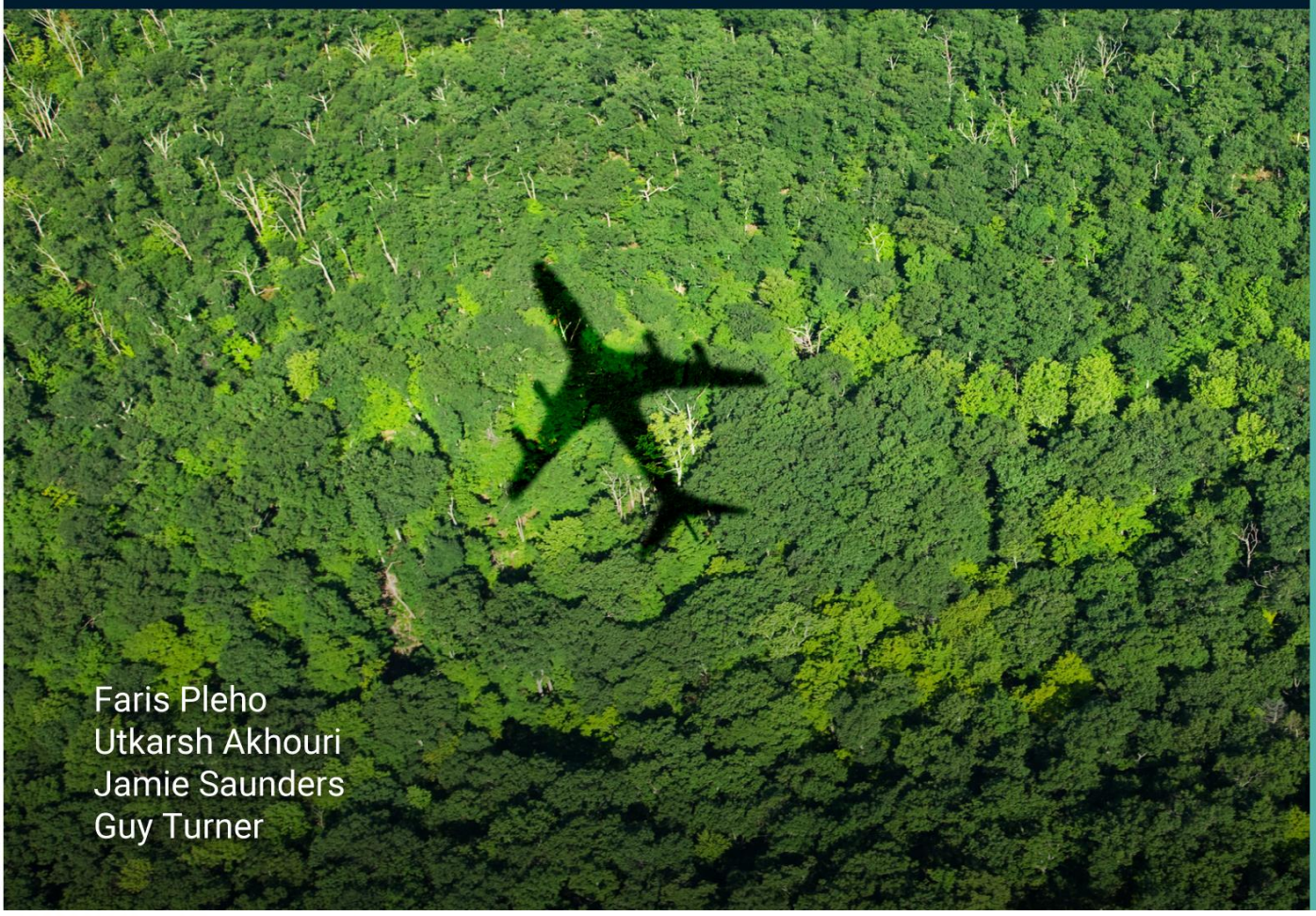
MSCI

RESEARCH INSIGHT

CORSIA: Costs and Implications for the Airline Industry

MSCI Carbon Markets

November 2024



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Executive summary

International aviation is a material contributor to global emissions, with the sector accounting for around 3% of global annual CO2 emissions.[1] As such airlines are under pressure from a number of stakeholders, including investors, passengers and regulators, to reduce emissions.

To make these emission reductions, airlines will need to both improve the fuel efficiency of their aircraft and reduce the carbon intensity of aviation fuels. Through the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), international carriers will also be required to offset the part of their emissions that exceed 85% of 2019 emission levels.

This report analyzes the potential demand and supply for credits under CORSIA, and how much the scheme could cost — in higher ticket prices or lower profits for the airlines. The analysis uses projected credit demand and cost scenarios that are available for over 400 airlines on the MSCI Carbon Markets platform. The key insights are:

- Airlines could generate cumulative demand for CORSIA-eligible carbon credits equivalent to 106-137 million tonnes of CO2 equivalent (MtCO2e) during Phase I (2024 to 2026) of CORSIA. Demand during Phase II of the scheme (2027 to 2035) could amount to 502-1,299 MtCO2e.

- This demand could exceed the supply of eligible credits. In a conservative scenario, cumulative supply could be as low as 94 MtCO2e during Phase I and 900 MtCO2e during Phase II. The need to use credits with a corresponding adjustment is expected to be the main limiting factor on supply.

- Modeling by MSCI Carbon Markets suggests that CORSIA credits could command prices in the USD 18-51 range per tCO2e during Phase I and USD 27-91 during the latter stages of Phase II (2033 to 2035).

- At these prices, the costs to international airlines would be modest. Total costs during Phase I would be USD 1.9-7.0 billion and USD 13-109 billion in Phase II. These would represent a cost of less than USD 2 per ticket in Phase I and up to USD 5 in Phase II.

- The net impact on airlines would depend on how much of the cost would be passed through to customers. If all these costs were passed on, the average international ticket price would increase by 0.5-1.0% in Phase I, but if all the cost of CORSIA compliance were to be absorbed by the airlines, Phase I could reduce operating profits by up to 4%. The impact on each individual airline would, however, vary considerably based on company-specific flight paths and operating models.

[1] "CO2 emissions in aviation in the Net Zero Scenario, 2000-2030," IEA, July 2023.

1 What is CORSIA?

1.1 Origins

Aviation is an important contributor to global emissions, accounting for just over 1 gigaton of CO2 (GtCO2), or 3%, of global energy-related emissions in 2019, according to the International Energy Agency (IEA).[2] Around 61% of these emissions were from international air transport and 39% from domestic flights.

Domestic aviation emissions are managed within the scope of the Paris Agreement. Emissions from international travel (aviation and maritime), however, fall outside this scope. International aviation emissions are therefore reported and addressed separately by the International Civil Aviation Organization (ICAO).

Reducing emissions from aviation is challenging. Reductions can be achieved via improving aircraft technology, enhanced operations and/or adoption of more sustainable fuels. Each of these takes time to adopt, however, and the extent of emission reductions they can eventually deliver remains uncertain.

In 2016, ICAO launched CORSIA. Its job was to address emissions from international air transport and to act as a stop-gap measure giving time for the other levers of decarbonization to become viable and established in the industry.

The aim of CORSIA is to offset, via carbon credits, any growth in emissions from international aviation above their baseline level. The baseline is currently set at 85% of 2019 emissions. Credits are sourced from the voluntary carbon market but must meet ICAO's own minimum quality requirements. Importantly, the credits must be "correspondingly adjusted," which is a mechanism to ensure emission reductions/removals are not double counted under the Paris Agreement.

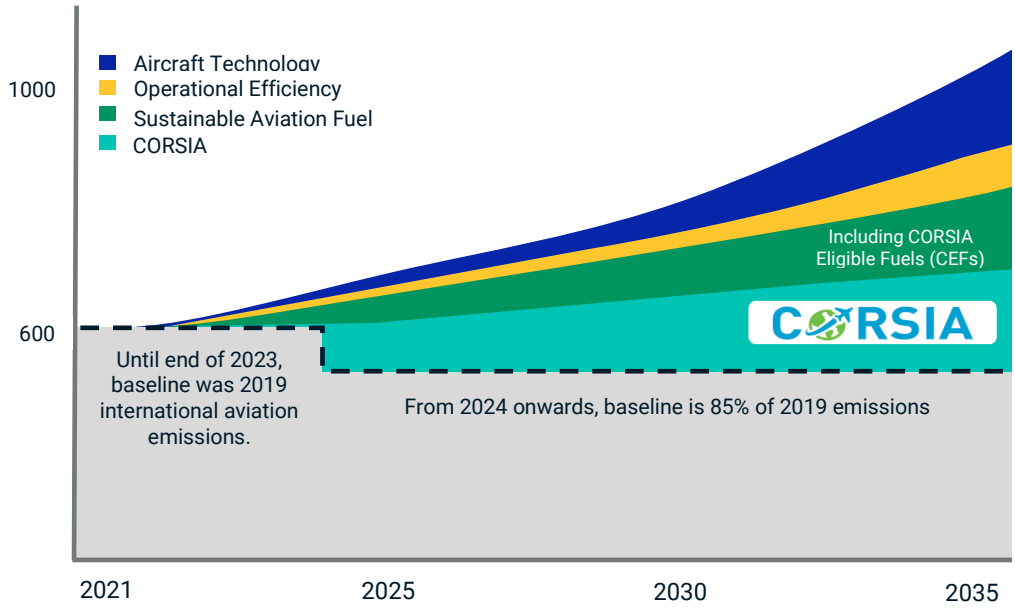
CORSIA's implementation includes a now-completed pilot phase (2021 to 2023), followed by a voluntary first phase (2024 to 2026) and a mandatory second phase (2027 to 2035). Phase I currently has 126 participating countries, while 193 countries will be covered when it becomes mandatory from 2027.[3] The scheme adopts a route-based approach, so only flights where both the departing and arriving country participate are covered by CORSIA.

