



ICAO

ENVIRONMENT

Council – 223rd Session

Subject No. 50: Questions relating to the environment

Update to Scenario Based Analyses of Potential Impacts of Covid19 on CORSIA (Presentation of Executive Summary)

Presented by CAEP



At its 220th session*, and subsequent 222nd session, the Council...

...requested CAEP to continue to analyse the impact of COVID-19 on CORSIA, drawing upon ICAO's ongoing work to analyse the economic impact of COVID-19 on aviation including the regional breakdown and recovery scenario modelling, and to provide an update for Council's consideration during the 223rd Session, including:

- Question 1** {
- i. quantification of the volume of CO₂ emissions from international aviation that will not have been emitted due to the reduction in aviation activity compared to forecast activity each year until such time as international aviation fuel burn and emissions equals or exceeds 2019 levels; and
 - ii. an analysis of the cost implications of CORSIA offsetting requirements, taking into consideration the current and expected emission unit prices offered by the Emissions Unit Programmes approved for CORSIA by the Council.
- Question 2** {

Status



Addressed

based on interim updated version of Covid19 Scenarios (April 2021)



Addressed

Updated estimates of demand for emissions units (April 2021). Added price and costs through 2026.

* Reference: C-DEC 220/13

Disclaimers (on updated to ICAO/CAEP Covid19 scenarios)

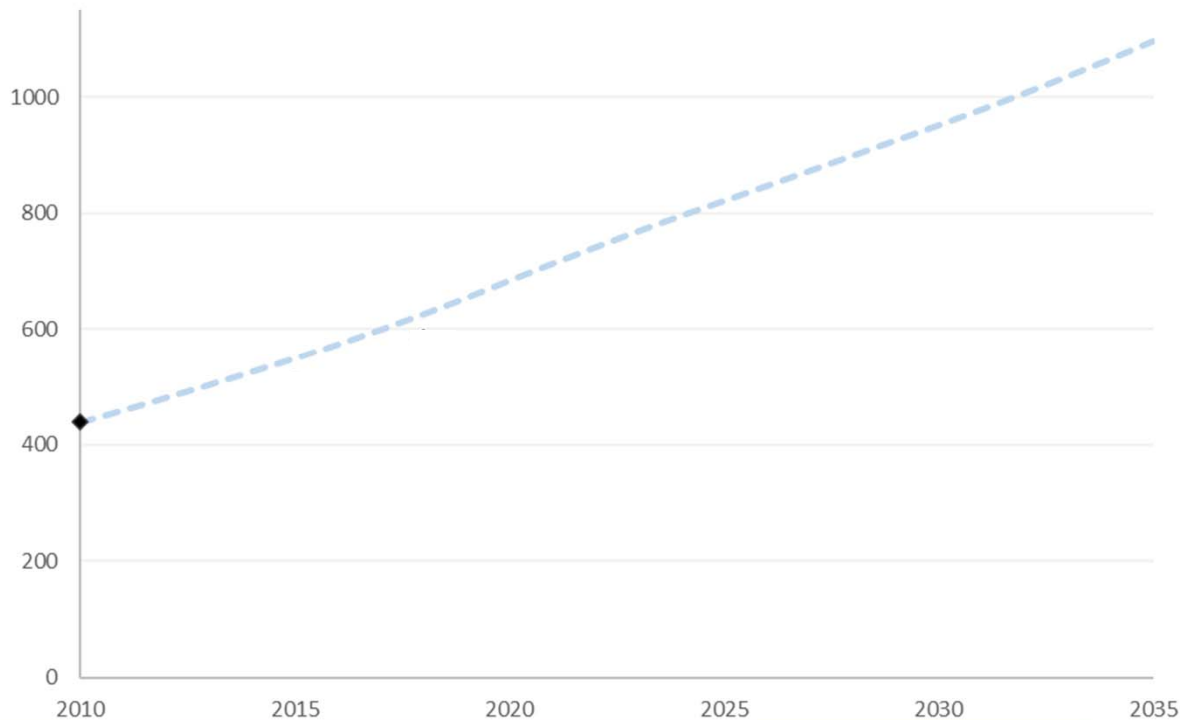
- *The April 2021 version of the Covid19 scenarios for international aviation from 2020-2035 represent a further interim update of the January 2021 version that were used as input to the analyses presented to the 222nd session of the Council.*
- *The updated Covid19 scenarios are preliminary and only for the purpose of updated order magnitude and bounding assessments of the potential impacts of Covid19 on CORSIA.*
- *The updated (April 2021) Covid19 scenarios have been provided pending finalization of the FESG forecasting exercise during 2021. The updated version includes an interim approach for distributing cargo capacity (ATK) across the 40 route groups for international aviation. An update may be provided by CAEP although not expected to change cargo forecast at the aggregate (international aviation) level.*
- *Modeling methodologies used in this version of the analyses allow for the allocation of growth in CO₂ emissions across operators based on geographical location of operations (i.e., across FESG route groups). This results in a broad set of operators (under scope of CORSIA in reference years) with varying growth rates according to the growth of the route groups in which they operate. For other analysis purposes (i.e., assessment of new entrants' baseline) some modelers in CAEP have developed models that simulate the emergence of potential new entrant operators. These models may be used for subsequent analyses of regional breakdown of Covid19 impacts on CORSIA (pending ongoing work in CAEP). Aggregate results (for all international aviation) are not expected to change.*
- *CAEP (WG4) expects to provide another update to the Council 224th session.*





