TREND
AVIATION

Air traffic takes off again, leaving the climate transition on the tarmac

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Following an unprecedented paralysis of the aviation sector caused by the pandemic, airlines and airports are almost back to their "normal". Despite some regional and inter-sectoral differences, air traffic is on track to return to 2019 levels and exceed them in 2023. While the sector prepares for exponential growth in demand, the current energy crisis underlines the unsustainability of a fuel based on fossil energy. To reconcile geopolitical and ecological priorities, the chosen strategy appears to be the decarbonization of fuel and aviation activities, rather than modal shifts in transport demand.

DATA OVERVIEW

Despite turbulence, air traffic successfully takes off again

Since the 2000s, commercial flights have grown by 5% per year on average, leading to a 2% annual increase in CO_2 emissions.[1] Emissions from the sector amounted to 905 megatonnes of CO_2 in 2019, double the level of 2000. They make up 2.8% of global annual emissions – but contribute over 3% of radiative forcing[a] – and constitute 10.9% of emissions from the transport sector, ranking the aviation sub-sector second after road transport.[2] Although aviation went took a nosedive in 2020 with the Covid-19 crisis, it has picked up speed since restrictions began to relax in mid-2021. In 2022, the sector's recovery is confirmed, with a return to 2019 levels expected in 2023,[3] while only a year ago, this recovery was not expected until 2024.[4] *"Aviation is resilient and on the rise,"*[5] headlines a new report by the International Air Transport Association (IATA). Total traffic in July 2022 reached 74.6%[6] of its July 2019 level. Emissions have also started to increase once more: following a drop from 905 $MtCO_2$ in 2019 to 495 Mt in 2020, they rose again to reach 577 Mt in 2021 and are expected to total 809 Mt in 2022.[7] Losses for the industry went down from $137.7 billion in 2020 to $42.1 billion in 2021 and are not likely to exceed $9.7 billion in 2022. While all regions have seen their financial performance improve, only North America chalked up a positive margin in 2022.[8]

The recovery of traffic has been driven by domestic travel (domestic flights in July 2022 were at 86.9% of their July 2019 level) but international flights are catching up (in July 2022, they amounted to 67.9% of their July 2019 level). In any case, the impact of the pandemic on domestic flights was not so great as for international travel: international passenger flights dropped 74% over the whole of 2020 (and up to 98% in April), while domestic flights only decreased by 49%. In 2022,[9] the regional distribution of aviation activity saw some notable changes compared to 2019.[10] Asia-Pacific shrank from 34.7% to 27.5 % of the market, Europe from 26.8% to 25%, the Middle East from 9% to 6.5%, and Africa from 2.1% to 1.9 %. Two regions saw their share increase: Latin America moved from 5.1% to 6.6%, and North America from 22.3% to 32.6%. These changes can partly be put down to the slower recovery of the Asia-Pacific region **(FIG. 1)**, due to continued health restrictions in China.

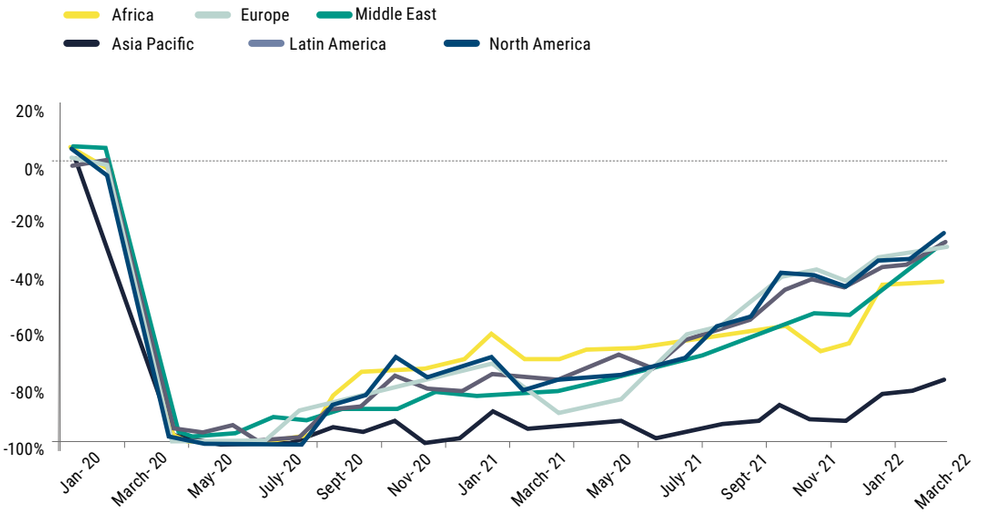
Away from the spotlight, the pandemic provided an opportunity for new airlines to enter the market. An academic study shows that following the most serious crises affecting the sector over the last twenty years, i.e., the aftermath of 9/11, the 2007 financial crisis, and the 2010 debt crisis in Europe, the aviation sector has emerged stronger each time.[11] According to the same study, the pandemic – or future pandemics – could be a boon for start-ups in the aviation sector, mostly because they are more flexible in the face of demand. The pandemic also perturbed the distribution of operating staff – pilots, flight attendants, etc. – prepared to accept new posts. Bearing in mind that start-ups generally manage to establish themselves in closed markets thanks to new technologies, the pandemic gave them greater margins for manoeuvre in terms of investment compared to companies in debt. Other reasons related to market perturbation are highlighted in the study. Of the 46 airline start-ups during the pandemic analysed, most are located in Europe, low cost, and designed to carry out regional or domestic flights. These young companies also tend to find their position on the market, not thanks to new green technologies, but because they offer additional, cheaper flights. Despite some first success stories dating from June 2021, their future is still uncertain.