More details on the background to CORSIA are provided in the appendix.

[2] "CO2 emissions in aviation in the Net Zero Scenario, 2000-2030," IEA, July 2023.

[3] "International Revenue Tonne Kilometre (RTK) Rankings 2018," ICAO. RTK data for 2018 will be used for the purposes of determining the participation of countries in the second phase of CORSIA.

Exhibit 1: Net CO2 emissions from international aviation (MtCO2)



Data as of November 2024. Source: MSCI Carbon Markets, adapted from ICAO's initiatives to address climate change

1.2 The pilot phase and beyond

During the initial pilot phase, a total of 115 countries decided to voluntarily participate. However, due to the major downturn and prolonged recovery of international aviation following the COVID-19 pandemic, emissions stayed below the 2019 baseline. As a result, ICAO confirmed that there would be no requirement for airlines to purchase credits as part of the pilot phase.[4]

This is expected to change significantly during Phase I due to:

- The post-COVID-19 recovery in international aviation,
- A reduction in the baseline to 85% of 2019 levels, and
- Limited reductions in emissions from the sector due to a limited adoption of SAFs and constrained availability of next-generation aircraft because of technical and certification issues limiting deliveries.

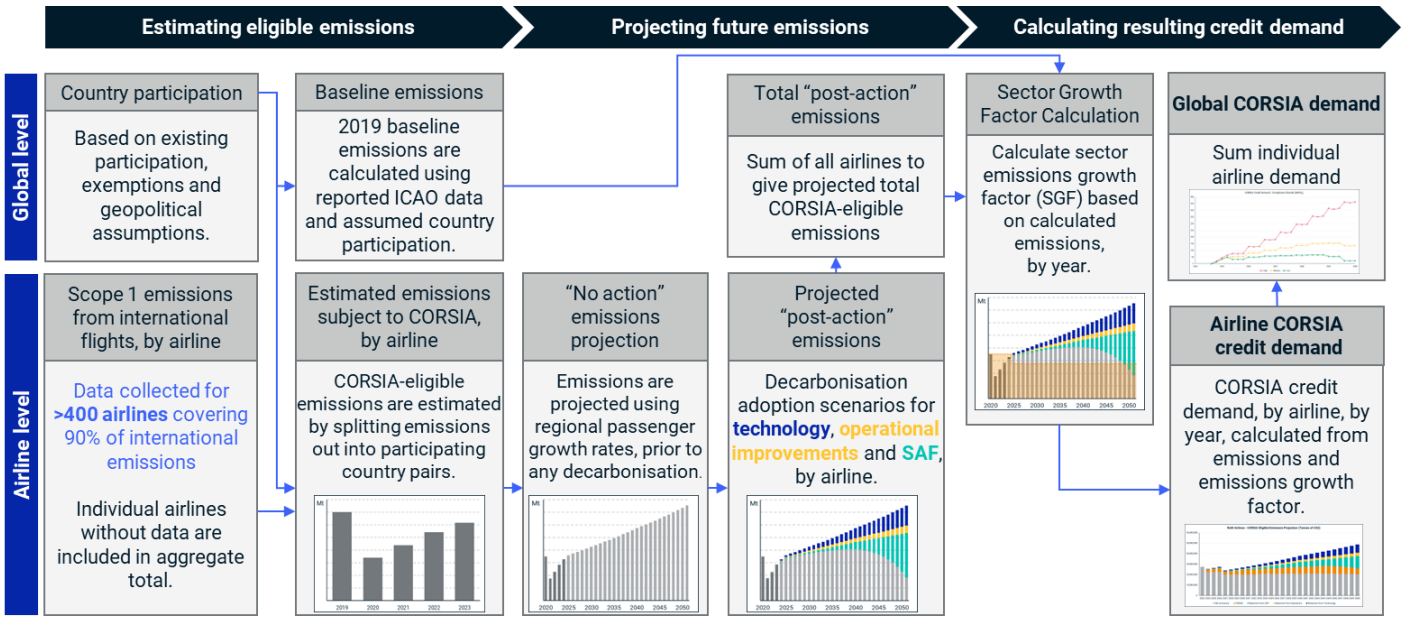
[4] "CORSIA Annual Sectoral Growth Factor (SGF) Report 2024," ICAO, October 2024.

2 Outlook for credit demand under CORSIA

2.1 CORSIA demand model

The MSCI Carbon Markets global CORSIA forecast uses a bottom-up methodology that creates decarbonization pathways for the individual airlines. These are based on reported emissions, regional growth factors and the willingness and ability to adopt in-sector decarbonization levers.

Exhibit 2: MSCI Carbon Markets demand model



Source: MSCI Carbon Markets, November 2024

For Phase I, the model uses the published list of currently participating countries. For Phase II, it builds in scenarios to account for geopolitical and policy factors that could drive participation. These are (i) high participation: all ICAO members participate in CORSIA (excluding currently exempt countries), (ii) medium participation: all ICAO members participate except for China and Russia, and (iii) low participation: the U.S. joins China and Russia as a nonparticipating member of CORSIA.

Emission projections are made for individual airlines out to 2050, based on their country-by-country flight paths. Projections are initially produced for a no-action scenario based on current historic emissions and expected future regional passenger growth rates (around 3-4% per year).

In-sector decarbonization is then netted from each airline using regional adoption rates and split across three main levers: technology, operations and SAF. These decarbonization actions are applied to the no-action emissions projections for each airline to create projected net emissions for each scenario. Total CORSIA-eligible emissions are then equal to the sum of all individual airline emissions projections.

The CORSIA sector emissions growth factor (SGF) is calculated using the net emissions growth above the baseline for each year of the scheme, using the methodology specified by ICAO. The SGF is then multiplied by each airline's CORSIA-eligible emissions to calculate their individual offsetting

requirement per year. The global total offsetting requirement in each three-year compliance period is then equal to the sum of each individual airline's demand for those three years.

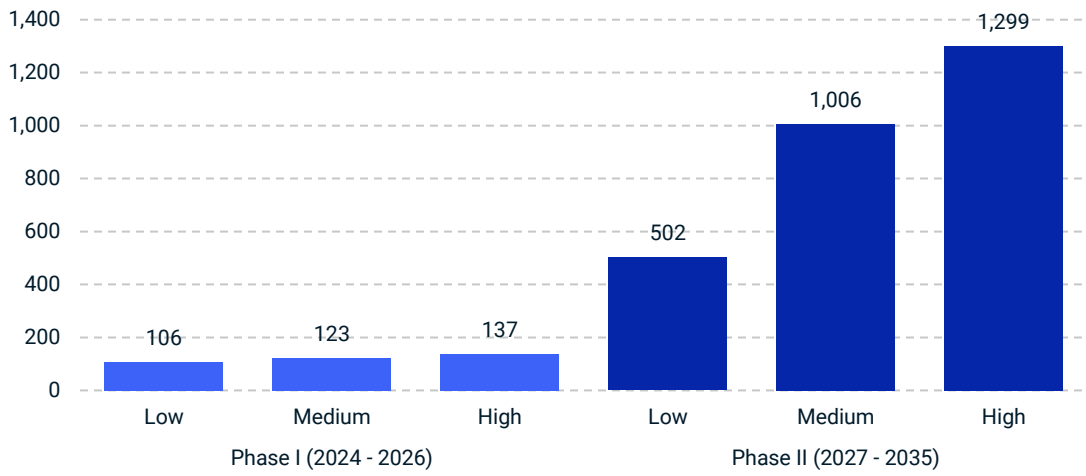
2.2 Demand scenarios

In our **high-demand scenario**, we assume international aviation traffic grows quickly (+4% per year), but in-sector decarbonization is relatively slow (emission reductions related to SAF stand at just 11% by 2050, and technical and operational improvements reduce business-as-usual 2050 emissions by 21%). As a result, cumulative demand for credits is projected to be around 137 MtCO2e in Phase I and 1,299 MtCO2e in Phase II.

In our **medium-demand scenario**, we assume passenger growth is lower, but in-sector decarbonization increases through greater use of SAF and increased fleet-renewal efforts. As a result, cumulative demand is projected to be around 123 MtCO2e in Phase I and 1,006 MtCO2e in Phase II.

In our **low-demand scenario**, we assume the world enters a period of low growth and low climate action with poor geopolitical co-operation. As a result, the U.S., China and Russia do not participate in Phase II and international passenger growth is at very low levels. Additionally, in-sector decarbonization remains slow as SAF uptake remains limited and airlines continue to operate existing aircraft for longer, resulting in only some demand materializing, at around 106 MtCO2e in Phase I and 502 MtCO2e in Phase II.

Exhibit 3: CORSIA offsetting requirements by phase (MtCO2e)



Data as of November 2024. Source: MSCI Carbon Markets

At an individual airline level, modeled demand is heavily skewed to a small number of airlines, with the 10 largest projected to account for 40% of cumulative CORSIA demand up to 2035, according to our analysis.

Regionally, the greatest demand, on a cumulative basis through 2035, in all three scenarios is projected to come from European airlines, despite intra-European Economic Area (EEA) flights not falling under the scope of CORSIA because they are covered by the EU Emissions Trading Scheme (ETS). If this exclusion is expanded to encompass all international flights that start or end within the EEA, then global cumulative credit demand to 2050 could fall by 25-50%.

3 Outlook for credit supply under CORSIA

3.1 Credit eligibility

ICAO has set out specific requirements for credits that can be used toward offsetting obligations under CORSIA.[5] Known as eligible emissions units, they must meet the following criteria for Phase I:

- Be registered to an approved registry that has passed an assessment by ICAO's Technical Advisory Board;
- Be from a project with a crediting-period start date after Jan. 1, 2016;
- Be issued with a vintage year between 2021 and 2026;[6] and
- Have a corresponding adjustment applied to avoid double counting the emissions reduction against a country's nationally determined contributions (NDC).

