TRANSPORT & ENVIRONMENT

Briefing

Above the clouds: European aviation emissions in 2023

Introduction

Every April, the European Commission releases compiled EU and Swiss emissions trading system (ETS) emissions data. While EU and CH ETS airline data are limited to emissions from intra-European flights, Transport & Environment (T&E) extends the analysis to all flights departing from EU27, Norway, Iceland, Switzerland and the UK - hereon called Europe - to allow for a more comprehensive picture of aviation-related emissions at European and international level. This is done by combining EU and Swiss ETS data with emissions calculated from OAG flights data (link to methodology). T&E's analysis focuses on 2023 emissions, compares them to 2019, as the historical peak year of Europe's aviation emissions before Covid-19, and to 2022 emissions. The scope of emissions considered in the briefing are those linked to departing flights from European airports, as they are directly linked to fuel uplifted on European territories.

In 2023, more than 6.7 million flights[1] departed from European airports, emitting a total of 164.85 Mt of CO2. This is equivalent to the emissions of 80 million petrol cars in one year. Compared to 2022, this represents a growth of 11.2% in terms of number of flights, and 13.2% growth in terms of CO2 emissions. European aviation as a whole is not back to its pre-Covid levels (89.2% of number of flights and 87.95% of CO2 emissions compared to 2019), however some airlines have bounced back and exceeded their 2019 emissions levels.

In 2023, flights to destinations outside of Europe, not covered by carbon pricing, showed the highest growth since 2022 (+19.9%) while domestic flights (i.e. flights within one country[2]) only grew by 4.3%. Intra-European (including domestic) flights grew by 9.7% compared to 2022.

Preliminary analysis of the EU ETS by BloombergNEF[3] also shows that aviation is the only sector within the EU that has largely exceeded its 2022 emissions. Other sectors like cement, ceramics and power have significantly reduced their emissions since last year. Aviation grew by 11% since last year, while emissions from cement decreased by 9.8%, ceramics by 20.5% and power by 23.7%.

[1] Only scheduled and some charter flights from commercial passenger aviation are included in the analysis of the number of flights. Integrator operations (e.g DHL) are not included, as they are out of OAG coverage.
[2] To take into account their longer range, flights between outermost regions and their respective member states are not considered domestic in the current analysis, while flights within the same outermost regions (e.g. Gran Canaria - Tenerife) are considered domestic flights
[3] BloombergNEF, *Airlines Face Rising Emissions Bill as EU Carbon Perks End*, April 08 2024

This briefing covers the following analyses and includes policy recommendations:

1. Airline emissions and top 10 polluters
2. The rise of low cost carriers in different flight segments
3. Carbon price and cost of a ton of CO_2 for Europe's top airlines
4. Ranking of most frequented routes departing from Europe
5. Policy recommendations

Airlines: ranking of top 10 most polluting carriers in Europe

The graph below presents the **top 10 most polluting airlines departing from Europe** in 2023, along with their evolution compared to 2019 levels.

Europe's 10 most polluting airlines in 2023

Ranking	Airline	CO_2 emissions 2023 (Mt)	CO_2 emissions growth 2019 - 2023 (%)
1	Ryanair	14.9	↑+23.0%
2	Lufthansa	9.5	↓-26.7%
3	British Airways	8.7	↓-18.7%
4	Air France	8.2	↓-14.5%
5	easyJet	6.9	↓-13.4%
6	KLM	5.4	↓-18.4%
7	Emirates	5.3	↓-10.4%
8	Wizz Air	4.5	↑+39.7%
9	Iberia	3.6	↓-8.4%
10	United Airlines	3.6	↑+20.8%

Source: European commission and OAG.

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Like in 2021 and in 2022, Ryanair remains the top polluting airline in Europe. It has far exceeded its 2019 emissions level (+23.0%). Wizz Air also increased its emissions considerably compared with 2019 (+39.7%)

and showed a significant year-on-year surge (+22.6% compared to 2022). On the other hand, the aviation industry in Europe as a whole is 'only' at 87.8% of 2019 emissions levels, with legacy carriers such as Air France and Lufthansa still at 85.5% and 73.3% of their 2019 emissions respectively for departing flights.