a Radiative forcing describes the balance in the atmosphere caused by the energy received by and reflected back by the earth, which determines the temperature on the planet. The concentration of greenhouse gases affects this balance, causing global warming.

FIGURE 1

YEAR-ON-YEAR CHANGE IN INTERNATIONAL REVENUE PASSENGER KILOMETRES (RPKs)

Source: IATA, 2022



Air freight is following a different upward trend, since by May 2021 it had already exceeded its May 2019 level, driven by a 9.4% increase in global demand[12] (measured in cargo tonne kilometres – CTKs), 4.6% of it involving US cargo planes.[13] Commercial flight activity in fact made up over two-thirds of the sector's revenues, generating $155 billion, which is twice as much as in 2020.[14] Nevertheless, in 2022 freight flights went down by 10.2% compared to their level in July 2021, and 3.5% compared to 2019,[15] due to a drop in exports (which started picking up in China in June 2022) and the war in Ukraine. Europe is the most affected region, with a decreased freight capacity of over 11%[16] in March 2022 compared to March 2021. Yet the future of air freight looks bright: Boeing is planning on increasing its cargo fleet by 70% in 2040, compared to 2019, partly to meet the surge in online trade. In addition, although it represents only a small proportion (1%[17] of global freight), air freight became much more competitive vis-à-vis maritime[18] from May 2020 to March 2022 **(SEE "MARITIME TRANSPORT" TREND).**[b]

Order books are filling up again, but manufacturers are having to deal with a disrupted supply chain. Airbus and Boeing, with respectively 771 and 909 orders in 2021, are returning to their average sales during the decade preceding the pandemic. At the end of August 2022, the two major airplane manufacturers had already clocked up 843 (Airbus)[19] and 446 (Boeing) new orders, pursuing the trend of 2021. While the industry saw the cost of fuel decrease dramatically in July 2020, prices have since surged, reaching over $155 a barrel for kerosene[c] in April 2022, a level not seen since the 2008 financial crisis. Not all airlines are impacted equally by these price hikes due to different financial hedges, which have in particular protected US airlines.[20] In addition to rocketing operational costs for airlines due to the rise in the price of fuel, supply of new aircraft has been saturated by the pressure of demand and by numerous disruptions in the supply chain. Inflation in raw materials affecting the construction of airplanes (aluminium, nickel, cobalt, magnesium) constitute an additional cost, and the difficulties encountered in supply chains of electronic components have hit airplane manufacturers hard.[21] Deliveries are thus delayed, accentuated by labour shortages in the sector.[22] The armed conflict in Ukraine has done little to relieve pressure on supplies, since the Russian Federation is the world's third producer of aluminium and nickel, and the second for cobalt and magnesium. Flight prohibitions over Russian territory also mean that planes have to make large detours that require more fuel.[23]

The Covid-19 pandemic and the energy crisis in Europe have upset the linear growth pursued by air traffic since the 2000s, but they are also the catalysts for its future transition. Airlines, subject to frequent criticism from civil society, are banking on breakthrough technologies to come up with "zero-emission" planes. But the race for biofuels raises ecological questions, involves shifting strategic dependencies, and requires waiting until 2035-2040 for them to be operational. Until then, flight emissions are supposed to be offset, but CORSIA, the Carbon Offsetting and Reduction Scheme for International Aviation, has come up against obstacles before even starting. The obvious solution of reducing traffic is controversial, since it goes against the economic objectives of stakeholders in the sector: airlines, airports and manufacturers.

b A year-on-year change compares a value at two dates, usually one year apart – or one quarter (variation from one quarter to the next) – it is therefore different from an annual variation, which analyzes the variation over the same year. (Insee)

c The price of kerosene is slightly higher that of a barrel of crude oil.

