible, and the steps that need to occur for NZ to be a reality
- We don't have a specific fixed scenario of what will happen. We're flexible and will adapt. The different stakeholders involved will have slightly different

ideas and priorities when it comes to net zero, but that's fine. We all have the same goal. The roadmaps show the actions that need to be taken and the sequence in which they need to occur

- We'll be monitoring that and adjusting the Roadmaps regularly as new information becomes available. It is by no means a "fixed" static document

5 roadmaps, 3 levers of action



Source: IATA Sustainability and Economics



3 levers of action – 5 roadmaps. This chart depicts how the five Roadmaps cover the three levers to reduce, neutralize or eliminate emissions.

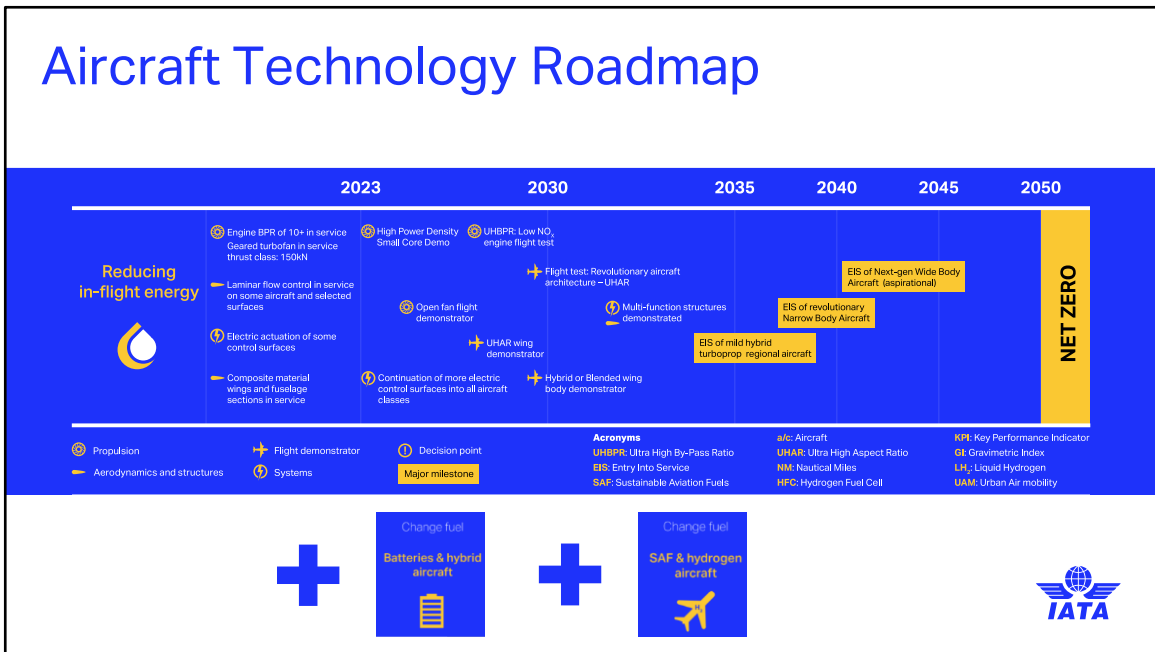
Aviation is one of the hardest sectors to decarbonize. As other sectors speed up their journeys to reach their net-zero carbon objectives, aviation could lag, and increase its share of the total global emissions. To avoid this, there are three levers of action that the sector can use to reduce, neutralize, and eliminate its emissions:

- Reduce aircraft energy use (= less fuel = less CO₂).
- Change the fuel and reduce its carbon footprint.
- And re-capture all the carbon which could not be abated, or which is associated to the manufacture of new fuels.

5 roadmaps (tech, infra, ops, pol, finance) to deliver this. The first three are the “what?” what do we need to get to net zero, the second two, are the “how?” how do we enable these new technologies, new fuels, and better operations through smart policy and financing mechanisms.

The roadmaps are set out to articulate in detail the developments that are necessary to reach our net zero goal, identifying important milestones on the way. The roadmaps chart a possible course towards net zero for the aviation industry, by leveraging all the possible technological, infrastructural, operational, financial, and policy levers in an integrated way. Furthermore, the roadmaps are scenario dependent, and the scenarios defined today might differ from the pathway the sector will follow, as this will be influenced by the ever-advancing research in all the five areas that the roadmaps address.