Legacy carriers such as Air France, Lufthansa or British Airways still represent a significant amount of emissions as they fly longer distances internationally. Extra-European flights represented 15.2% of all flights from Europe but accounted for 54.3% aviation emissions, as these are longer distance flights that emit more. Legacy carriers (30.5%) and selected third country carriers (11.6%) represent nearly half of all emissions from departing flights from Europe (42.2%). Most of the other half is caused by 401 other airlines flying from Europe. So 20 airlines (legacies and big third country carriers) are responsible for more emissions than that of these 401 airlines combined.

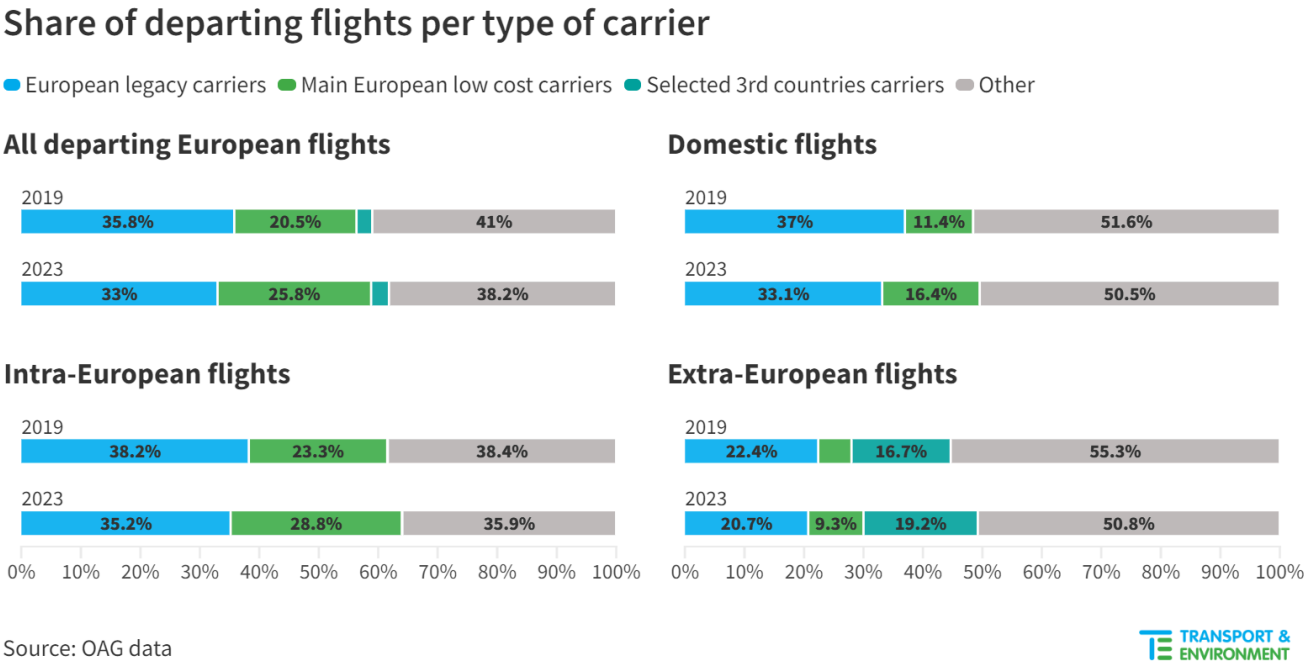
The figures in this briefing do not quantify non-CO_2 effects of aviation, which are known to be at least as damaging for the climate than CO_2 alone. In order to fully address aviation's climate impact, the European Commission should adopt a non-CO_2 Monitoring Reporting and Verification (MRV) scheme that applies to all emissions from Europe by 1st January 2025. This will enable airlines and policymakers to finally quantify the non-CO_2 climate impact of aviation, which has flown under the radar for decades.