THE OBSERVATORY'S LENS

Traffic picks up fast while attempts to reduce carbon intensity lag behind

CORSIA kick-off delayed, carbon offsetting on the back burner

The 2015 Paris Agreement established specific national measures for emissions generated by domestic flights as part of the application of the United Nations Framework Convention on Climate Change (UNFCCC). However, as of 2021, only 6%[24] of nationally determined contributions (NDCs) that explicitly designate modes of transport identified aviation as a sector for mitigating carbon emissions (compared to 5%[25] in 2016). To compensate for the absence of international flights in the Paris Agreement, since they represent about 65% of the sector's CO_2 emissions, in 2016 the International Civil Aviation Organization (ICAO) launched CORSIA. This programme established the possibility for airlines to purchase carbon credits to offset their annual emissions when they exceed their average emissions in 2019 and 2020. However, following the Covid-19 crisis and the drop in emissions in 2020, the ICAO Council decided in June 2020 to activate a safeguard clause contained in the CORSIA agreement that allows the reference threshold of the offsetting programme to be modified, thus taking 2019 as the sole reference year for the pilot phase. CORSIA had already come under fire, but the establishment of this measure rendered meaningless the pilot phase running from 2021 to 2023, during which time emissions were not supposed to exceed 2019 levels.[26] In June 2022, the ICAO Council decided that the baseline applied to the first (2024-2026) and second phases (2027-2035)[d] would be the equivalent of 85% of emissions during 2019.[27] Other criticisms of CORSIA include: the voluntary nature of the pilot phase and the first phase that only allows carbon offsetting between participating countries;[e] the risk of an excess supply of carbon credits compared to demand, which reduces their price and effectiveness; and the risk of "double counting" global emissions reductions.[28] In addition, the effectiveness of the carbon offsetting measures put in place has been called in to question.

As part of the new Fit for 55 EU roadmap, a revision by the European Parliament intends to integrate CORSIA into the EU ETS.[29] Since 2012, before CORSIA started, the European Emissions Trading System (EU ETS) has included domestic aviation activities. EU Member States have mostly been reticent about the CORSIA international programme, considering that it is likely to be less effective than the EU ETS since CORSIA does not apply sanctions, whereas the EU ETS imposes financial penalties if end-of-year quotas are not respected. The EU ETS, launched in 2005, operates on the basis of emission quota exchanges between actors in the industry, whereas CORSIA involves an emission threshold above which companies must offset additional emissions. The EU ETS therefore removed offsetting from its scope of action in 2020. CORSIA's aim is to offset emissions from international flights, which make up most of the emissions in the sector (60%[30] in 2019) and are not covered by the emissions trading system, which only deals with flights arriving in or leaving the European Economic Area (EEA). CORSIA therefore applies to all flights arriving in the EEA or outside it, for countries participating in the programme. As CORSIA concerns international flights, its scope of application overlaps that of international flights between EEA countries. Airlines in this area are therefore subject to two legislations as soon as their emissions reach 2019 levels, which triggers the application of CORSIA.

