REFLECTION PAPER

DESTINATION 2050

THE PRICE OF NET ZERO

AVIATION EXPENDITURES TOWARDS DESTINATION 2050

March 2023

INTRODUCTION

Europe's airlines, airports, civil aeronautics industry and air navigation service providers have laid out a joint long-term vision along with concrete solutions to the complex challenge of reaching net zero CO_2 emissions by 2050 from all flights departing the EU, UK and EFTA.

The DESTINATION 2050[1] Roadmap is based on a combination of four key pillars; i) improvements in aircraft and engine technologies including full electric, hybrid-electric, and hydrogen propulsion, ii) using Sustainable Aviation Fuels (SAF), iii) implementing economic measures and iv) improvements in air traffic management (ATM) and aircraft operations.

The "Price of Net Zero" report[2], seeks to establish the level of expenditure needed to successfully realise the objectives set out in the DESTINATION 2050 Roadmap. The total expenditure includes investment in technology development, fleet renewal, air space and ATM, ground operations at airports, and costs for alternative fuels and economic measures.

The report shows that considerable additional efforts (compared to a business as usual development of the aviation sector) in terms of public sector investment, private sector finance, out-of-sector investments and regulation are required to achieve the aviation sectors climate ambitions.

Financing in-sector sustainability measures will enable for much of the emissions reduction at lower costs. This can be further complemented for example by carbon compensation and/or carbon removals projects that can support further emission savings through out-of-sector carbon reduction. Further, the costs of inaction on climate change are immeasurable (IPCC, 2022[3]).

A streamlined funding and enabling regulatory framework providing clarity, predictability, clear criteria for sustainable investment are needed to support a faster adaption of innovative sustainable aviation projects.

Aviation plays a critical role in the European socio-economic model, bringing people and regions closer together and facilitating transport of goods. The European aviation ecosystem continually drives forward innovation and technology thanks to highly skilled employees upholding competitiveness worldwide in this crucial sector.

We are firmly committed to a climate neutral European aviation in line with the EU climate goals and the Paris Agreement targets. Therefore, decarbonisation is at the heart of our business.

Although challenging to do an accurate assessment of the price of reaching net zero for the European aviation sector, we have commissioned this scientific study to establish a better understanding.

The scope of this study is limited to expenditures with a direct relation to aviation carbon emissions. Other necessary expenditures related to (e.g.) maintenance, repair and overhaul, personnel costs, infrastructure's own emissions and other fees and charges are considered out of scope.

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[1] www.destination2050.eu/wp-content/uploads/2021/03/Destination2050_Report.pdf

[2] www.destination2050.eu

[3] www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FinalDraft_FullReport.pdf

HIGHLIGHTS OF THE REPORT

The pillars of DESTINATION 2050 Roadmap are technically complex and economically uncertain as costs of future technologies and inputs are by nature based on forecasts and assumptions.

The Price of Net Zero[4] report shows that expenditures needed to reach net zero aircraft emissions for European aviation by 2050 require considerable additional efforts compared to a business as usual development of the aviation sector. The report distinguishes between business as usual and premium expenditures. Premium expenditure expressing the additional expenditure needed to achieve on-time decarbonisation. Whereas, business as usual (BAU) expenditures alone will not generate on-time decarbonisation. Expenditures comprise a mix of costs and investments.

A successful, on-time decarbonisation therefore requires sufficient access to finance and public investments, which in turn depends on enabling legislation.

It is important to note that the cost of no action is not considered in this report, as it is not seen as an option by the European aviation sector in line with EU climate goals and the Paris Agreement targets.

Key findings

The European aviation sector will require additional **premium expenditures** amounting to €820 billion (43% of the total net zero expenditure) to decarbonize in line with its ambitions (Figure 1).

The **business as usual expenditures** between 2018 and 2050 are estimated to be €1068 billion. Accordingly, the aviation sector's total expenditures towards net zero will be just under €1.9 trillion (€1068 billion of BAU expenditures + €820 billion of premium expenditures – Figure 1).

Fleet renewal is the largest expenditure (43%) of which the business as usual scenario represents over 90% and premium expenditure in the order of 10% (€740 billion and €80 billion respectively) (Figure 1). Whilst a significant level of investment, these would result in a €188 billion saving in fuel costs and a further €76 billion saving in carbon pricing.

Alternative fuels expenditures (incl. drop-in SAF, hydrogen and renewable electricity) is the second largest expenditure (40%) with premium expenditures representing near 59% and business as usual just over 41% of the costs (€441 billion and €310 billion respectively; Figure 1).

Air traffic management (ATM) and ground operations also requires premium expenditure to yield on-time results. Estimated at €20 billion for ATM and €9 billion for ground operations in addition to the business as usual expenditure of €18 billion (Figure 1).