3.2 Corresponding adjustments

An important aspect of CORSIA is how it relates to corresponding adjustments, whose purpose is to ensure that the same tonne of CO2e is not counted toward two different greenhouse-gas emissions-reduction targets, also known as "double claiming."

Carbon credits used within Phase I or II must have a corresponding adjustment applied. That means the carbon-selling country (also known as the host country) must authorize a project to sell credits to an airline to use against their CORSIA targets by issuing a Letter of Authorization (LoA). This, in theory, ensures that the host country will adjust their progress toward achieving their NDCs to reflect the transfer of that emissions reduction or removal to the respective airline. This process requires the country to have an operational national carbon registry or an agreement with one of the voluntary carbon market registries, such as Gold Standard or Verra, to act as their national carbon registry. The host country and the airline will use a corresponding adjustment to demonstrate that they have complied with this criterion.

Many countries, however, do not yet have the infrastructure or institutions in place to authorize and track corresponding adjustments. Questions also remain over whether countries could ever revoke such authorizations. Due to these complicating factors, there is considerable uncertainty over the near-term supply for credits with corresponding adjustments.

MSCI Carbon Markets has completed an assessment of 40 countries to see how ready they are to issue corresponding adjustments, categorizing them from high to very low. The methodology uses eight criteria covering legal, institutional and procedural aspects, including transparent approval procedures, accounting and reporting. These 40 countries represent more than 90% of carbon credit issuances since the start of 2016.

[5] "CORSIA Emissions Unit Eligibility Criteria," ICAO, March 2019.

[6] The vintage is the year in which the verified emissions that a carbon credit represents occurred.

3.3 Current state of supply

In March 2023, ICAO granted full eligibility for Phase I to the carbon credit standards ACR and ART TREES. In late October 2024, it also granted eligibility to four additional standards: Verra, Gold Standard, Climate Action Reserve (CAR) and the Global Carbon Council (GCC). Four smaller registries are also conditionally eligible, but yet to be confirmed by ICAO as fully eligible.

As of the end of October 2024, there was a surplus of some 230 MtCO2e of credits from Phase I-eligible registries, sourced from over 1,400 projects.[7] This supply of credits is a marked increase on the roughly 50 MtCO2e of credits (from around 175 projects) that were eligible prior to ICAO's recent decision to extend eligibility to four additional standards.

However, only 7 MtCO2e of these issued credits currently meet all eligibility requirements for use in Phase I; these were all issued in Q1 2024 by the Guyanese Jurisdictional REDD+ project registered with ART TREES. The main reason the remaining credits are not yet fully eligible is that they have not been issued with an LoA by their respective host-country governments.

Near-term supply is expected to remain constrained due to the lack of LoAs to enable credits to be correspondingly adjusted. For this to expand rapidly, governments need to agree and negotiate how corresponding adjustments will be implemented. Very few countries have yet put all the regulations and infrastructure in place for corresponding adjustments to be effective. Given the time and steps involved, many countries are unlikely to be ready until the late 2020s or even later. Of the 40 countries that MSCI Carbon Markets has assessed, only two currently rank high in their preparedness.

3.4 Supply projections methodology

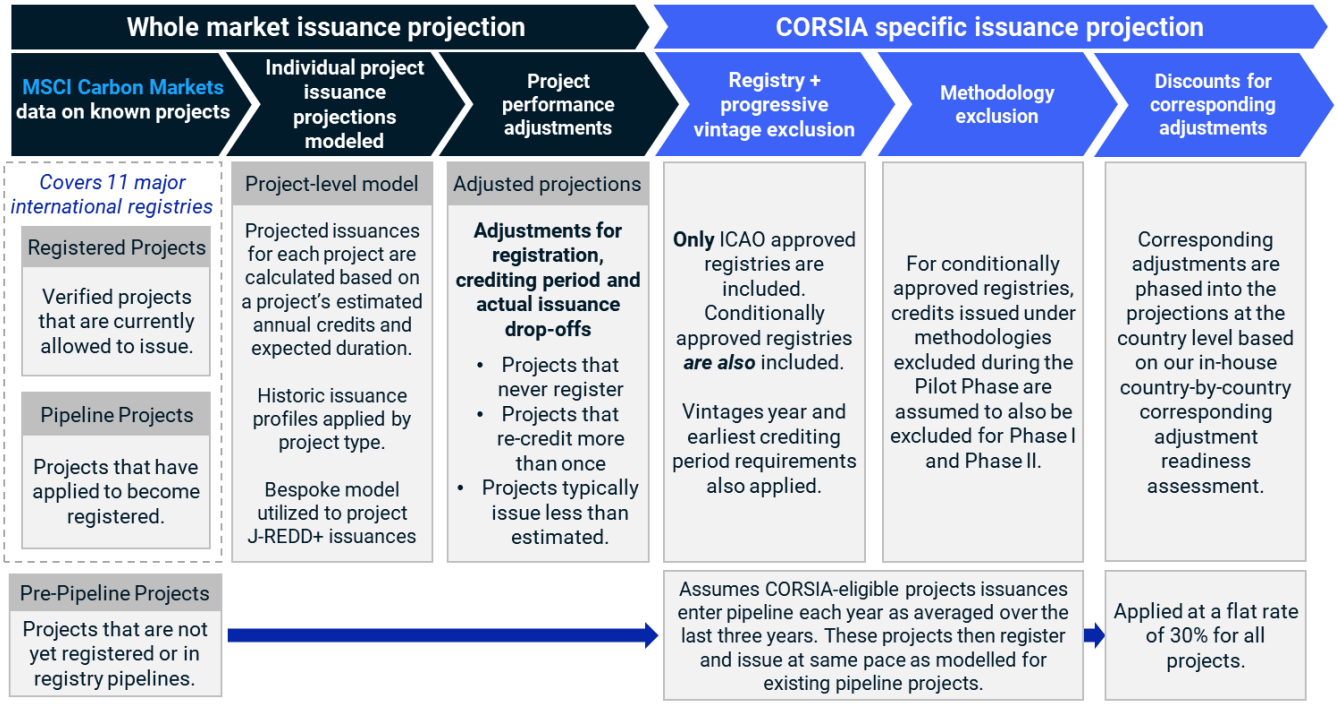
The MSCI Carbon Markets CORSIA-eligible credit issuance model methodology builds on our approach to projecting supply in the wider carbon credit market, which includes adjustments for registration, crediting period and actual issuance drop-offs based on the recent record of similar projects in the market.

Our overall market-issuance projection is made CORSIA-specific by applying the registry eligibility, vintage year and earliest crediting-period requirements as specified by ICAO. Finally, the requirement for a corresponding adjustment is included based on our in-house country-by-country assessment of readiness to issue such credits by a project's host-country government. A discount is applied to the projected issuance of projects from each country based on that country's readiness to correspondingly adjust credits, to give an estimate of the potential supply of credits that are eligible for use within the CORSIA scheme.

In the projections used in our price forecasts, potential supply is also included from projects that are not yet in registry pipelines based on the number of CORSIA-eligible projects and issuances entering the market over the last three years. A reduction factor of 30% is applied to these projects to account for the likelihood they could apply a corresponding adjustment.

[7] This assumes no methodological restrictions or exclusions are placed on the four newly approved carbon credit registries by ICAO. At the time of writing, ICAO had not confirmed whether any such restrictions would be applied. Such restrictions were previously applied during the pilot phase of CORSIA.

Exhibit 4: CORSIA-specific issuance projection



Source: MSCI Carbon Markets, November 2024

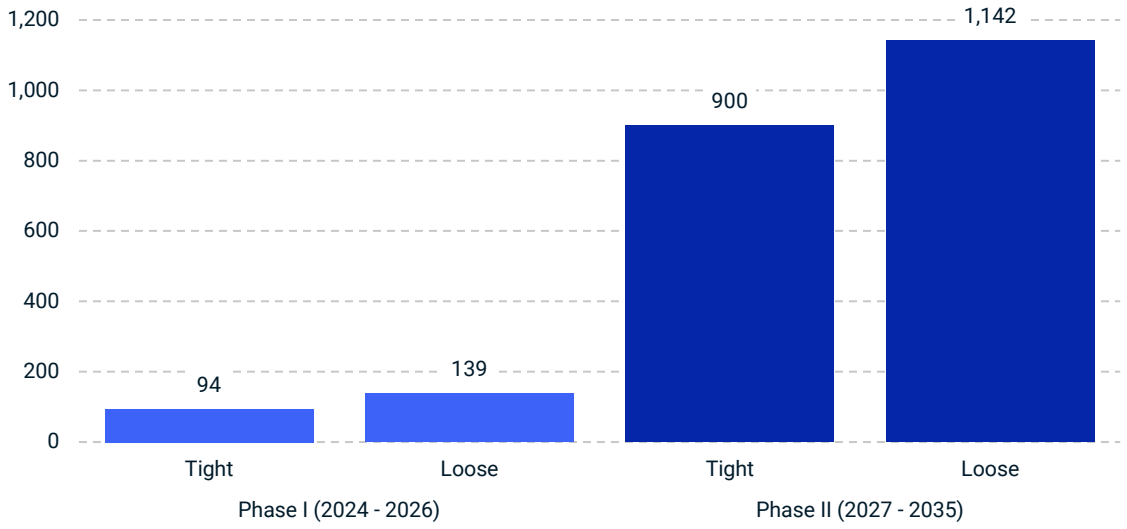
3.5 Projected supply scenarios

Relatively few countries appear ready to immediately offer corresponding adjustments — around 90% of potential supply is projected to come from countries with an MSCI Carbon Markets readiness score of "low" or "very low." As a result, the projected supply of CORSIA-eligible credits falls materially when applying assumptions on the likely availability of corresponding adjustments.