The rise of low cost carriers in different flight segments

The European aviation market is evolving, and low-cost carriers have been **growing their market share** in most flight segments.

The figure below illustrates the evolution of the aviation market (defined here by the share of departing flights operated by an airline) across low-cost carriers, legacy carriers and third-country carriers[4] since 2019 on different flight segments: 1) all flights departing from a European airport, 2) domestic flights, 3) intra-European flights (including domestic flights), and 4) extra-European flights. All of the bar charts show that low-cost carriers are gradually increasing their market share of the European aviation sector.

[4]The analysis defines easyJet, Ryanair and Wizz Air as **low cost carriers**. Aer Lingus, Air France, Alitalia, Austrian Airlines, British Airways, Brussels Airlines, Finnair, Iberia Airlines, KLM, LOT - Polish Airlines, Lufthansa, Scandinavian Airlines and TAP Portugal are the 13 **legacy carriers** included in the analysis. The **selected third country carriers** are: Delta Airlines, Emirates Airlines, Etihad Airways, Ethiopian Airlines, Qatar Airways, Turkish Airlines and United Airlines. The remaining carriers are classified under the category **other.**



Source: OAG data

In 2023, one flight out of four **departing from Europe** was operated by one of the three main low cost carriers (easyJet, Ryanair, Wizz Air). In 2019, it was one out of five. Legacy carriers, on the other hand, seem to be losing market shares at the expense of low cost carriers (-2.8 percentage points (pp) of market share for legacy carriers compared to 2019, whereas low cost carriers have grown +5.3 pp since 2019). Third country carriers are just back to pre-Covid levels (100.9% of 2019) and have kept similar market shares (+0.4 pp) since 2019.

The majority of airlines have experienced significant growth between 2022 and 2023 for **flights within Europe**. This is due to the fact that Covid travel restrictions were fully lifted last year in Europe. Legacy and third-country carriers are back to 82.3% and 90.4% of pre-Covid levels, respectively, while low-cost carriers have already surpassed 2019 levels on European routes by more than 10.1%.

Even on **extra-European flights** - traditionally not the remit of low-cost carriers - budget airlines have recorded the biggest market share growth since 2019 (+3.7pp). In 2023, they flew 46% more flights on these routes than in 2019, and grew an impressive 31% since last year. Their overall market share remains small (9.3%).

On the other hand, legacy carriers have lost a 1.7pp of market share since 2019 on flights outside of Europe and they are not fully back to pre-Covid levels, which may also be linked with business travel not bouncing back to pre-pandemic levels. Third country carriers have slightly increased their market share on extra-European flights (+2.5pp) since 2019. But as T&E showed recently[5], and contrary to what European legacy airlines maintain, European climate measures are not the cause for this loss of market share. In fact, as explained in the next section, airlines that grew the most were those the most exposed to

[5] *Flying via Istanbul: escaping climate measures?* T&E, September 2023

carbon pricing, low-cost airlines. But as this briefing shows the actual cost of emitting CO_2 under the ETS is so low for airlines, it does nothing to incentivise emissions reductions, especially from low cost airlines.

Summary

- Ryanair is Europe's top polluting airline for the third year in a row. Wizz Air has also significantly increased its emissions since 2019, now the 8th most polluting airline in Europe.
- On all flight segments, low cost carriers have exceeded their pre-Covid levels, whilst legacy carriers have not rebounded back and have lost some market shares since 2019. Third country carriers have only slightly increased their market share since the pandemic.

Carbon price and cost of ton of CO_2 for top European airlines

Aviation was brought into the EU's emission trading system (EU ETS) in 2012 and has been included in the UK ETS since its introduction in 2021. Each year, polluters have to surrender a number of permits equivalent to the amount of CO_2 they emitted in the preceding year. Polluters acquire permits through an annual allocation system and some are issued by member states for free. If polluters don't have enough allowances to acquit their previous year's emissions, they can buy additional permits at auction or from other companies having a surplus. The EU and the UK put a maximum cap on the CO_2 emissions that can be emitted by restricting the number of permits available on the market. In principle, as issued permits become scarcer due to progressive reductions in the cap, the permit price goes up, providing emitters with an incentive to reduce their emissions where that is cheaper than buying permits. The ETS currently give free allowances to airlines - but this will be phased out in 2026.