A study has evaluated that from 2010 to 2016 the EU ETS only led to a reduction in emissions growth from aviation of 3 $MtCO_2$ per year and did not result in an absolute reduction in emissions.[31] The effectiveness of the EU system is slightly better when only taking into account short and low-cost flights, going from an overall reduction of 4.7% to 10-11%. The study compared this annual reduction in emissions growth with the reduction of annual flights over the same period (-4.9 %), "*indicating the main channel through which carbon pricing operates in the sector is via output reduction, as opposed to aircraft improved efficiency*". The limited effectiveness of the EU ETS over this period should also be considered in terms of the low price of a tonne of carbon, which was about €5 per tonne compared to a current average of about €80. While the ambition of CORSIA, in particular since the reference year was changed, was called into question by the European Union in a study published in September 2020,[32] the High Council for the Climate in France underlined in 2020 that aviation was the only sector subject to the EU ETS for which emissions continued on an upward trend (5% in 2019).[33] Both systems are therefore subject to criticisms, either between each other or coming from the outside. Airlines are reticent about the fact that the two systems overlap because they do not want to be subject to different legislations. Despite conflicting interests, climate change organisations are also not in favour of both systems in situ in view of the fact that emission reduction results are far below the increase in traffic. However, a study by Carbon Market Watch has illustrated that emissions would be more effectively reduced if the EU system covered all flights leaving and arriving in the EEA rather than relying on CORSIA for flights outside the EEA.[34] The two systems remain intrinsically different and, as a carbon offsetting system, CORSIA also offers a possibility to contribute to projects with environmental co-benefits.

In response to these limitations, some countries, airports and airlines have set up parallel initiatives to offset their carbon emissions. However, a study dating from October 2022 carried out by the Okö Institute and commissioned by Carbon Market Watch deplores the environmental quality and offsetting

d Starting from this phase the system becomes mandatory.

e On 1 January 2022, 107 countries out of the 193 ICAO members were voluntary participants, and eight others volunteered during 2022, taking the total to 115 for 2023. Russia, China, India and Brazil are still absent from the list.

effectiveness of carbon credits purchased by airlines.[35] "Carbon pricing" is a complementary tool employed by carbon offsetting markets which are applied after emissions are made. Voluntary compensation is based on credits granted by local or international labels. Airlines can give passengers an opportunity to pay a "carbon charge" in addition to the cost of their flight. Nevertheless, participation varies widely depending on the company, and among those that offer this option, only 1%[36] of passengers take it up. Voluntary carbon offsets are criticized because they put the onus of emissions on consumers, but are also put forward as an efficient complementary tool to regulate future demand. The Okö Institute study of eight major European companies reveals a lack of transparency and ambition concerning the voluntary compensation actions they claim to make. Of the eight airlines, only three provided results on the emissions avoided thanks to carbon pricing and only easyJet effectively offset all of its emissions. The cost of the price of a tonne of offset carbon also varied from €9 to €30 depending on the company, and the price paid by passengers for an offset tonne was up to four times higher than that paid by the airline as a company.

International carbon offsetting is necessary for airlines to achieve their carbon neutrality targets without compromising the expected tripling of traffic by 2050. The British company easyJet has nevertheless announced its decision to drop this lever and simply focus on reducing its carbon intensity.[37] The airline's new roadmap includes stopping its carbon offsetting system from 31 December 2022, with exceptions up to September 2023. The programme has allowed easyJet to offset over 8 $MtCO_2$ since its launch in 2019, but incurs costs for the company, which has announced that it prefers to devote these amounts to reduction efforts. The airline therefore aims to target using biofuels, renewing its fleet, integrating flight optimization systems, and participating in future projects such as hydrogen engines and direct air capture (DAC). While the objectives of this new roadmap are more ambitious than before, this focus on emissions intensity only allows for a relative drop in emissions (by turnover or passenger kilometre), while the airline's total emissions will likely continue to rise.

To meet demand, airlines are setting their sights on carbon neutrality and technological innovation

The ICAO's triennial assembly agreed to set an objective of carbon neutrality for the sector for 2050, following a meeting held from 27 September to 7 October 2022.[38] The opening speech mentioned the sector's focus on new technologies and biofuels to reach these objectives. Also included on the agenda was a consideration of the sustainability of the measures defended, and a reflection on optimizing air traffic routes. Carbon neutrality may be the buzzword of the moment, but results do not always follow suit. A study published in May 2022 by the NGO Possible concluded, for example, that only one of the 50 British airlines had achieved the climate targets they set since 2000.[39]

Policies aimed at fostering the growth of biofuel production are niche measures: in late 2021, only three countries (Finland, Indonesia and Sweden) had set targets specifically concerning biofuels in the aviation sector.[40] In parallel, since 2020, numerous European states have modified their legislation with the aim of accelerating the transition to biofuels for the aviation sector. To align with the European roadmap featuring in the Fit for 55 regulations, since 1 January 2022 France has required that airplanes refuelling in the country must use at least 1% sustainable aviation fuels (SAF) (this requirement climbs to 2% in 2025, 5% in 2030, and 50% in 2050).[41] ReFuelEu[42] also stipulates avoiding overloading airplanes and only filling them with enough fuel for the flight, while encouraging European airports to adapt their facilities for alternative fuels. According to the IATA, airlines purchased the entire stock of SAF available in 2021 and have signed future purchasing contracts worth $17 billion.[43]