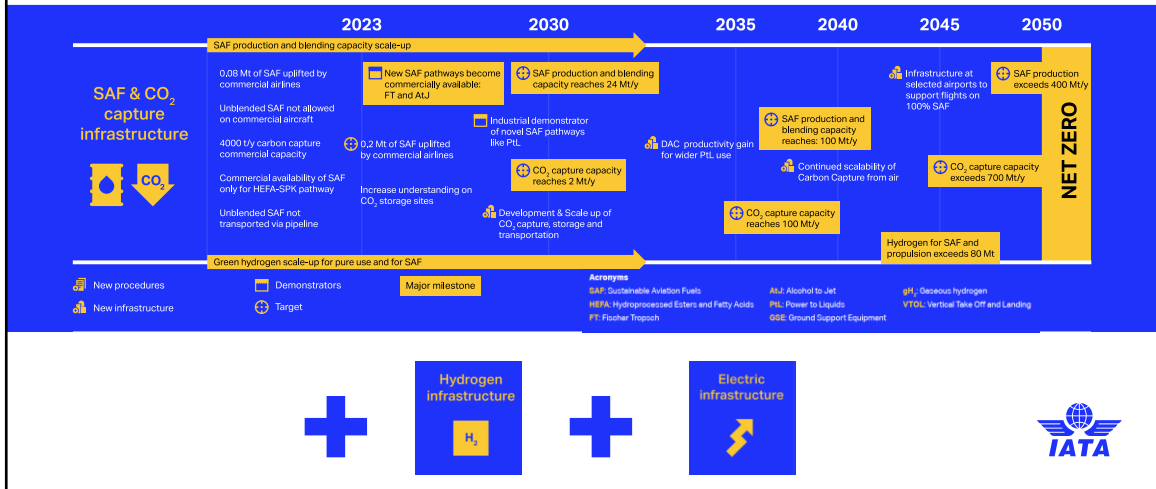
Aircraft Technology Roadmap



Aircraft Technology: the focus is on the development of more efficient aircraft and engines. Particularly important are the steps needed to enable aircraft powered by 100% SAF, hydrogen or batteries. All development milestones are backed-up by announced investment and demonstrator programs. Also included are new engines, aerodynamics, aircraft structures and flight systems.

37 milestones

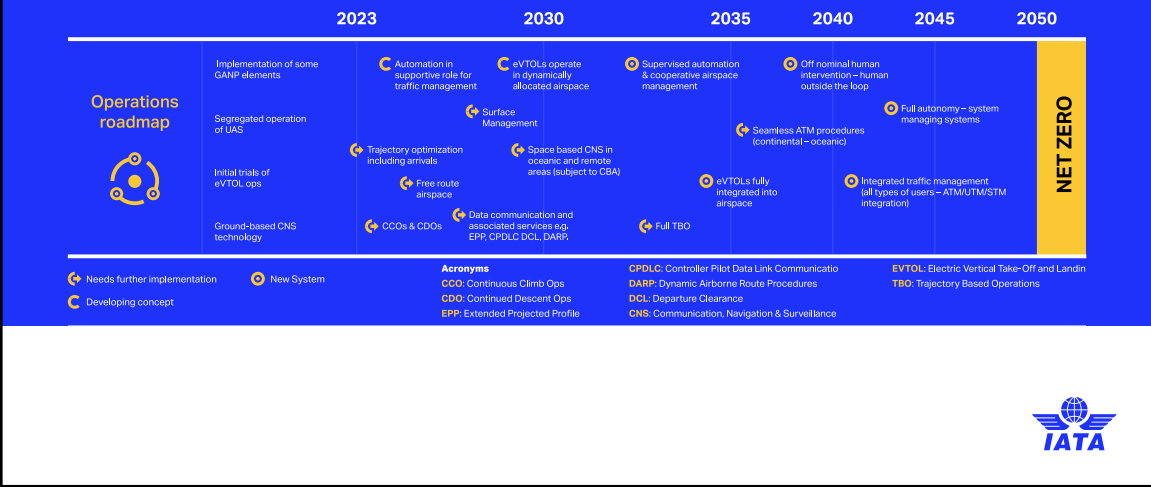
Energy & New Fuels Infrastructure Roadmap



Energy and New Fuels Infrastructure: the focus is on the fuels and new energy carrier infrastructure upstream from airports needed to facilitate the use of aircraft powered by SAF or hydrogen. Renewable energy plays a vital role in meeting the aviation sector's energy demand, and the roadmap outlines milestones to enable the necessary infrastructure developments.