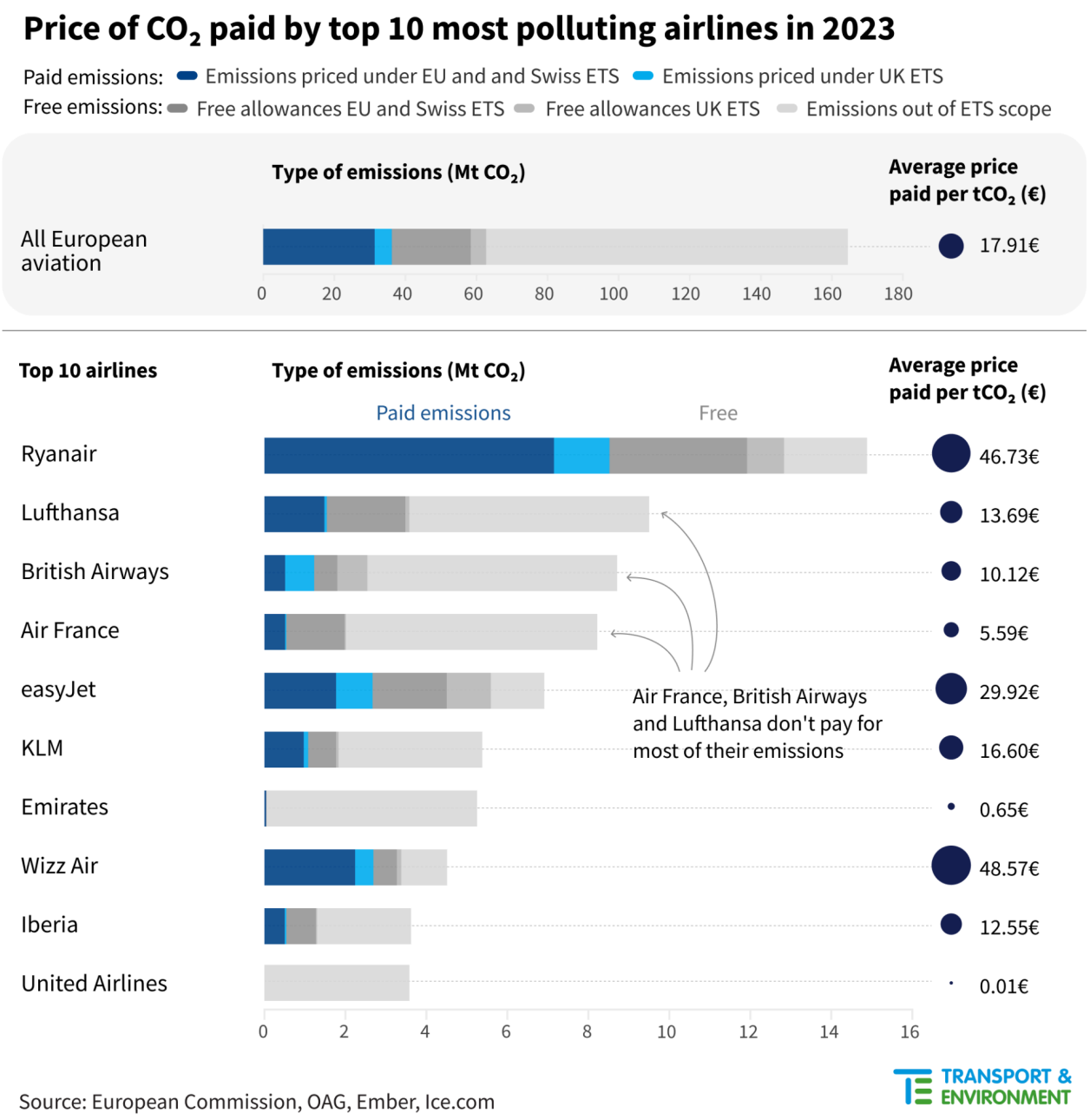
Both the UK and EU carbon markets are **limited to intra-European flights** and fail to include long-haul flights in the pricing scheme. Some long haul flights are covered by the international offsetting scheme Corsia (Carbon Offsetting Reporting Scheme for International Aviation), however we did not consider this in our analysis, as only emissions over 85% of 2019 levels would need to be offset with credits that are trading as low as 1€/ tonne of CO_2[6]. This would have a minimal impact on results shown below.