Europe launched its Destination 2050 programme in 2021, aimed at reducing the carbon intensity of the sector, at the same time as a 1.4% annual increase in traffic.[44] The joint Clean Aviation initiative also joined the Alliance for Zero-Emission Aviation (AZEA) in 2022. Following on from Clean Sky 1 and 2, Clean Aviation is a public-private partnership involving the European Commission and the European aerospace industry with a target of reducing the carbon intensity of the aviation sector. The first call for projects was launched by Clean Aviation in 2022. The initiators of the programme say that it also aims to adapt airport facilities since, for example, hydrogen takes up three times more volume[45] than kerosene for the same energy capacity. AZEA includes 74 stakeholders from the entire aviation sector and has a goal to develop research and set up model airplanes running on hydrogen and electricity.[46]

The Association of Asia Pacific Airlines (AAPA) announced in September 2021 that it was committed to reaching carbon neutrality by 2050. Some of the fifteen airlines had already committed to the same target, but the AAPA was keen to make the goal a shared one. These strategies are massively based on substituting fossil fuels with either biofuels (bearing in mind that the Asia-Pacific region is likely to constitute 40% of global biofuel demand)[47] or more marginal solutions like electrofuels[f] and hybrid ad electric engines. The AAPA nevertheless immediately pointed out that hydrogen and electricity solutions were not suitable for the Asian market, where flights are generally longer than 1,500 km, outstripping the capacities of existing electric and hydrogen engines.

The ICAO published a second edition of the definition of "sustainability criteria"[48] for biofuels in November 2021. Airlines that use fuels respecting these criteria "*can claim associated reductions in their CORSIA* CO_2 *offsetting requirements*".[49] These criteria are based on the quality of SAF *vis-à-vis* numerous objectives. They will be applicable from 1 January 2024, which is the end of the pilot phase during which only the first edition is in force. The second edition is more detailed than

f Electrofuels comprise recycled CO_2 and green hydrogen (green hydrogen, unlike blue or grey hydrogen, is produced using a renewable energy source and is formed by electrolysis).

the first one, integrating twelve different themes compared to only two: greenhouse gases (GHG) and carbon sinks. The fuels eligible for the CORSIA programme must, for example, generate fewer emissions over their lifecycle to respect the GHG criterion and, to respect the carbon sink criterion, must not have been produced from biomass coming from land with a high carbon sequestration potential. From 2024 onwards, they will therefore also need to respect criteria relating to: water, soil health, air quality, conservation of biodiversity, promotion of waste management, human rights, land use rights, water access rights, local and social development, and food security. These new themes integrate more fully the impacts of biofuels and the Sustainable Development Goals (SDGs), in response to increasing criticisms concerning their negative externalities on the environment.[50] In competing with agriculture, the increased demand for biofuels could trigger higher prices for essential foodstuffs.[51] The respect of these criteria will be certified by the Sustainability Certification Scheme, developed by the ICAO. American Airlines received the first CORSIA certificate for biofuels in July 2022[52] after using biofuels produced by the Finnish company Neste at San Francisco airport. Neste, one of the key SAF producers, is in parallel attempting to attain German international sustainability and carbon certification (ISCC). The company claims that its biofuels reduce usual GHG emissions by 80%.

Since 2011 and the first flight operated by KLM, 443,512 commercial flights[53] have employed SAF (342,256 flights in June 2021) although no plane is 100% SAF-reliant. Sustainable aviation fuels are used instead of kerosene for up to 50% of an airplane's fuel, combined with fossil-derived kerosene. The latter is a pure source of hydrocarbons, whereas biofuels are derived from biomass, organic waste, and other plant matter, and cannot yet be used autonomously.[54] At a cost three or four times higher than conventional fuels, their expense is also dissuasive. Some organizations are attempting to improve SAF so that they can be used on their own, involving local production. Japan Airlines (JAL) successfully carried out its first commercial flight using SAF produced in Japan in February 2021[55] combined with kerosene. TotalEnergies has launched its own production in France and has started supplying French airports with alternative fuels following a first successful commercial flight in June 2021.[56] In particular, the company supplies fuel to the collaborative French programme *Vol Avec Carburants Alternatifs Nouveaux* (VOLCAN) – which includes Airbus, Safran and Dassault – launched in late 2021. The programme is funded by the sector's recovery plan in the wake of the pandemic, which has a budget of €1.5 billion over three years for research on low-carbon airplanes. The project saw its first 100% SAF Airbus flight take off in October 2021, but will continue testing into 2023.[57] To evaluate the impact of these first "unmixed" flights, the Airbus will be followed by a "sniffer plane" to measure its emissions.[58]