Interim Updated Covid19 Scenarios

CO₂ emissions from international aviation
(in MtCO₂)



Base (CAEP/10 – ref.2010)*

Information available in 2013 (A38 trends) and confirmed in 2016 (A39 trends)

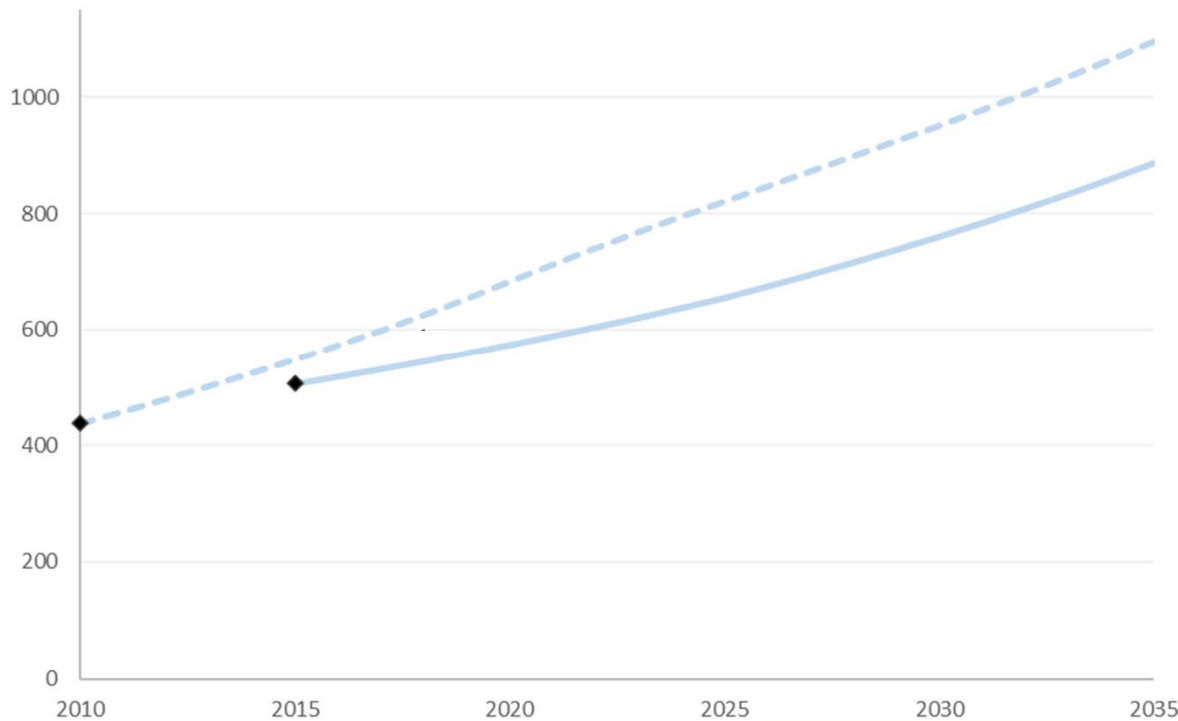
◆ **Actual CO₂ emissions**
(estimations based on actual international aviation activity)