Extra-European flights represented 15.2% of all flights from Europe but accounted for 54.3% aviation emissions, as these are longer distance flights that emit more. This translates into 101.8 Mt of CO_2 falling out of the pricing scheme scopes. On top of this, in 2023, **27.2 million allowances were given to airlines for free** (in the EU, Swiss and UK ETS), reducing the amount of emissions actually priced by another 27.2 million tonnes. Overall, 78% (or 128.9 Mt of CO_2) of Europe's aviation emissions remained unpriced.

As a result of the limited scope of the scheme and the free allowances awarded to airlines, many carriers pay a very low average price for a tonne of CO_2 emitted. Using an average EU ETS carbon price of 85.3€[7],

[6] *Corsia: worst option for the climate* T&E, March 2021
[7] Source: Ember - *Carbon Price Tracker*

and 62.3€[8] for the UK ETS carbon price, T&E calculated the average price paid for each ton of carbon by the top 10 most polluting airlines in 2023.



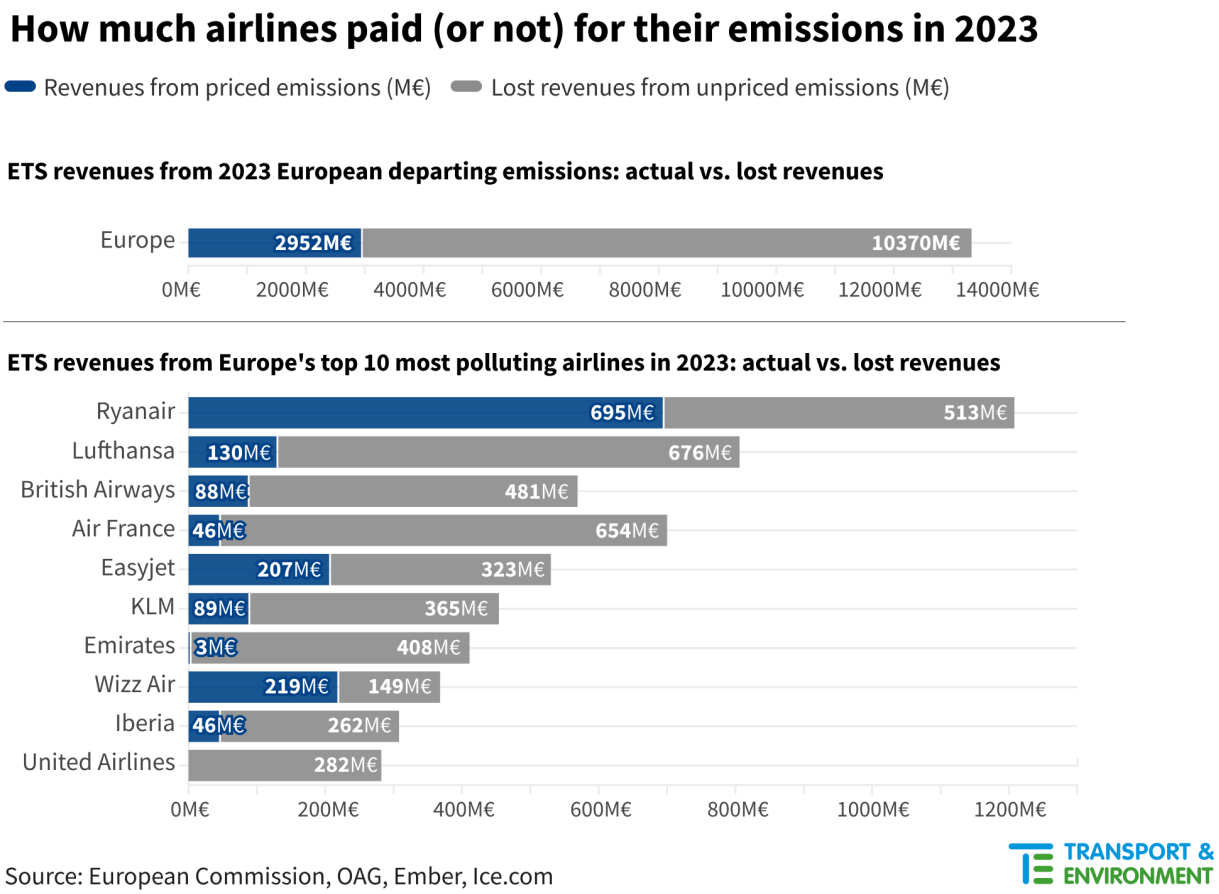
The average cost of a ton of CO_2 in Europe for airlines was €17.91 last year. For the top 10 polluting airlines, the average cost was 18.44€.