Remaining Premium expenditures **R&D in future aircrafts** (100 billion), **Airport infrastructure adaptation** for future aircrafts (€18 billion) and **Carbon pricing and economic measures** (€152 billion) represent just under 1/3 of the premium expenditure and only just over 14% of the total expenditure (Figure 1).

Premium expenditures comprise a mix of **costs** (73%) and **investments** (27%) in opposition to business as usual expenditures where investments represent 71% and costs 29%.

Premium expenditure costs embody €441 billion towards SAF and economic measures representing respectively 54% and 19% of the total premium expenditures.

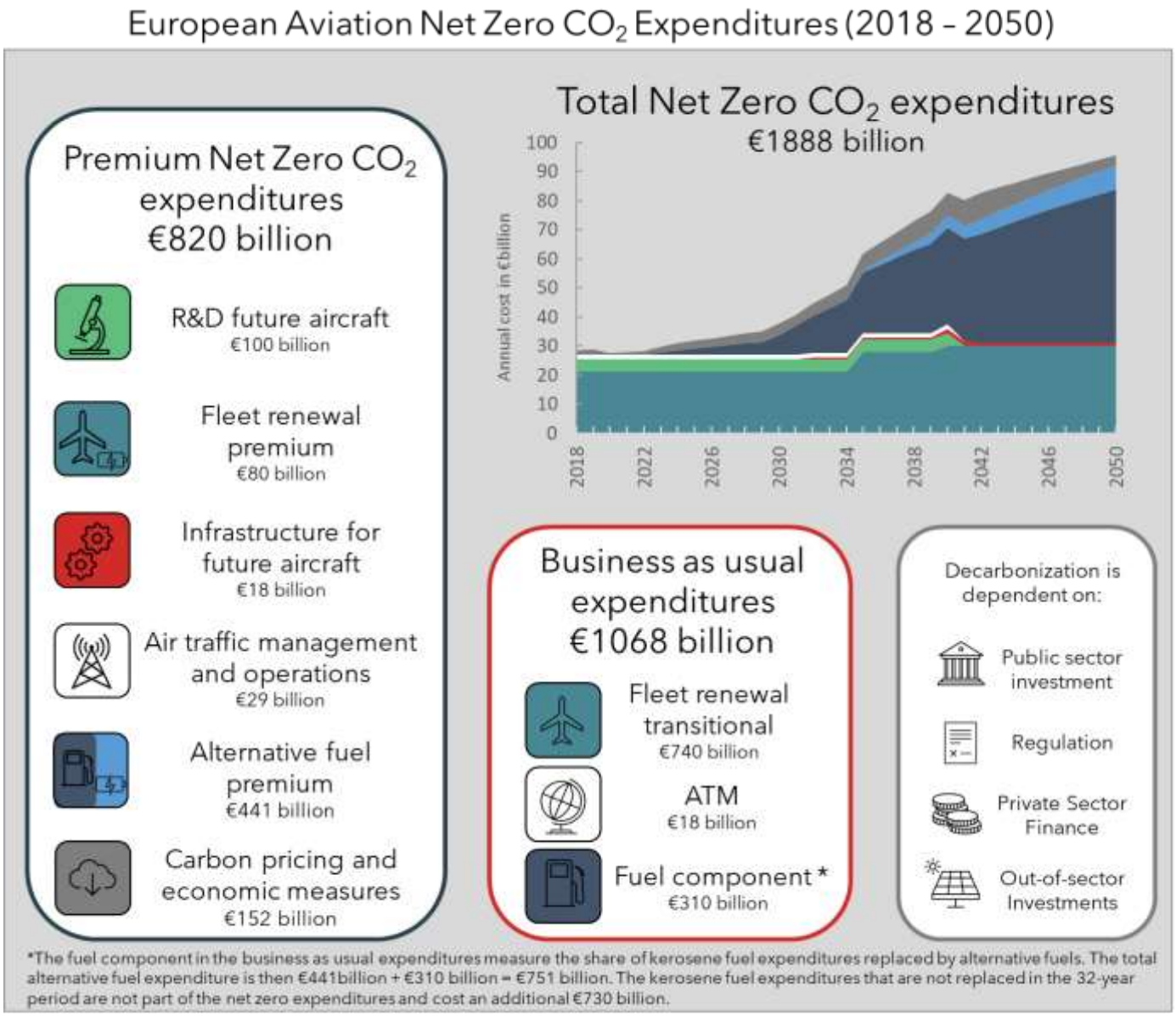
Premium expenditure investments are broken into future aircraft R&D (12%), fleet renewal (10%), ATM (3%) and airport infrastructure to support alternatively fuelled future aircrafts (2%).