35 milestones

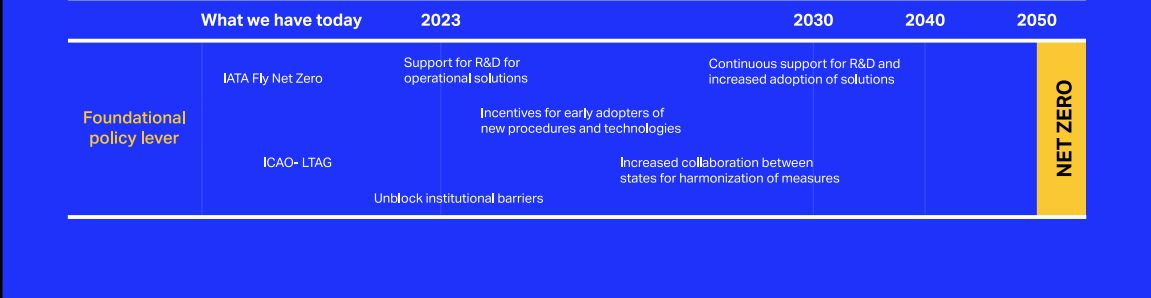
Operations Roadmap



Operations: the opportunities for reducing emissions and improving energy efficiency by improving the way existing aircraft are operated. Automation, big data management, and the integration of new technologies are key enablers for optimizing air traffic management and enhancing the overall efficiency of the air transportation system.

15 milestones

Policy Roadmap



The aviation industry cannot decarbonize alone, and the support of regulators and policy makers on this journey is absolutely essential.



Policy: the need for globally aligned strategic policies to provide incentives and support for the aviation industry's transition to a net-zero future. As with all other successful energy transitions, collaboration between governments and industry stakeholders is crucial in creating the necessary framework to achieve the decarbonization goals.

Finance Roadmap



Early stages of project development Mature technologies show tangible commercial promise

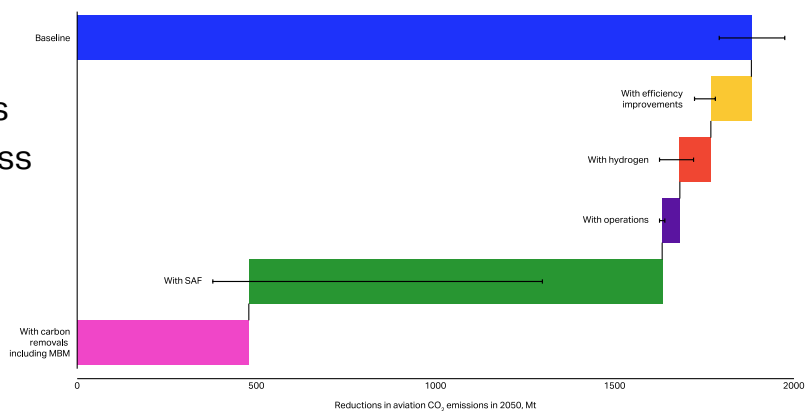
The investment needed to bring about aviation’s transition to net zero by 2050 could be as high as **USD 5 trillion** over the period to 2050. The annual investments required in that case would be close to **USD 180 billion**. This is not disproportionate to the annual investments in other industries



The investment needed to bring about aviation’s transition to net zero by 2050 could be as high as USD 5 trillion over the period to 2050. This includes technological advancements, infrastructure developments, and operational improvements. The annual investments required in that case would be close to USD 180 billion.

The Effect of Finance and Policy “Enablers”

- Harmonize policies
- Accelerate progress
- Reduce costs
- Enable transition



Enabling the right policy and finance support from aviation’s stakeholders would benefit harmonization of policies, accelerate progress the net zero by 2050 goal, help abate some of the costs and investments needed while enabling the energy transition.

Blue: baseline emissions – all aircraft get replaced by their best in-class replacement available today but nothing else happens

Then we see reductions from efficiency, hydrogen, operations, SAF etc..

The black lines show the ranges of our scenarios. If things don’t happen at pace, if the right policies are absent and the financing mechanisms don’t exist, then we will lag and the reductions in emissions will be less than those depicted in our scenarios. This would mean we would rely even more on out-of-sector measures.

In contrast, if we accelerate progress, bring in more efficient aircraft sooner, scale-up SAF much faster than what current policies indicate, and introduce hydrogen aircraft sooner and more aggressively, then our reductions will be even more than the central scenario and offsets could account for 10-15% of the solution by 2050.

Industrial and academic contributors to Technology and Infrastructure Roadmaps



The roadmaps were not developed in isolation. A peer-to-peer review, complemented by a modeling tool provided by the Air Transportation Systems Laboratory at University College London, was conducted to calculate emission reductions for each technology. Other stakeholders also contributed to the Technology and Infrastructure roadmaps. This made sure that every milestone is backed by existing investment or technology demonstrator programs.

Conclusions

- It is **possible** to achieve the **Net Zero** goal by 2050.
- Success depends on **early, harmonized policy support**, which should be technology agnostic, and include targeted financing .
- The greatest challenge is not related to any specific solution, but to **the pace at which it needs to happen, and the collaboration needed.** .