Considering the average price for EU and UK ETS in 2023[9], airlines flying in Europe paid three billion euros in ETS allowances, but avoided paying an estimated €10.3 billion for their emissions thanks to the free

[8] Source: Ice.com

[9] 85.3€ and 62.3€ respectively. Ember - *Carbon Price Tracker*, Ice.com

allowances and emissions not covered by the scope of a carbon market. The breakdown per airline below shows how little some carriers had to pay for their emissions last year.



Not only did legacy carriers like Lufthansa, Air France and British Airways fail to pay for the full price of their emissions (respectively 83.9%, 93.4%, 84.5% of their emissions remained unpriced in 2023), third country airlines like Emirates and United Airlines are also entirely escaping their climate bills. Despite generating similar levels of emissions than other European airlines, this middle eastern and american carrier are even paying less than some of their European counterparts. This is why it's important for the EU to ensure these emissions are covered by the current EU ETS scheme to ensure a level playing field between European and third country airlines.

Given most low cost airlines receive free allowances, on average they only paid for half of their emissions in 2023 (52%). Ryanair was exempt from paying for 42.5% of its emissions, easyJet 61% and Wizz air 40.6%. Even though free allowances are expected to be phased out in the next few years, low ETS carbon prices might counter the added benefits of requiring airlines to pay for their full emissions.

At the end 2023 and early 2024, the price of a ton of carbon within the EU ETS had fallen, reaching a low of €57,21 on the 25th of February 2024[10]. This drop in price presents some serious challenges for the future

[10] Ember, *Carbon Price Tracker*

of carbon pricing for aviation, notably diminishing the incentive for industries to invest in cleaner technologies and for encouraging alternatives (like rail). Furthermore, current low prices (€57.41 for EU ETS[10], and €38.14 for UK ETS[11], at the time of the analysis[12]) could offset the year-on-year decrease in free allowances. Although about 5.8 million additional tonnes of CO_2 will be priced next year thanks to the progressive phase-out of the free allowances in the UK and EU carbon markets, overall revenues from ETS will decrease if such low carbon prices remain throughout the year. The phase out of these free allowances could increase the revenues from aviation in the ETS by €494 million (reaching a total of €3.4 billion) in 2024, if the ETS carbon prices stay similar to the 2023 averages. If ETS prices in 2024 see the same decline as the one observed at the end of 2023, total revenue from aviation in the ETS would drop to 2.3 billions, resulting in a loss of €651 million compared to 2023 and a 1.1 billion loss compared to a situation with a higher ETS price in 2024, effectively countering the potential gains of phasing out allowances[13].

Summary

- The average carbon price paid by the top 10 European carriers on their European flights was €18.4 per ton of carbon last year. Legacy carriers operating most of their flights outside of Europe paid a much lower average. Air France, for example, paid an average €5.6 last year per ton of CO_2.
- Current low prices in ETS schemes for a ton of carbon could offset the year-on-year decrease in free allowances.