Despite numerous "carbon-neutral" initiatives put forward by private companies, jet planes have a major responsibility for emissions in the sector. Private jets are five to fourteen times more polluting than commercial (passenger) flights, and the CO_2 emissions from flights in private jets rose 31% from 2005 to 2019, according to the NGO Transport & Environment (T&E) in a study[59] published in 2021. T&E also conclude that jet planes are twice as likely to be used for flights of under 500 km within Europe, to the detriment of commercial flights, or other means of transport. This negative impact is highlighted by civil society with the practice of "jet tracking",[60] which intensified in 2022. Jet tracking consists in following the journeys of jets by well-known personalities on social networks, indicating the distance and emissions associated with each journey **(SEE SIGNALS)**. Jets emit on average 50% more than trains, and in Europe, 70% to 80% of private jet flights have a high-speed train alternative.[61] Private jets are also exceptions in the EU ETS, and kerosene is not taxed, bearing in mind that the average private jet owner is worth €1.3 billion. In France, these inconsistencies motivated the left-wing political party LFI to present a bill in September 2022[62] to ban private jet planes from the territory due to their excessive ecological cost compared to the proportion of the population that uses them.

To save face, some jet companies are branching out. In September 2021, the Canadian jet builder, Bombardier, announced the launch of a new prototype that took off in 2022, running partly on alternative fuels in order to be carbon-neutral.[63] The Brazilian company Embraer made a commitment in August 2021[64] to make its activities carbon-neutral by 2040 thanks to alternative fuels, coupled with electrification and hybrid engines. The company has, for example, tested out a plane running on 100% SAF, which it says reduces emissions by 85%.[65]

Lastly, while electric vehicles are booming in the road transport sector, and even in the rail sector, electric batteries and hydrogen apparatus are harder to put in place in airplanes[66] and maritime freight. Research on e-kerosene, produced from green hydrogen and renewable energy, has made progress since 2018, but its capacities remain limited. If demand continues to follow its current growth path, the European aviation sector could consume up to 24% of the renewable electricity produced in Europe by 2050.[67] In addition, airplanes running on electric or hybrid engines, or on hydrogen, are not expected before the 2030 decade and are likely to mainly concern short flights. For long-haul flights, the challenges are much greater: hydrogen planes require bigger fuel tanks, which increases the weight of the aircraft and therefore the energy required for the flight. While e-fuels have the advantage of not competing with agriculture, they are in competition with critical materials required to produce electric batteries.

Measures aimed at carbon neutrality do not deal with all of the pollution generated by aviation. Two-thirds[68] of the particles generated by flights that participate in radiative forcing are not CO_2. While the sector is focused on carbon neutrality, an academic article published in 2022[69] makes the case for thinking in terms of climate neutrality rather than carbon neutrality in order to consider the other impacts of aviation. Nevertheless, carbon dioxide particles remain in the atmosphere for years, unlike other particles, which means that each tonne of CO_2 avoided has a direct effect.[70] The interest in CO_2 emissions is partly due to the fact that they are easy to evaluate, unlike other particles, which have different effects depending on climate conditions. For example, the particles emitted during night flights tend to contribute more to global

temperatures than flights during the day.[71] However, the data available is not precise enough to produce sufficiently targeted trajectories, in particular since night flights are strategic for the aviation industry. Air traffic adaptation features among the European objectives announced in the Destination 2050 roadmap, which anticipates that it could contribute 6% to CO_2 emissions reduction targets.