[4] www.destination2050.eu

Timing and pace

Timing and pace is essential for the success of decarbonising the European aviation sector.

Figure 1 shows an overview of the expenditures necessary to achieve net zero aircraft CO2 emissions along the DESTINATION 2050 pathway, including the 'business as usual' expenditures and the 'premium expenditures' (i.e. the additional expenditures to be made, beyond business as usual). Each in-sector element in the development process towards decarbonising the European aviation sector has its own timeline, effects and requirements for expenditure.



INDUSTRY ASKS

DESTINATION 2050 partners ask policy makers – national and European – to facilitate the pathway towards an environmentally and economically sustainable European aviation sector by appropriate supporting measures necessary to drive the transition towards net zero.

Most of the costs and investments required to achieve the sector's climate ambition occur within the aviation sector itself, a capital-intensive industry. The aviation sector's expenditures towards achieving net zero are substantial and are dependent on access to finance from the private and public sector. This is vital when capital reserves are insufficient to make large upfront payments for new aircraft and infrastructure.

The availability of capital can be facilitated with the right set of incentives and policies (outlined below).

The aviation sector's ability to finance its decarbonisation pathway depends largely on its financial and operational health.

To accelerate the efforts and achieve the targets set by the industry a vast requirement for capital must be secured. Only with the right set of incentives and policies, the required capital can be made available for the sectors decarbonisation. This means timely and effective measures bringing long-term clarity and predictability for investors. Regulatory frameworks must encourage low carbon technology deployment.

Sustainable Aviation Fuels

Alternative fuels (including drop-in SAF, hydrogen and electricity) must become available in sufficient volumes and at competitive prices. This will be a critical and crucial transitional element in the upcoming years.

The expected expenditures for alternative fuels represent nearly 54% of the premium expenditure to reach net zero in time. At the same time, expenditures for realising the necessary infrastructure to support alternatively fuelled future aircraft represent over 2% of the premium expenditure. These two combined making the availability of an incentivised investment climate particularly important for the production and uptake of alternative fuels and in turn the reduction of CO_2 emissions.

Therefore, we call upon regulators to prioritise:

- The implementation of an enabling and coherent policy framework that will provide certainty and risk reduction for investments including the ReFuelEU Aviation initiative and the Alternative Fuels Infrastructure Regulation (AFIR). Ambitious SAF blending mandates give strong signals to the market for a swift ramp up of production. Whilst drop-in SAF will require limited adaptations to the fuel distribution and supply systems, aviation will also be an end user of other sustainable fuels, such as hydrogen and other energy sources based on electricity. Financing the deployment of adapted infrastructure to such sustainable fuels is of utmost importance.
- The implementation of a system with sufficient quantity of allowances for SAF under the EU ETS for Aviation, presently not provided for, is of paramount importance. Such a mechanism will enable aircraft operators to be granted free allowances under the EU ETS commensurate with overall CO_2 reduced using SAF, which in turn will incentivise the SAF production and uptake.
- The adoption of a system allowing for the most cost-effective logistics, by minimising associated CO_2 emissions while promoting the development of SAF production in the EU. A flexible mechanism similar to a book and claim system, favouring the production of SAF in Europe, would offer the possibility to comply with the blending mandate.

Air Traffic Management (ATM) and Operations

Continued improvements in ATM and operations remains essential for European aviation to reach its decarbonisation objectives. Often characterised as the low hanging fruit, in reality reaching the full network potential of ATM has proved more challenging.

The expected premium expenditure for ATM, airline operations and ground operations at airports is 3% of the premium expenditure to reach net zero in time.

Therefore, we call upon regulators to ensure:

- Swift and decisive implementation of the Single European Sky to facilitate the introduction of a more coherent, network-centric and collaborative ATM system.
- Continued support for the SESAR research programme, which aims to accelerate through research and innovation the delivery of the Digital European Sky. This will contribute to the digital transformation in ATM and to a better operational efficiency, reducing emissions.

Engine and Aircraft Technology

To support the goals of the DESTINATION 2050 Roadmap, the European aviation sector is investing in more efficient aircraft, development of new aviation technologies, reducing fuel consumption and replacing fossil-based fuels with sustainable fuels. This requires continued and significant investment in R&D and innovation driving forward upgrades of existing aircrafts and completely new aircraft designs.

The expected expenditures for R&D investments in engine and aircraft technology accounts for about 12% of the premium expenditure to reach net zero in time. EU Aviation experiences an untapped potential for green financing.

Therefore, we call upon regulators to promote:

- The inclusion of aviation in the EU taxonomy is fundamental to leverage such level of investment by all aviation stakeholders.
- Public support mechanisms such as Clean Aviation Partnership, SESAR III and the EU ETS Innovation Fund make high-risk investments into new technologies feasible. They reduce cost pass-through to consumers (in line with the Just Transition) and reduce competitive distortion risks and carbon leakage.
- Financial instruments from the European Investment Bank (EIB) will lower costs and support the transition.