Ranking of most frequented routes departing from Europe

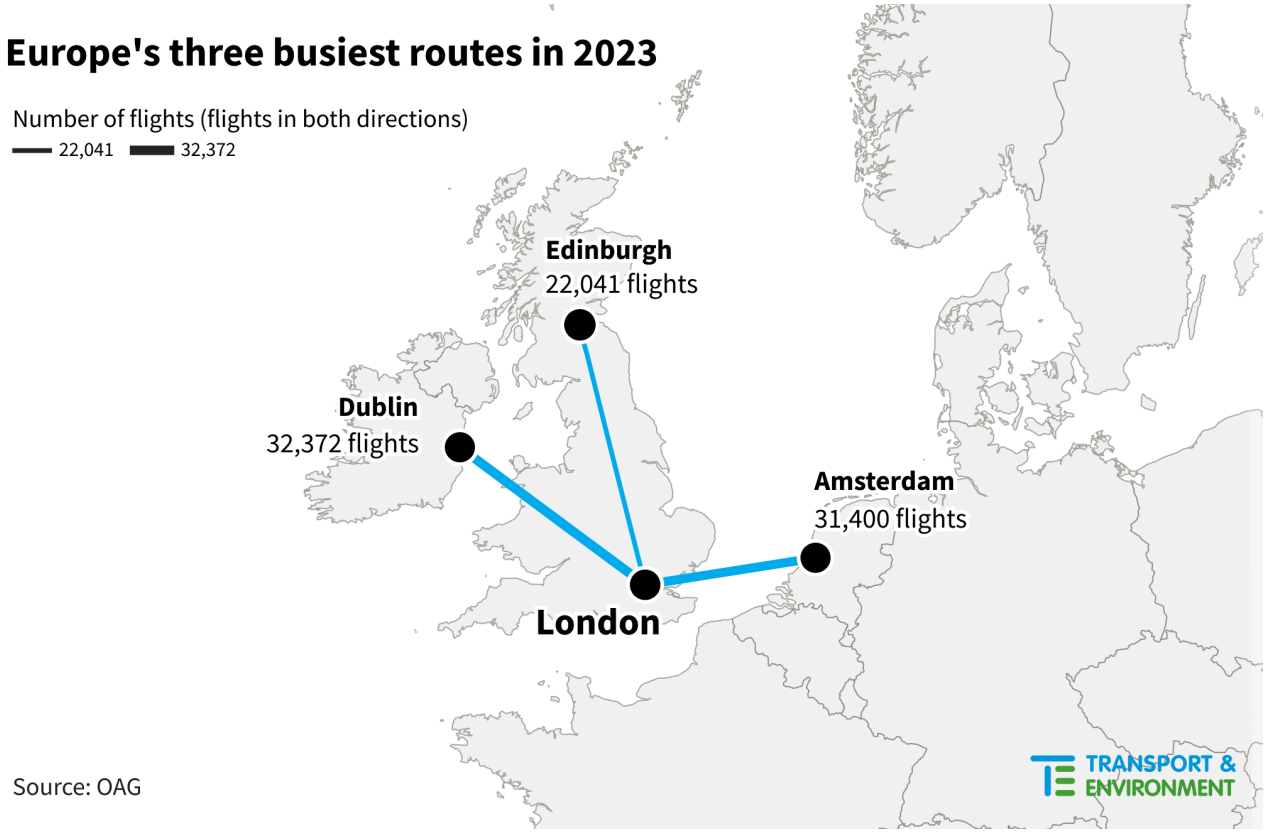
The map below shows the top most frequented routes departing from a European airport[14].

[11] Ice.com

[12] On the 3rd of April 2024. Although prices might increase again during the year, they are projected to remain lower than in 2023 (Analysts cut EU carbon price forecasts on weak industry, power sector demand, Reuters 2024), which would at least partially offset the effect of the decrease in free allowances.

