2024 commercial aviation emissions grow above 2019 levels

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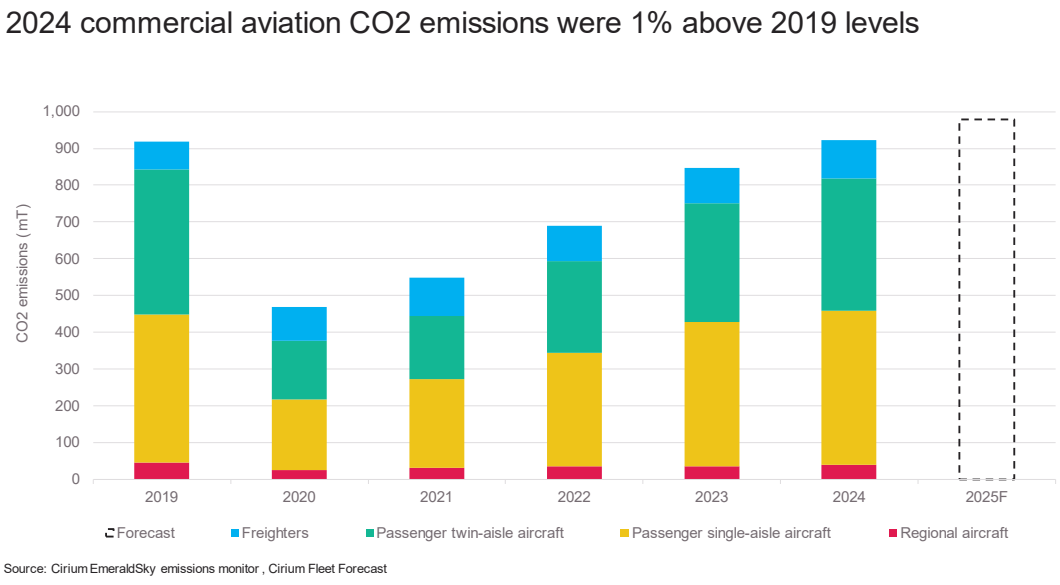
The commercial aviation industry concluded its post-Covid recovery in 2024. Almost all markets, the exception being China's international sector and some Asian domestic markets, have exceeded 2019 traffic and capacity levels. IATA figures showed a 10.4% annual increase in revenue passenger kilometres (RPK) and an 11.3% increase in cargo tonne kilometres in 2024. This means passenger traffic for 2024 was around 4% above 2019 levels, and freight traffic was 7% higher.

Cirium's tracked utilisation data, which includes over 99% of all passenger and cargo flights, is used as the basis for estimated CO2 emissions. Fuel-burn models are applied as part of our EmeraldSky emissions model. This is at the individual flight level for all scheduled and non-scheduled records with aircraft larger than 30-seater types. The annual data reveals that 2024 gross emissions were 1% higher than in the CORSIA baseline year of 2019. Within this figure, regional aircraft and twin-aisle passenger jets were still well below, with the increases in

emissions driven by single-aisle passenger jets (up 4% versus 2019) and freighter aircraft. The latter saw a huge increase in usage during Covid, which has been sustained, largely by ecommerce, ever since. Freighters are often older-generation aircraft types, and their emissions have increased by 40% from 2019 to 2024.



Source: Cirium EmeraldSky emissions monitor , Cirium Fleet Forecast

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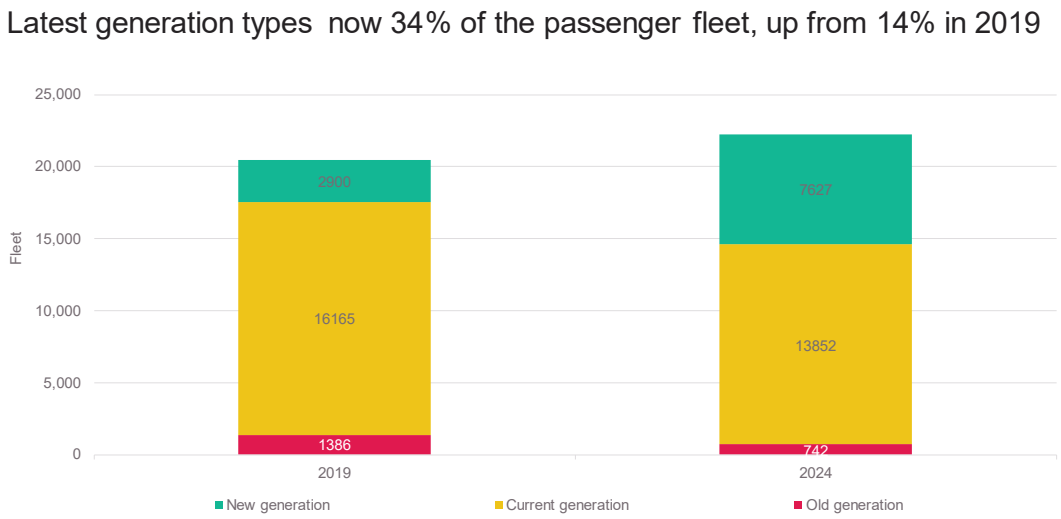
In total, passenger aircraft emissions in 2024 were 3% lower in 2024 than in 2019, even with a 4% increase in RPKs over the period. This does show some success in improving efficiency, with CO2/RPK down around 7% on this basis. Given that passenger load factor in 2024 was very close to 2019, this efficiency gain is down to changes in the fleet mix, with many older-generation types replaced by new aircraft such as the Airbus A320neo family, A350, Boeing 737 Max, or 787. Even with the well-known supply constraints at Airbus and Boeing, the fleet mix at the end of 2024 shows a much higher penetration of latest-generation types. These now make up 34% of the passenger fleet, up from 14% at the end of 2019. The typical fuel, and hence CO2, benefit of replacing an older type (e.g. A320ceo, 737-800, A330-300) with a new-generation aircraft (A320neo, 737-8 Max, A350-900) is 10-20%.



Looking ahead to 2025, we expect passenger traffic to grow by 7-8% over 2024, with gross emissions increasing around 6%. Unfortunately, the penetration of sustainable aviation fuel will be too small to make a significant dent on this increase, with IATA estimating around 0.3% SAF usage in 2024, perhaps growing to 0.5-1.0% this year. Thus, the divergence between actual net CO2 emissions and Net Zero pathways will widen further.

Emissions by airline domicile region very much reflect the traffic growth trends since 2019. North America and Europe are the two largest emitters, although European airline emissions are still 1.6% below 2019 levels. CO2 emissions have grown the most over the past five years in Africa and India, driven by strong economic growth and a rapid post-Covid traffic recovery. The rest of Asia-Pacific has seen emissions cut since 2019, as a result of the slow recovery in traffic to/from China (by non-Chinese airlines) and capacity cuts in Indonesia.

Operator region	2024 CO2 emissions (million tonnes)	Change versus 2019
North America	227	+4.0%
Europe	229	-1.6%
Asia-Pacific (excl. India/China)	163	-8.0%
India	22	+21.2%
China	118	+5.1%
Middle East	93	+3.0%
Africa	23	+17.6%
South & Central America	44	+7.0%

This analysis indicates that the aviation industry has started to grow both gross and net emissions above the 2019 baseline once again. Strong demand underpins this, with the move to more efficient aircraft and take-up of SAF being insufficient to offset growth. It is likely 2025 will see a further significant increase in aviation CO2 emissions. How the airline industry and governments react to these increases is uncertain, and likely to vary between regions and individual states. Aviation is much more difficult, and expensive, to decarbonise than other sectors, and this reality will become more obvious than ever in 2025.