Airport Infrastructure

The DESTINATION 2050 Roadmap addresses emissions resulting from the use of fossil fuels, while most airport operator emissions result from construction and use of the airport infrastructure assets. Consequently, much of the cost and effort to decarbonise airports is not accounted for.

To aid airports' green transformation, we call on policy markers to:

- Ensure lending from the European Investment Bank (EIB) that will help lower costs and support the transition.
- Recognise that DESTINATION 2050 establishes a clear decarbonisation Roadmap, and therefore the EU's Green Taxonomy framework should include eligible investment.
- Support R&D via the European funds mentioned above to increase the efficiency of airport operations.

Economic Measures

As modelled in the DESTINATION 2050 Roadmap, the use of economic measures is required, by 2050, to compensate for all remaining emissions, after application of the aforementioned three pillars of in-sector decarbonisation measures. Both the EU Emissions Trading System (EU ETS) and ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) are essential for the European aviation to reach net zero. The expected aviation sector expenditures for economic measure accounts for about 19% of the premium expenditure to reach net zero in time.

Considering that the actors of the European aviation ecosystem, still recovering from the COVID-19 crisis, do not have infinite financial in sector resources, smart economic instruments are essential to drive the decarbonisation process.

Economic measures must be effective and focused on driving the required decarbonisation processes forward through positive incentives attracting in- and out-of-sector capital. On the contrary, taxation and operational restrictions will hamper the industry's ability to invest and innovate due to a diminished financial capacity and in turn jeopardising the global competitiveness of European aviation.

Carbon trading (like the EU ETS) and offsetting schemes (like CORSIA) impose a carbon price on aviation and ensure it contributes towards the climate objectives of reducing CO_2 emissions in Europe and globally.

New taxes like a kerosene tax are counterproductive and will not help the EU achieve its climate goals, but hamper the industry's ability to invest in decarbonisation measures due to a diminished financial capacity.

Therefore, we strongly recommend:

- Revenues from the EU ETS be reused within the sector enabling investments to support and incentivise break-through technologies and innovative infrastructure to decarbonise the aviation sector and the production of SAF.
- The EU level playing field to be ensured through the right level of economic incentives for the production and uptake of clean energy so that an attractive EU market for aviation is maintained.

THE IMPORTANCE OF EUROPEAN AVIATION

Aviation plays a vital socio-economic role in the European project connecting people, regions and countries supporting in-sector and out-of-sector economic growth and employment.

EU28 Air transport[5] directly supported 9.8 million jobs and €672 billion economic activity in 2018. That is 4.2% of all employment and 4.2% of GDP.

For European aviation, the transition to net zero is as much an opportunity as a challenge. An opportunity to take a lead on European and world aviation decarbonisation and a challenge to accelerate the otherwise slower business-as-usual transition. An accelerated transition equals the requirement for premium investments and other expenditures beyond the immediate capacity of the aviation sector.

Therefore, to ensure that aviation continues to develop in an economical and environmentally sustainable manner, policies are needed to ensure that the required financial capacity can and will be deployed to reach the climate targets.

COMMITMENTS

DESTINATION 2050 is an industry alliance committed to climate neutral European aviation in line with the EU climate goals and the Paris Agreement targets, in full cooperation with policy-makers and stakeholders.

DESTINATION 2050 partners and their members are committed[6] to drive forward the decarbonisation of the aviation sector through dedicated investments and other measures supporting the environmental and economic sustainability of European aviation.

ABOUT DESTINATION 2050

DESTINATION 2050 comprise Europe's airlines, airports, civil aeronautics industry and air navigation service providers through five partner association A4E, ACI EUROPE, ASD Europe, CANSO and ERAA.

In February 2021, they laid out a joint long-term vision along with concrete solutions to the complex challenge of reaching net zero CO_2 emissions from all flights departing the EU, UK and EFTA by 2050. Today known as the European Aviation Roadmap to net zero.

The independent report shows how a combination of actions from all stakeholders – including the EU and national governments – in four key areas could achieve substantial CO_2 emissions reductions in line with EU climate goals.

- Improvements in aircraft and engine technologies (including full electric, hybrid-electric and hydrogen propulsion),
- Using sustainable aviation fuels (SAFs) both for fixed- and rotary-wing platforms,
- Implementing economic measures, and
- Improvements in air traffic management (ATM) and aircraft operations.

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[5] ATAG – Aviation Benefits beyond borders 2020 https://aviationbenefits.org/downloads/aviation-benefits-beyond-borders-2020

[6] www.destination2050.eu/commitments