[13] All other things being equal. The potential increase in ticket price from higher ETS price, and the resulting effect on demand is not considered in this estimate.

[14] European airports serving the same city were pooled for this analysis, but not third country airports.



The most frequented routes in 2023 were linked to the UK's busiest airports in London. There are approximately 44 flights a day (one-way) for the most frequented route, London-Dublin. For the London-Amsterdam Schiphol route, more than 43 flights are scheduled per day, despite having a train connection alternative under 4 hours.

The tables below show the breakdown of the most polluting routes departing from a European airport (taking into account EU27, Norway, Iceland, Switzerland and the UK) and then only for the EU27[15].

Table 1: Five most polluting routes departing from a European airport

Route	CO_2 emissions in 2023 (Mt)	% of 2019 levels	Type of Flight
London-Dubai	2.3	104.6%	ExtraEU
London-New York JFK	2.2	90.7%	ExtraEU
London-Singapore	2.1	90.7%	ExtraEU
London-Los Angeles	1.6	98.5%	ExtraEU
Frankfurt-Shanghai	1.4	93.3%	ExtraEU

[15] European airports serving the same city were pooled for this analysis, but not third country airports.

Table 2: Five most polluting routes departing from an EU27 airport

Route	CO_2 emissions in 2023 (Mt)	% of 2019 levels	Type of Flight
Frankfurt-Shanghai	1.4	93.3%	ExtraEU27
Frankfurt-Incheon	1.1	87.8%	ExtraEU27
Paris-JFK	1.0	106.6%	ExtraEU27
Amsterdam-Shanghai	1.0	102.1%	ExtraEU27
Paris-La Réunion	0.5	99.1%	IntraEU27

The top polluting routes are all to destinations outside of the EU, and not covered by a carbon market (European, Swiss, or UK), meaning that airlines operating these flights do not pay for their carbon emissions. For instance, no airline had to pay a carbon price for its emissions on the most polluting route departing from Europe - the London-Dubai leg - even though it accounted for 2.3 Mt of CO_2 in 2023.

Summary

- Europe's most frequented routes all depart from a London airport and two of them have alternatives by train.
- Europe's top five polluting routes are not covered under an ETS, meaning airlines do not pay for the CO_2 emitted on the most polluting routes.

Policy recommendations

The analysis has shown that aviation emissions are climbing back to pre-Covid levels and are particularly booming in the low-cost carrier segment. It demonstrates that the sector has not built back better from Covid-19, as it had pledged it would. While emissions from all other sectors of the economy have started to decrease, those from transport, especially aviation, remain high and continue to grow. Without legislative action to better implement the polluter pays principle in the sector, aviation emissions are projected to increase further. T&E calls for the following policy actions:

1 **Extend the Emissions Trading Schemes** (EU and UK ETS) **to all extra-European flights** departing from an European airport, thereby correcting the current situation where most aviation emissions are excluded from any effective carbon pricing mechanism. The EU has the

opportunity to extend the ETS to all flights departing from EU airports in 2026, in the revision of the ETS text, and should seize it urgently.

2 **Implement taxes on kerosene**. In the EU, this means implementing a revision of the Energy Taxation Directive (ETD) to implement a tax at the full initial scope as proposed by the European Commission as part of its Fit for 55 package in 2021. In the UK, this means applying a fuel duty on all departing flights where air service agreements allow. Most fuel usage should be subject to a tax. It is crucial to end the climate and social injustice that allows kerosene to remain one of the only untaxed fuel products in Europe.

3 **Adopt national measures to reduce air traffic growth.** The analysis demonstrates that emissions arise from specific routes and airports. European nations should follow the example of Schiphol's cap on the number of flights and follow through with a cap on emissions of Europe's busiest hubs. Additionally, short haul flights should be replaced by rail connections in Europe.

4 **Non-CO_2 effects of aviation should be monitored** as required by the latest revision of the EU ETS on all flights departing from and arriving into Europe and publically reported under Emissions Trading Schemes, as they contribute at least as much to global warming as CO_2 alone.

Link to methodology.

Further information

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