In a high-availability scenario, cumulative supply is projected to be around 139 Mt during Phase I and 1,142 Mt during Phase II, while in a more conservative, low-availability scenario, it is projected to be around 94 Mt during Phase I and 900 Mt during Phase II.

Supply could be higher if CORSIA expands the number of projects that are eligible for use within the scheme, or governments make corresponding-adjusted credits more widely and/or quickly available. Supply could, however, also be even more constrained if CORSIA tightens its eligibility criteria further, or if, as expected, new integrity initiatives within the market tighten overall supply (which our modeling suggests could lead to a reduction in projected CORSIA-eligible supply of 2-30%).

Exhibit 5: Projected cumulative supply of CORSIA-eligible credits (MtCO2e)



Data as of November 2024. Source: MSCI Carbon Markets

4 Scenarios for CORSIA-eligible carbon credit prices

4.1 Supply-demand gap under CORSIA

By comparing our projections for credit supply and demand, we estimate the potential supply-demand gap. During Phase I, we project a potential supply deficit in all three of our scenarios involving tight supply, ranging from 12-43 Mt. In our scenarios involving loose supply, however, a supply surplus is projected, ranging from 2-33 Mt. The supply deficit would be a lot larger if airlines did not have until January 2028 to offset their Phase I emissions, allowing them to use eligible credits issued in 2027.

During Phase II, a potential supply deficit is projected in the high-demand scenario as well as in the medium-demand scenario, with low readiness for corresponding adjustments. A supply surplus is projected in the medium-demand scenario with high availability of corresponding adjustments, as well as under both low-demand scenarios.

Exhibit 6: Gap between supply and demand under different scenarios (MtCO2e)

Supply scenario	Demand scenario	Phase I			Phase II		
		High	Medium	Low	High	Medium	Low
Loose: High availability of corresponding adjustments	Demand (Mt)	137	123	106	1,299	1,006	502
	Supply (Mt)	139			1,042		
	Surplus (Mt)	+2	+16	+33	-257	+36	+540
Tight: Low availability of corresponding adjustments	Demand (Mt)	137	123	106	1,299	1,006	502
	Supply (Mt)	94			833		
	Surplus (Mt)	-43	-29	-12	-466	-173	+331

Data as of November 2024. Source: MSCI Carbon Markets

4.2 Price-projection methodology

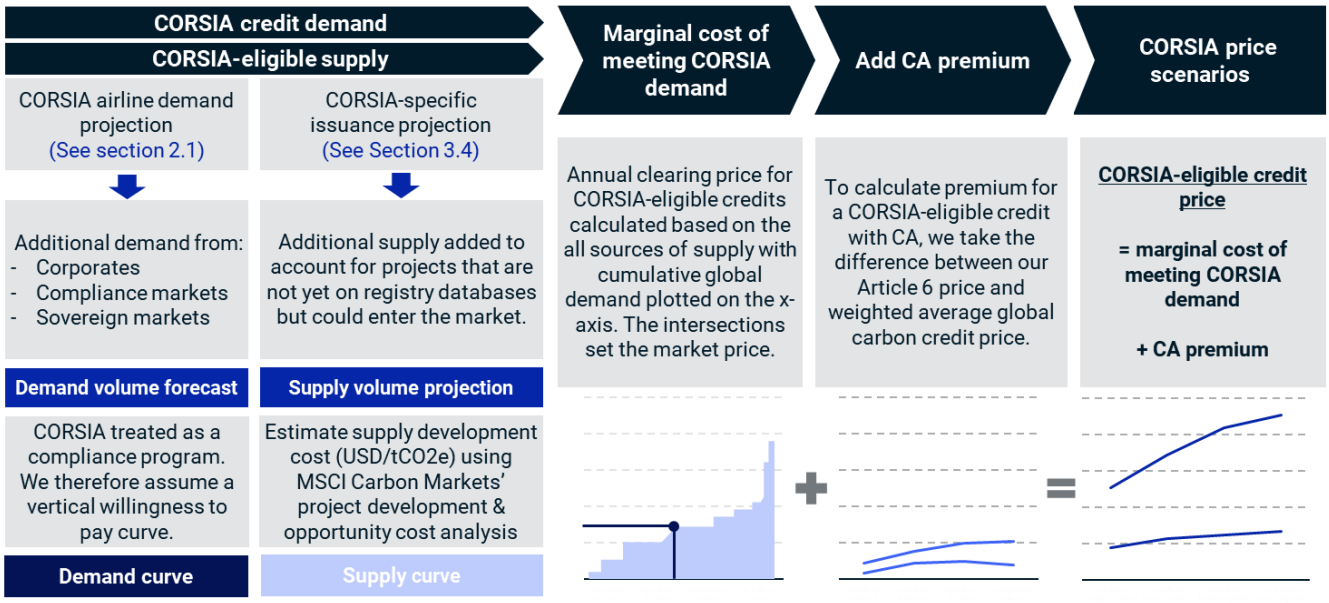
The methodology used by MSCI Carbon Markets for price projections under CORSIA starts by identifying potential sources of eligible credit demand, namely, from international aviation. CORSIA-eligible credits can also, however, be used by companies other than airlines, so potential demand from other sources is also included. This could come from voluntary corporate activity (for example, by companies that see CORSIA eligibility as a mark of quality) as well as potentially from compliance markets or sovereign governments seeking to use correspondingly adjusted credits (for example, to contribute to their NDC).

On the supply side, our CORSIA-specific issuance projection is combined with our project-development cost models to create a marginal-abatement-cost curve for each issuance scenario. This provides a projected supply volume for different market prices.

The annual clearing price for CORSIA-eligible credits is then calculated based on the aggregation of all sources of supply with cumulative global demand. Two scenarios on the demand side (high and low) and two on the supply side (loose and tight) are modeled.

Finally, a premium for a correspondingly adjusted credit is applied to calculate the final projected price of a CORSIA-eligible credit. The corresponding adjustment premium is based on the difference between the volume-weighted global average prices in the MSCI Carbon Markets carbon credit forecast and Article 6 price forecast.

Exhibit 7: Price-projection methodology for CORSIA-eligible carbon credits



Source: MSCI Carbon Markets, November 2024

4.3 Price scenarios

Cumulative demand for CORSIA-eligible credits is projected to be 600-1,800 MtCO2e up to 2035. The source of demand for these credits is primarily international aviation (up to around 90%) but can also include some demand from sovereigns or corporates for use within a compliance scheme or for a voluntary climate commitment.

Cumulative supply for CORSIA-eligible credits is projected to be 1,000-1,300 MtCO2e up to 2035. Supply of 250-300 Mt could be delivered at a cost of up to USD 50-60/tCO2e by the fourth compliance period (2033 to 2035).

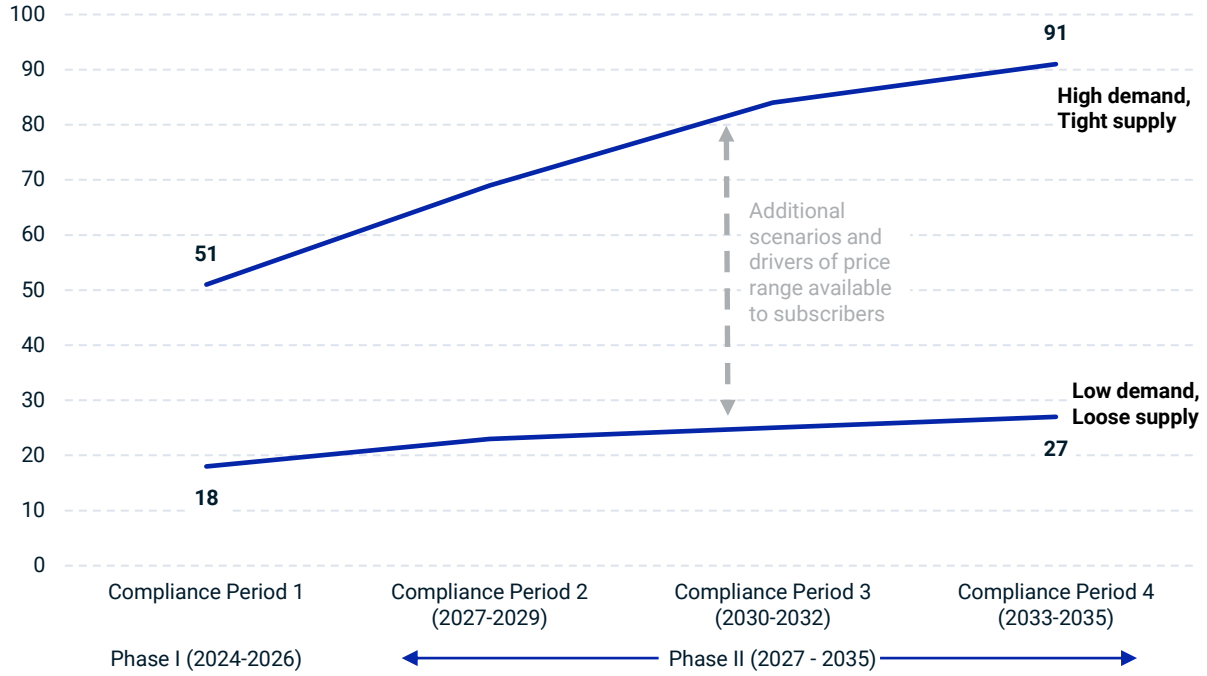
As a result, the overall CORSIA-eligible credit price is projected by MSCI Carbon Markets to range from:

- **USD 18-51/tCO2e in Phase I, and**
- **USD 27-91/tCO2e in compliance period 4 (at 2024 prices)**

These projected price ranges are inclusive of the corresponding-adjustment premium and represent potential demand-supply dynamics for CORSIA-eligible credits over time.