Calls to reduce traffic receive relatively less attention

While the aviation sector's strategies for reaching carbon neutrality are mainly based on innovation and technology so as not to compromise the increase in traffic – and even to boost it – the degrowth of the sector[72] could be a complementary lever for action. The French environment and energy management agency, Ademe, defends capping air traffic as a means to reduce the sector's carbon intensity, which could be 75% in 2050 "*only if all levers are activated: energy efficiency of planes, decarbonization of fuels, and reduction of traffic.*"[73] A few days before the Ademe study was published, the president of the Aéroports de Paris (ADP) group invited consumers to "be reasonable"[74] while awaiting the decarbonization of aircraft and their fuels, which is unlikely in the next 20 years. Traffic has already been capped by numerous airports to limit sound pollution at night.[75] On 24 June, following complaints about the sound level of traffic at Amsterdam-Schiphol Airport, the Dutch government presented a project to restrict traffic to 440,000 flights per year – compared to 500,000 before the pandemic – starting from end 2023, a decision that it justified as being ecologically coherent.[76] This government measure was hailed as pioneering by numerous climate change action organizations.

France illustrates the conflict of interest between companies encouraging a rise in traffic, and civil society calling for a reduction. In 2021, the *Convention Citoyenne pour le Climat* (the citizens' climate convention) attempted to pass laws to complement limitations of short flights, aimed at airport extension projects. Nevertheless, dozens of projects[77] are going ahead or underway: those that began before 1 January 2022 are not concerned by the laws ultimately voted. As pointed out by Sarah Fayolle, transport campaign officer for Greenpeace, in an article in Reporterre, the prohibition only concerns projects, "*that need new land for their extension, which involves expropriating other owners […]. But in the vast majority of cases, airports have land reserves, which means they have enough room to extend on their own land without needing to expropriate anyone, and therefore they don't need a declaration of public utility* [recognition that the proposed project has public benefits] *to carry out the work*."[78] The extension of terminal 2 at Nice Airport was the subject of an appeal by environmental associations that was rejected on 19 September 2022.[79]

Caught between calls from civil society and experts, and the need to respond to a growing demand from airlines, governments are focusing on limiting domestic flights. In the European Union, Austria and France have started to put this type of restriction in place. Austria has prohibited flights when an alternative by train is possible in under three hours (France has done the same for journeys with a direct alternative under two and a half hours that operates several times a day) and has established a tax of €30 per passenger since 1 September 2020 on flights shorter than 350 km, except for transfer flights.[80] This tax applies to both domestic and international flights. Belgium has set up a tax in force since 1 April 2022, mostly on international flights given the size of the country, amounting to €10 for flights under 500 km, €2 on flights within the EEA, the United Kingdom and Switzerland, and €4 for other flights, excluding transfers. Bills have been presented in the Netherlands but have not gone through due to a lack of political or government agreement. The definition of a "short-haul flight" is unclear, with some basing it on flight distance and others on the duration of rail alternatives.

The capacity of the modal shift of consumers towards other means of transport depends on political volition. The creation of a "climate ticket" in Austria and a €9-ticket in Germany in summer 2022 showed the positive response of demand when trains are easier to access. They also showed the importance of adapting infrastructures to respond to an increased use of the network. Another study[81] by the NGO Possible, whose aim is to encourage climate action, calls for a shift in British policy to support rail infrastructures instead of subsidizing airlines. The NGO's conclusions are based on a study of a representative sample of the British population who said they would respond positively to such a measure. The frequent passenger tax,[82] which makes plane travel more expensive, is one example put forward by the NGO. This tax would target frequent flyers – according to Possible, 70% of British flights are used by 15% of passengers – and revenues would be employed to support less carbon-intensive alternative means of transport. This measure came second (with 89% positive responses) in a British survey in 2021[83] designed to evaluate which measures the population supported to ensure that the country reaches is emissions reduction targets by 2030. In another example, in 2019 Sweden recorded a drop in traffic compared to 2018, put down to the rise of "flight shame" (*flygskam*) among Swedish people, who opt to make some of their journeys by train instead.[84]

KEY TAKEAWAYS

After going through a very turbulent zone in 2020 and 2021, air traffic has taken off again. But initiatives to direct the sector towards decarbonization are lagging behind the recovery of traffic growth, which is already catching up to pre-pandemic levels. Alternative to fossil fuels, either based on biofuels or electricity, are unlikely to be sufficiently developed before 2040, although some successful tests were observed in 2021 and 2022. While awaiting 2040, the effectiveness of the CORSIA system, designed to offset the sector's emissions, has been weakened and delayed by the drop in traffic in 2020. As a result of these realities, the ultimate option – a decrease in traffic – is increasingly being called for, especially in Europe, although it goes against the economic *raison d'être* of airlines. Recent studies and civil society therefore insist on the role of states, local governments, and airports to reach national emissions reduction targets.

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