Subsequently, if these demand and price projections are realized, the CORSIA credit market could be worth USD 2-8 billion during Phase I, rising to USD 5-66 billion by the fourth compliance period.

Exhibit 8: Projected CORSIA prices for two of four modeled scenarios: "High demand, tight supply" and "Low demand, loose supply" (USD per tCO2e)



Data as of November 2024. Source: MSCI Carbon Markets

5 How will CORSIA impact airlines?

The costs associated with aviation decarbonization, and specifically CORSIA, will need to be covered by the airlines, either by raising additional revenue to pass all or some of the costs directly to passengers via higher ticket prices or by absorbing all or some of the costs against profits. In this section we provide a case study of the potential impact on the airline industry as a whole before we assess the potential impact on three individual airlines.

5.1 Phase I (2024 to 2026)

Airlines could need to offset between 106 and 137 MtCO2e of emissions using carbon credits during Phase I, which equals 3-4% of global aviation emissions over the period. If our demand and price scenarios are realized, CORSIA could collectively cost airlines USD 1.9-7.0 billion during Phase I.

Based on MSCI modeling, Phase I costs, if fully passed on to passengers, could increase a global average ticket price by up to USD 2 or 1% or, if fully absorbed, could reduce operating profits for the industry as a whole by up to 4%. The potential profit impact for certain individual airlines, however, may be more material depending on their route scheduling and operating practices.

5.2 Phase II (2027 to 2035)

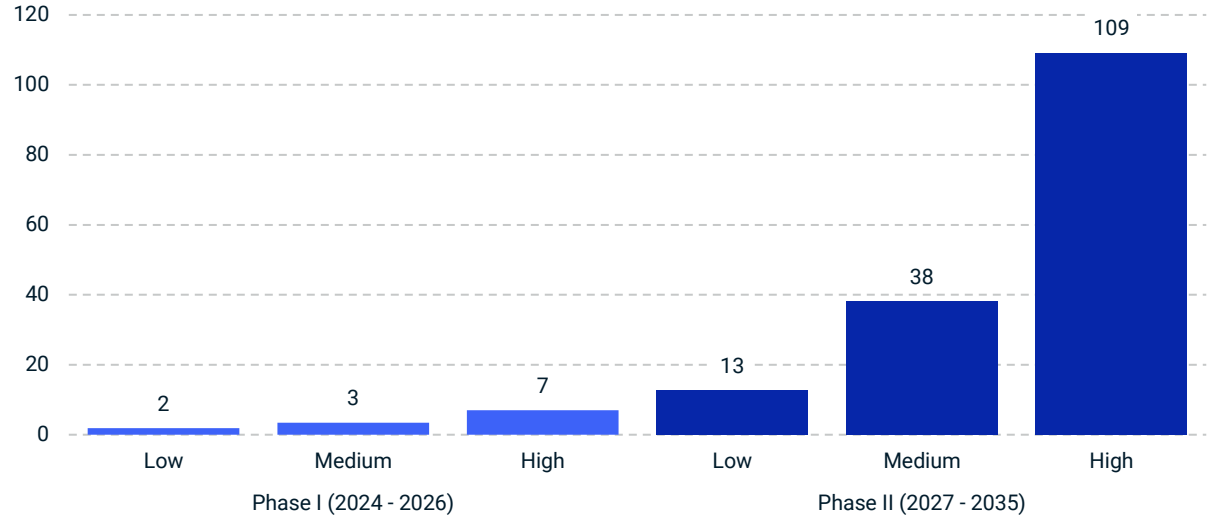
During Phase II, airlines could be required to offset an additional 502-1,300 MtCO2e. This would take cumulative offsetting requirements to 607-1,436 MtCO2e for the duration of CORSIA, which is currently planned to end in 2035.

Phase II could cost USD 13-109 billion. These costs would represent up to an additional cost of USD 2 on the average price of a ticket in compliance period 2, rising to USD 5 on average by compliance period 4.[9] Taking both phases together, CORSIA could cost airlines somewhere in the range of USD 15-116 billion through 2035.

Most of the cost and burden is projected to be carried by the 10 top airlines — accounting for approximately 40% of cumulative CORSIA demand. Offsetting requirements/demand is heavily skewed toward airlines in developed markets. Looking ahead to 2035, European airlines are estimated to account for 25-32% of cumulative demand and spend, although this could change significantly if the EU Commission expands the scope of the EU ETS to include flights arriving or departing within the EU (and thereby excluding such flights from CORSIA).

The next two largest regions are the Middle East and APAC, each accounting for approximately 20% of cumulative demand and spend, partly reflecting the longer average flight distance and, hence, larger emissions in these regions. North America is a large aviation market, but most flight emissions come from domestic aviation, which is outside the scope of CORSIA.

Exhibit 9: Projected CORSIA spend for airlines during Phases I and II (USD billion)



Data as of November 2024. Source: MSCI Carbon Markets

5.3 Financial impact of CORSIA Phase I

The International Air Transport Association (IATA) forecasts industry expenses to be USD 936 billion in 2024 and, assuming no change during Phase I, they would total just over USD 2.8 trillion.[8] If so, CORSIA may increase airline operating costs by 0.1-0.25% during this period.

IATA forecasts that revenues will be USD 996 billion in 2024.[8] Assuming no growth in annual revenues during the rest of Phase I, airlines would need to raise revenues just 0.2% to cover the projected cost of procuring credits for CORSIA.

Airlines could choose to pass CORSIA-related costs entirely to passengers, which could result in passengers paying an additional USD 0.3-2.0 per ticket, raising the global average ticket price by up to 1%.[9] This estimate does not include cargo or freight, which would likely share some of the cost burden. The actual impact on individual passengers could therefore potentially be smaller.

Alternatively, airlines could absorb the entire additional cost into operating profits. IATA forecasts industry operating profit to be USD 60 billion in 2024. If we assume this does not change through Phase I, the total projected cost of procuring credits for CORSIA could reduce this forecast by 1-4%.

In practice, airlines will likely apply a mix of these two extremes. Taken together, the estimated impact of both options when using MSCI price scenarios could be considered low enough for the CORSIA scheme to remain politically palatable, thereby avoiding country withdrawals or nonenforcement.

[8] "Global Outlook for Air Transport: Deep Change," IATA, June 2024.

[9] Based on IATA forecast passenger numbers of 4.9 billion for 2024. This results in average revenue per passenger of USD 199, assuming no growth in passenger numbers in the remaining years of Phase I. For Phase II we assume passenger numbers grow with a CAGR of 3.8% to 2035. Total global aviation capacity (international and domestic), when measured by available seat kilometers, is split approximately 60/40. However, due to the increased distance of international flights, it is assumed only 50% of the forecast passenger numbers over that period are international passengers. Cost of CORSIA only applied to passengers traveling internationally. This represents a global average across all passengers. Actual cost per ticket would depend on the airline route operated and passenger class of travel.

Businesses and investors in the aviation sector should note, however, that the impact at an individual-airline level might be more material. Several airlines, including Germany's Lufthansa and the U.K.'s Virgin Atlantic, have already started to introduce environmental surcharges to cover the cost of aviation decarbonization, including the cost of complying with CORSIA.

5.4 A closer look at three airlines

Subscribers to MSCI Carbon Markets can review the projected individual cost scenarios of complying with CORSIA for over 400 airlines. The potential impact on each airline differs depending on its operating model and country-by-country flight paths. Below, we highlight the potential impact CORSIA could have on three different airlines: the European low-cost carrier, EasyJet; the North American full-service carrier, Air Canada; and the Middle Eastern full-service carrier, Emirates.

EasyJet. EasyJet plc is notable for being one of the largest budget carriers in Europe, having flown over 82 million passengers in 2023.10 It is made up of three constituent airlines, EasyJet, EasyJet Europe and EasyJet Switzerland. The analysis presented here includes all three entities.

The group operates domestic and international scheduled services on over 1,000 routes across more than 35 countries. It predominantly operates short-haul city and leisure routes across Europe and North Africa. It has a fleet of over 350 Airbus A320 family aircraft with an average age of 9.9 years, lower than the industry average of 14.6 years, and is in the middle of a fleet-renewal cycle to replace their older aircraft with the A320 NEO family.[10, 11, 12] Currently 25% of its fleet is made up of these NEO aircraft, which are approximately 15% more fuel efficient than its previous generation of aircraft.[12] Its aircraft are configured in dense, all-economy seating layouts allowing the airline to have lower than average emissions per revenue passenger kilometer (RPK).

As most of EasyJet's flying occurs in Europe, much of it is under the scope of the EU ETS, limiting its exposure to CORSIA. As a result, EasyJet's Scope 1 emissions in 2022 were approximately 7.5 MtCO2e with 60% eligible under Phase I and 35% eligible under the EU ETS.[13, 14] Most of its CORSIA-eligible emissions arise from routes departing from, or arriving in, the U.K.

Air Canada. Air Canada is the Canadian flag-carrier and largest airline based in that country and operates as a full-service airline. It has a low-cost subsidiary called Air Canada Rouge which focuses on leisure routes, which we include in the analysis for this airline.

Air Canada has a substantial network of routes within Canada, so is out of scope of CORSIA, although it also operates short- and mid-haul routes across North America and long-haul international routes, with major markets being Europe and the Far East.

The airline operates a fleet of over 240 aircraft with an average age of 12.8 years.[15] It has already undergone a substantial fleet renewal, adding many next-generation aircraft, such as Boeing 787s and 737 MAXs and Airbus A220s, which now make up 46% of its current fleet.[15] Based on reported

[10] EasyJet Annual Report, 2023.

[11] "Slow aircraft deliveries delay renewal benefits to airlines," IATA, May 10, 2024.

[12] "EasyJet Group Fleet," Airfleets aviation, accessed Nov. 15, 2024.

[13] "CORSIA Central Registry," ICAO, December 2023.

[14] "Publication of 2022 emissions data from aviation," European Commission, March 2024.

[15] Air Canada Annual Report, 2023.

2022 emissions numbers, approximately 65% are eligible under Phase I, mainly arising from routes to the U.S. and Europe.

Emirates. Emirates, headquartered in Dubai, has grown to be one of the largest airlines in the world owing to a geographical location that allows it to connect passengers traveling between Europe and Asia.

The airline is notable for configuring its fleet of aircraft in premium-class-heavy layouts with an emphasis on first and business-class travel. This strategy, in turn, increases its emissions per RPK compared to many other airlines.

Its fleet of over 250 aircraft has an average age of 10.1 years and is composed entirely of Boeing 777 and Airbus A380 aircraft, two previous-generation long-haul aircraft.[16] The airline is the largest operator of the Airbus A380, known for its popularity among passengers for comfort, but having poor efficiency due to its four-engine configuration. Currently none of the Emirates fleet is next-generation aircraft, meaning the airline has a lot of potential to reduce emissions as it upgrades its fleet. Emirates has ordered over 200 Boeing 777X next-generation aircraft to replace its older fleet, but due to Boeing's production and certification issues, this transition has been delayed. The carrier has recently switched some orders to the already in-service Boeing 787 and Airbus A350. It expects these to enter the airline's fleet in 2025.

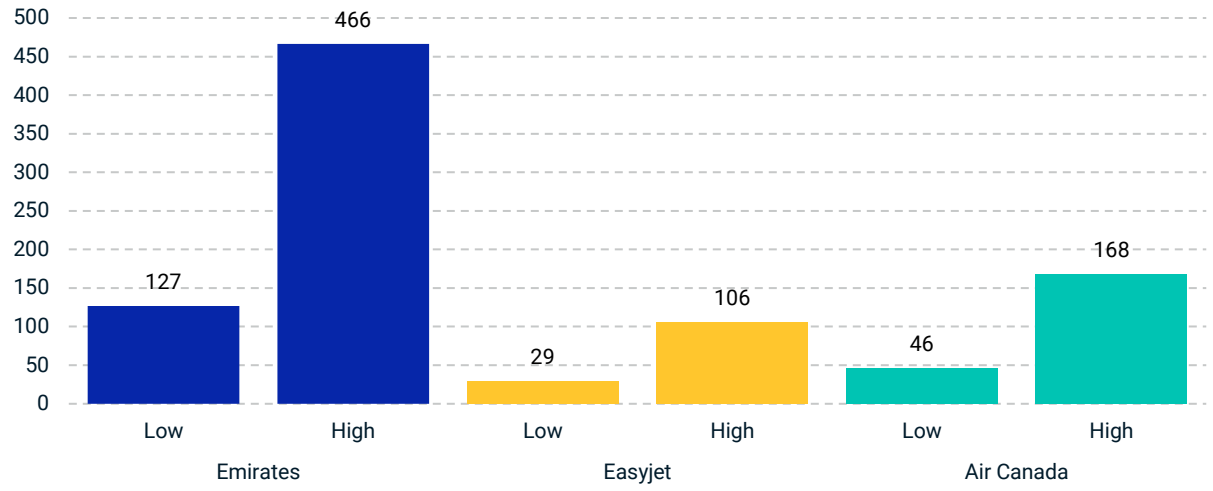
Emirates operates very few short-haul flights and does not have any domestic routes. This means more of the airline's emissions are eligible under CORSIA, increasing its exposure to the scheme relative to EasyJet and Air Canada. Based on 2022 data, 17 Mt out of the 27 Mt (approximately 63%) of its Scope 1 emissions will be CORSIA-eligible during Phase I. That proportion is likely to increase significantly in Phase II, however, as India and China participate.

1. Offsetting requirements and projected spend in Phase I

The MSCI Carbon Markets CORSIA model projects that EasyJet could have an offsetting requirement of 1.6-2.1 MtCO2e during Phase I. Applying our CORSIA price scenarios, this estimate could amount to a total spend of USD 29-106 million during the three-year period.

[16] Emirates Annual Report, 2024.

Exhibit 10: Projected Phase I spend by airline for low and high scenarios (USD millions)



Data as of November 2024. Source: MSCI Carbon Markets

Air Canada has a projected offsetting requirement of 2.5-3.3 MtCO2e, which could amount to a spend of USD 46-168 million over the course of Phase I. Emirates is the largest of the three airlines in terms of its projected offsetting requirement, with a projected Phase I demand of 7.0-9.1 MtCO2e, suggesting a cost of USD 127-466 million. For each of these airlines, our projections amount to offsetting 7-11% of their emissions over the next three years.

2. Financial impact of CORSIA Phase I

As outlined earlier, airlines can either pass any CORSIA-related costs to their passengers or absorb such costs into their operating profits. On a per-passenger basis, the potential costs we have described would be an additional cost per ticket of:

- 12 to 42 cents at EasyJet, on an average ticket price of USD 116;
- 34 to 125 cents at Air Canada, on an average ticket of USD 351; and
- 80 to 300 cents at Emirates, on an average ticket of USD 624.[17]

These estimates assume the entire cost is covered by passengers. In practice, airlines carrying freight either in dedicated aircraft or in the belly of passenger aircraft could also absorb some of the additional cost.

Our projections represent an increase in passenger ticket prices of 0.1-0.5% for Phase I across these airlines, well below the 11% average premium that passengers were willing to pay to offset carbon emissions, according to a recent survey.[18]

[17] Average revenue per passenger is used as a proxy for average ticket price. Some revenue is earned from non-passenger or cargo operations which are not accounted for in these figures. It is assumed all the cost is passed onto passengers and not spread to cargo operations and thus this represents the maximum likely increase. This also only includes the cost of procuring CORSIA credits and not of the administration of the scheme or monitoring, reporting and verification responsibilities.

[18] "2024 Passenger IT Insights," SITA, 2024.

Indeed, this level of expenditure may be small enough that airlines could offset the increased compliance costs through cost savings elsewhere, which would need to be the equivalent of just 0.1-0.5% of operational costs.

If these options are not possible, airlines' profit margins would then need to absorb the costs. If all the related costs were absorbed by each airline's operating profit, we could expect it to decrease by:

- EasyJet — between 1.6% and 5.7%
- Air Canada — between 0.9% and 3.4%
- Emirates — between 0.8% and 2.9%

Airlines with a larger operating profit margin may be able to absorb the costs more easily; this is the case for Emirates, which has the lowest modeled impact of the three airlines and the highest margin at 17%. EasyJet has the largest modeled impact on its operating profit, nearly double that of Emirates, due to its much smaller margin of 6%.

6 Conclusion

Airlines could have to offset 106-137 MtCO2e during Phase I (2024 to 2026) of CORSIA, with an additional offsetting requirement of 502-1,299 MtCO2e during Phase II (2027 to 2035).

Airlines have reportedly engaged well with CORSIA on the monitoring, reporting and verification of emissions. MSCI Carbon Markets data shows, however, that just 61 airlines have retired any credits to date, well shy of the over 400 airlines that would be required to do so under CORSIA. The retirement deadline of January 2028 for Phase I may seem far off, but many airlines could start considering soon their procurement strategies for credits to avoid a potential crunch around that date.

While the recent approval of four major registries helps to unlock substantially more supply, the lack of available supply of carbon credits remains a concern. The main constraint is now the availability of LoAs to enable these credits to be correspondingly adjusted as required by CORSIA. Very few governments have all the necessary legal framework and infrastructure in place to do so.

Based on MSCI Carbon Markets' modeling, CORSIA credits could command prices in the USD 18-51 range per tCO2e during Phase I and USD 27-91 per tCO2e during the latter stages of Phase II (2033 to 2035).

Based on these projected price scenarios, CORSIA may increase airline operating costs by 0.1-0.25% during Phase I. If fully passed on to passengers, this could increase the global average ticket price by up to 1% (or USD 2 per ticket) or, if fully absorbed, could reduce airline industry operating profit by up to 4%. The uncertainties are higher for Phase II, but the financial impact could be larger representing costs of up to USD 5 per ticket.

In summary, airlines face a challenging transition to reduce and mitigate their emissions. Carbon credits and CORSIA can play an important role in supporting airlines in mitigating their climate impact, while more-efficient technologies, operational practices and fuels are further developed. MSCI Carbon Markets' modeling suggests that the costs of complying with CORSIA, while unlikely to be overwhelming, could be material for airlines and their investors and, hence, are likely to come under increasing focus in the years ahead.

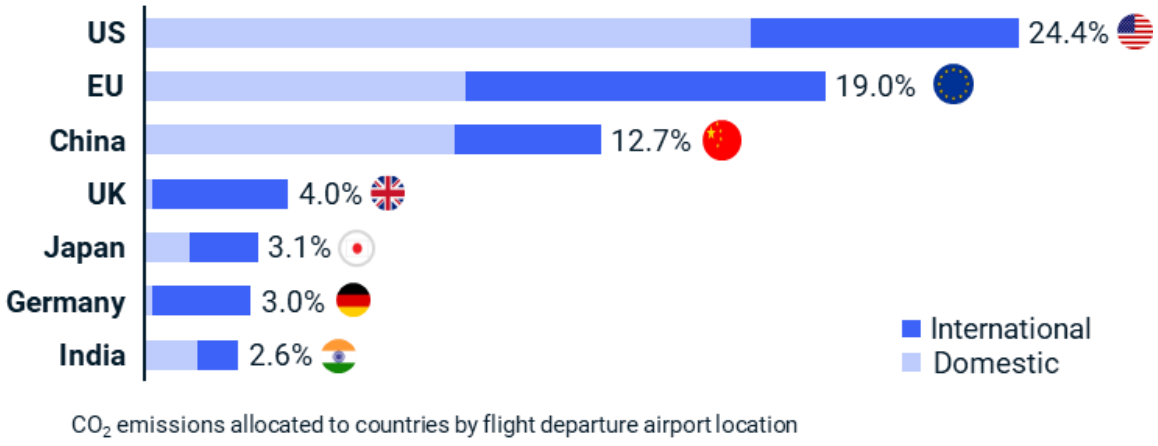
Appendix: CORSIA explained

Aviation and global CO2 emissions

Aviation is an important contributor to economic activity and to employment, supporting an estimated 88 million jobs worldwide in 2019.[19] It is, however, also an important contributor to global emissions, contributing just over 1 GtCO2, or 3%, of global energy-related emissions in 2019.[20] Around 61% of these emissions were from international air transport and 39% from domestic flights.

Around 24% of global commercial-aviation emissions came from domestic and international flights leaving U.S. airports, with 19% from the equivalent in the EU, 13% from those taking off from airports in China, 4% from U.K. airport departures and around 3% each from those originating in Japan, Germany and India.

Exhibit A1: CO2 emissions from commercial aviation by countries/regions in 2018



Source: The International Council on Clean Transportation, 2018

Although planes have become steadily more efficient over time, with emissions per passenger kilometer having fallen by more than 80% in the last 50 years, overall emissions have continued to rise.[21] In the absence of additional measures to reduce aviation's carbon footprint, emissions from the sector are generally expected to continue growing by 3-4% per year.[22]

[19] "Aviation Benefits Beyond Borders," Air Transport Action Group, September 2020.

[20] "CO2 emissions in aviation in the Net Zero Scenario, 2000-2030," IEA, July 2023.

[21] D.S. Lee, D.W. Fahey, A. Skowron, et al., "The contribution of global aviation to anthropogenic climate forcing for 2000 to 2018," *Atmospheric Environment* 244, January 2021.

[22] "Aircraft Engine Emissions," ICAO, 2022.

Levers airlines can use to decarbonize

An overwhelming majority of airline emissions are the direct emissions from aircraft. Reducing these emissions, which encompass both passenger and cargo flights, is the industry's real challenge. There are essentially four ways of doing this:

- **Aircraft technology improvements.** Upgrading existing planes or switching from old aircraft to newer models can lead to major improvements in fuel efficiency, approximately 15% between generations.[23] Next-generation jet engines contribute most of this benefit. New models may also be able to offer improved aerodynamics, be made of lighter materials and even make use of disruptive electric or hydrogen-propulsion technologies. ICAO estimates that this category of emissions-reduction effort could do 21% of the work in eliminating aviation emissions by 2050 (see Exhibit A2).

- **Operations and infrastructure.** This category includes improving traffic flow in the air, reducing landing delays and holding patterns, route optimization and airport-layout optimization to cut the length of taxiing and distance to aircraft gates. ICAO estimates that this category of emissions-reduction effort could make a 4-11% contribution to cutting aviation emissions to net-zero by 2050.

- **The use of SAFs.** This encompasses renewable jet fuel, such as biofuels made from crops or nonfood plants, fuels made from green and municipal waste, and fuels manufactured synthetically via a process that captures carbon directly from the air. IATA states that "Nine biofuel production pathways are certified to produce SAF, which perform at operationally equivalent levels to Jet A1 fuel."[24]

  ICAO estimates that the use of SAFs could be the predominant approach for cutting aviation emissions, making up to a 55% contribution to achieving net-zero emissions by 2050 in its most ambitious scenario.[25] Major challenges remain, however, including ensuring an adequate supply of suitable feedstocks, reducing costs in the manufacturing of SAFs and providing the infrastructure to enable it to be transported to airports around the world.

- **Market-based measures.** These include government levies on the use of non-SAFs, the inclusion of aviation in ETS and airlines offsetting their emissions via the purchase of carbon credits. Market-based options could, in theory, achieve lower emissions with greater cost efficiency and more flexibility than the other three approaches, but might potentially bring extra complexity to the aviation sector. ICAO estimates that market-based measures could do 13% of the job of cutting aviation emissions to net-zero by 2050.

[23] "Fuel Efficiency Comparison Between Old Generation and New Generation Aircraft," Cirium, Aug. 23, 2023.

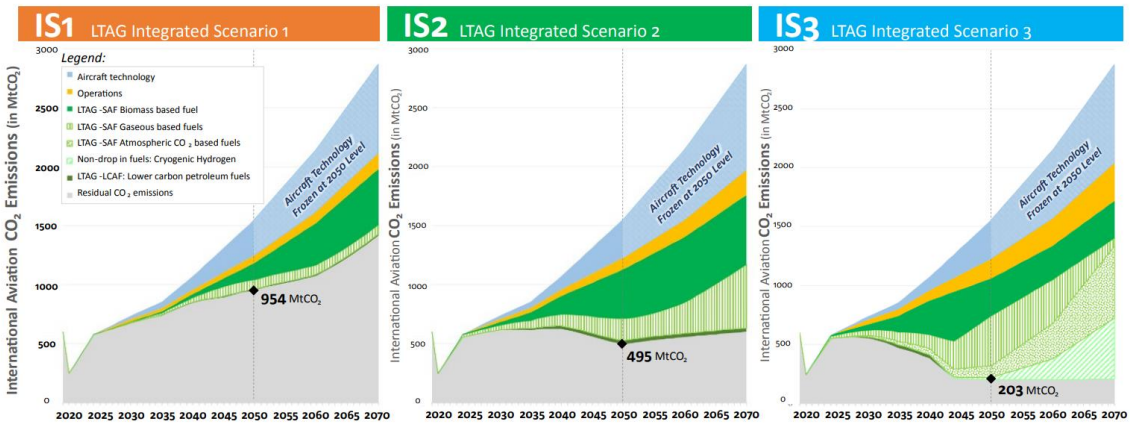
[24] "Net zero 2050: sustainable aviation fuels," IATA, May 2024.

[25] "Long term global aspirational goal (LTAG) for international aviation," ICAO, March 2022.

Although the four approaches outlined are theoretically available, they cannot necessarily be implemented quickly. For instance, uptake of SAFs has been low to date (just 0.2% of all aviation fuel[24]) despite being available for over a decade. Technology solutions both short- and long-term seem to be facing their own issues. In the short term, Boeing's woes with producing and certifying aircraft are forcing airlines to operate older-generation planes for longer. In the long term, electric propulsion is unlikely to contribute much to decarbonizing aviation, and Airbus is almost the only aircraft manufacturer working on hydrogen, which is unlikely to become an option until the late 2030s at best. Both these technologies are also likely to be unsuitable for long-haul flying.

No "silver bullet" exists for decarbonizing aviation, so progress will be sporadic and market-based measures are likely to be essential if the trajectory toward net-zero is to be credible over the decades ahead.

Exhibit A2: ICAO's long-term aspiration goal (LTAG) scenarios



Metrics	IS1	IS2	IS3
CO_2 Emissions in 2050 after Reductions	**≈950 $MtCO_2$** in 2050 *(**160%** of 2019 CO_2 emissions)*	**≈500 $MtCO_2$** in 2050 *(**80%** of 2019 CO_2 emissions)*	**≈200 $MtCO_2$** in 2050 *(**35%** of 2019 CO_2 emissions)*
Reduction in 2050 from the Baseline	**39% total** through: Technologies - 20%, Operations - 4%, Fuels - 15%	**68% total** through: Technologies - 21%, Operations - 6%, Fuels - 41%)	**87% total** through: Technologies - 21%, Operations - 11%, Fuels - 55%
Cumulative residual Emissions from 2020 to 2070	23 $GtCO_2$ (2020 to 2050) 23 $GtCO_2$ (2051 to 2070)	17 $GtCO_2$ (2020 to 2050) 11 $GtCO_2$ (2051 to 2070)	12 $GtCO_2$ (2020 to 2050) 4 $GtCO_2$ (2051 to 2070)

Source: ICAO, March 2022

The Paris Agreement

The Paris Agreement of December 2015 is a legally binding international treaty on climate change that was adopted by 196 countries at the UN Climate Change Conference, COP21, in Paris. It aims to hold "the increase in the global average temperature to well below 2 degrees Celsius above pre-industrial levels" and pursue efforts to "limit the increase to 1.5 degrees."

The Agreement works on a five-year cycle of increasingly ambitious climate action by countries. They must submit their climate action plans, known as NDCs, each cycle. Each successive NDC is meant to reflect a higher level of ambition than the one before.

Emissions reductions/removals can be traded by states and/or nonstates under Article 6 of the Paris Agreement. State-to-state trades will require a corresponding adjustment to be made to NDCs to prevent any double counting of emissions reductions/removals.

Domestic aviation emissions are within the scope of the Paris Agreement and should be incorporated into countries' NDCs. However, emissions from international travel (aviation and maritime) fall outside the scope of the Agreement. They are therefore reported and addressed separately by ICAO and the International Maritime Organization.

The advent of CORSIA

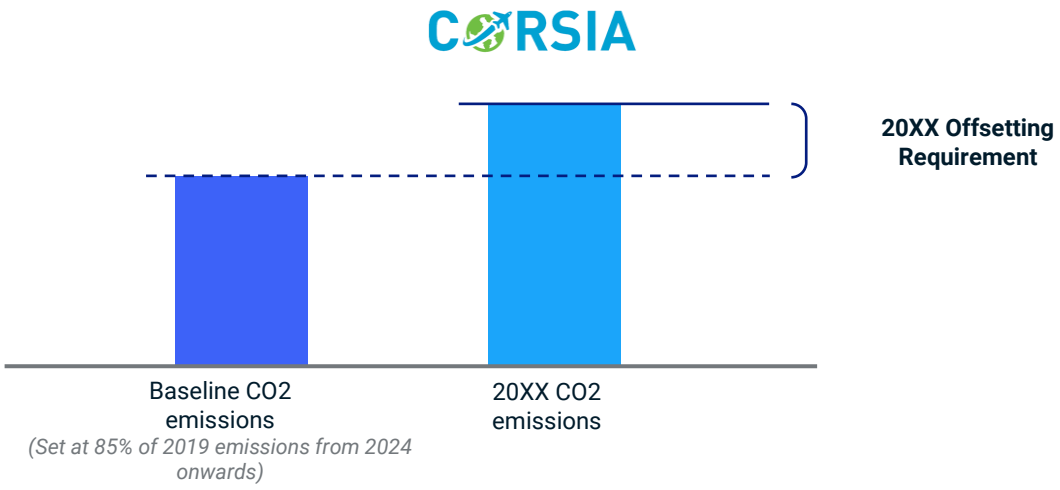
In 2016, in response to the Paris Agreement and to supplement its goals, ICAO launched CORSIA. Its job was to address emissions from international air transport, because they are not covered by the Paris Agreement, and to act as a stop-gap measure giving time for the other levers of decarbonization to become viable and established in the industry.

The aim of CORSIA is to offset, via carbon credits, any growth in international aviation emissions above their baseline level. At the time CORSIA launched, the goal was set at the average of 2019 emissions, but from 2024, it will be 85% of 2019 emissions.

To achieve this aim, while being compatible with NDCs and to avoid double -counting, carbon credits used within CORSIA from Phase I onwards (2024) will need to apply a corresponding adjustment and be authorized under Article 6.

The basic concept behind the scheme is that airlines that are able to stabilize and/or reduce their emissions, such as via the use of sustainable aviation fuels, will reduce their obligation to purchase credits under CORSIA. However, those airlines that rapidly increase their emissions will face a cost of an increasing carbon credit obligation.

Exhibit A3: Airlines required to offset their emissions above a baseline level



Source: MSCI Carbon Markets, adapted from the ICAO's FAQs on CORSIA

Governance and implementation

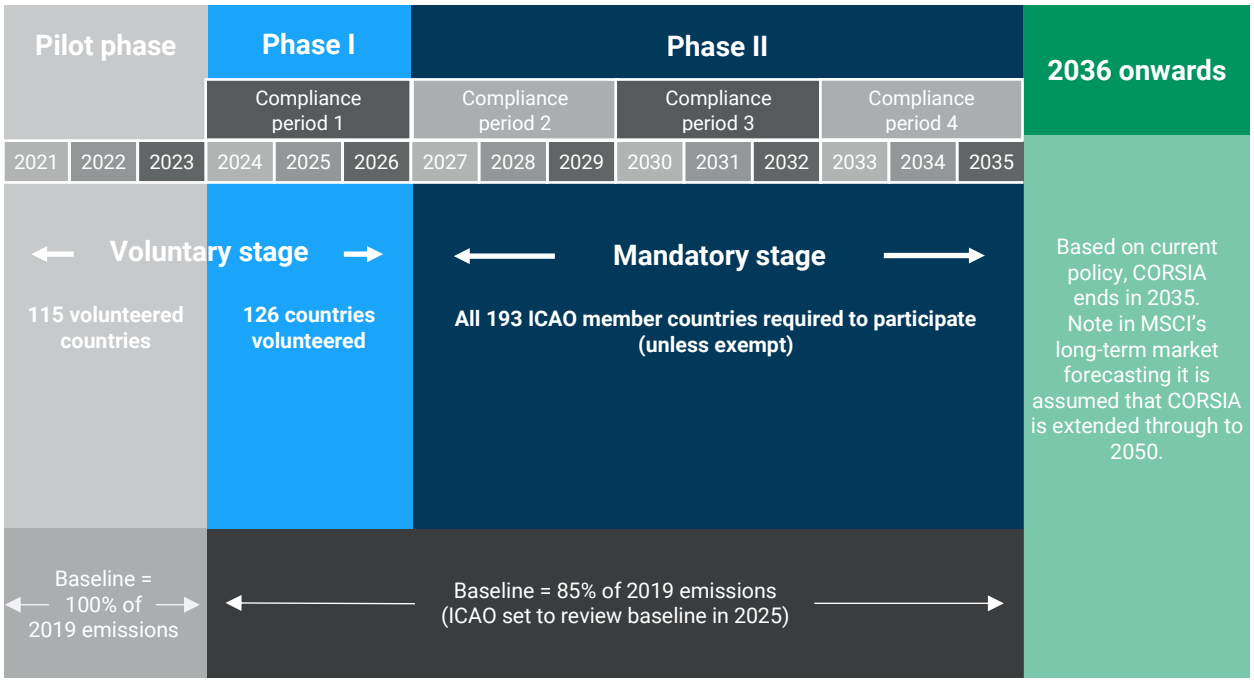
At the request of the 39th ICAO Assembly in 2016, the organization's council asked the Committee on Aviation Environmental Protection to develop standards, recommended practices and guidance to implement CORSIA. The ICAO Council is responsible for administering CORSIA at the international policy level. National governments, however, are responsible for implementing CORSIA regulation and ensuring compliance from carriers registered in their jurisdictions.

CORSIA is being run in a series of phases, with a review conducted every three years to assess its implementation and impact on international aviation. The idea behind this phased implementation is to allow ICAO to decide if any adjustment is needed to improve effectiveness.

CORSIA's implementation includes a now-completed pilot phase (2021 to 2023), followed by a voluntary Phase I (2024 to 2026) and a mandatory Phase II (2027 to 2035). Phase I has 126 countries participating and 193 countries will be required to participate when the scheme becomes mandatory.[26]

The baseline for Phases I and II has been set at 85% of 2019 emissions. Within each phase, reporting and offsetting will work on three-year compliance cycles.

Exhibit A4: Breakdown of CORSIA phases



Source: MSCI Carbon Markets, adapted from ATAG's CORSIA explained

[26] A small number of countries are exempt, for example, those categorized as the least-developed countries, small-island developing states and landlocked developing states.

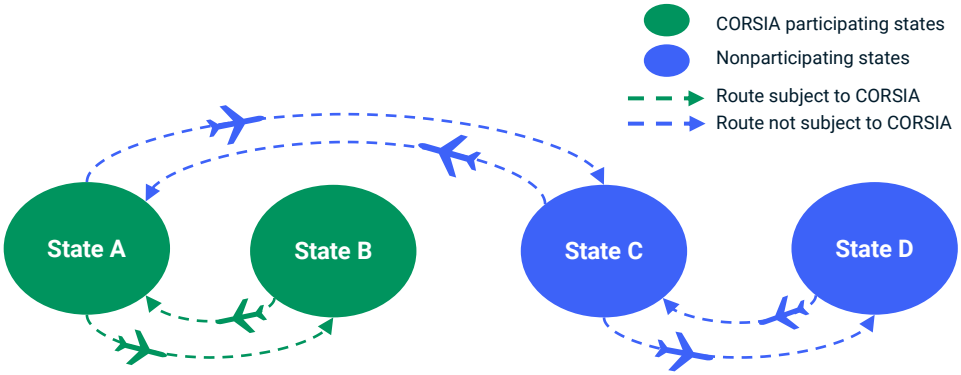
Participation by countries and airlines

Major countries' participation is critical for effective implementation of CORSIA. The scheme adopts a route-based approach, focusing on individual flight routes rather than the country of an airline's headquarters. If both the departure and arrival countries participate in CORSIA, any airline operating a flight between those countries will be subject to CORSIA offsetting requirements, even if it is headquartered in a third country that is not participating in CORSIA (see Exhibit A5).

Flights that start and end in an EU state are covered by the EU ETS and are therefore excluded from CORSIA. The EU has said, in future, it may also consider incorporating flights that fly between an EU and non-EU state into the EU ETS, in which case those flights could also be excluded from CORSIA.

Of the top 36 countries for international air traffic in 2018, 30 are already participating in CORSIA.[27] Together, these nations account for 71% of international aviation traffic. The six countries that do not yet participate in CORSIA are China, India, Russia, Brazil, Vietnam and Ethiopia. These countries account for 19% of global aviation traffic, and all are required to participate in Phase II.

Exhibit A5: Airlines subject to CORSIA offsetting requirements



Source: MSCI Carbon Markets, adapted from ICAO's FAQs on CORSIA

Collection, clarification and verification of emissions

The calculation, collection and verification of emissions are implemented through CORSIA's monitoring, reporting and verification system. An airline monitors its actual use of fuel to calculate its CO2 emissions and report third-party-verified annual emissions data and canceled credits to its government. The government authority is then responsible for reporting the aggregate data to ICAO through CORSIA's central registry system.

The CORSIA CO2 Estimation and Reporting Tool (CERT) is a simplified method designed by ICAO to estimate CO2 emissions. The tool is available free of charge on the ICAO CORSIA webpage. All airlines can use the CERT for a preliminary CO2 assessment.

[27] "International Revenue Tonne Kilometre (RTK) Rankings 2018," ICAO. RTK data for 2018 will be used for the purposes of determining the participation of countries in Phase II of CORSIA.

An airline with annual emissions from international flights of less than 500 ktCO2 during the period 2019-2020 is eligible to use the CERT to estimate and report its CO2 emissions. Verification of emissions data is still needed when CERT is used.

However, the approximately 150 airlines whose annual emissions from international flights are more than 500 ktCO2 are not eligible to report the CO2 emissions estimated by CERT. Instead, they need to monitor actual fuel use and calculate the CO2 emissions by using fuel conversion factors, for example, 3.16 kg CO2/kg of fuel for the commonly used Jet-A1 fuel.

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