* Central traffic and optimistic aircraft technology improvement scenario



Interim Updated Covid19 Scenarios

CO₂ emissions from international aviation
(in MtCO₂)



Base (CAEP/10 – ref.2010)* } Information available in 2013 (A38 trends) and confirmed in 2016 (A39 trends)

Base (CAEP/11 – ref.2015)* } Information available in 2019 (A40 trends)

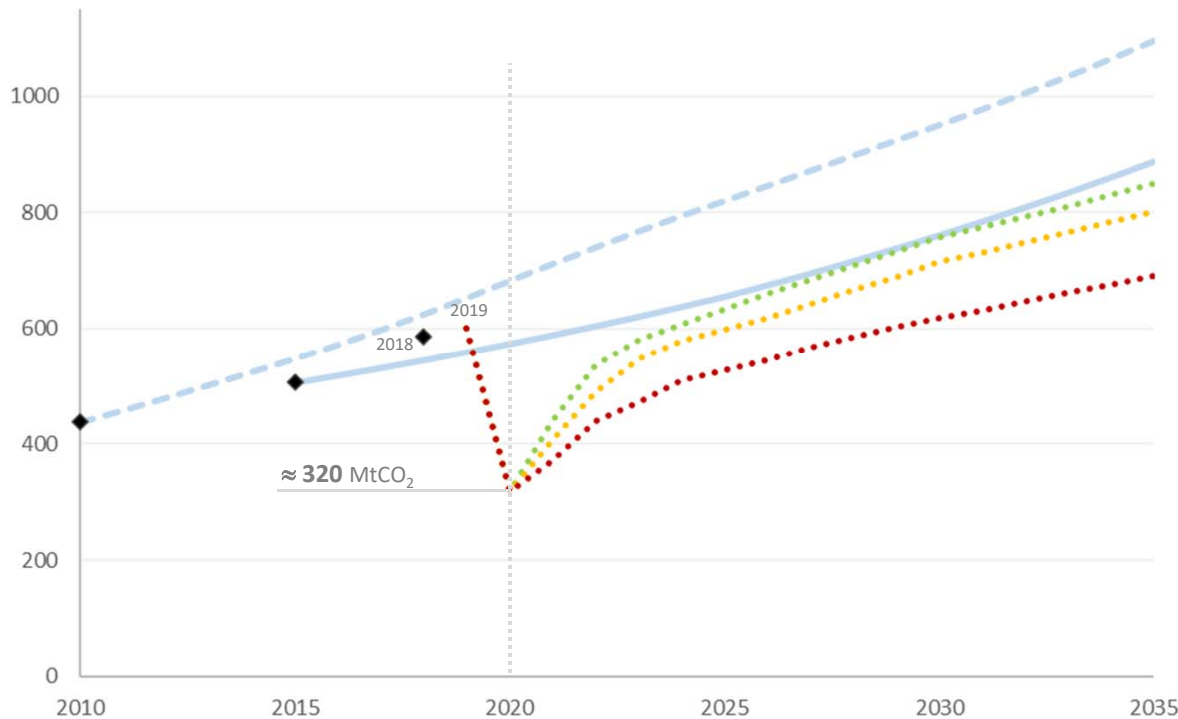
◆ Actual CO₂ emissions
(estimations based on actual international aviation activity)

* Central traffic and optimistic aircraft technology improvement scenario



Interim Updated Covid19 Scenarios

CO₂ emissions from international aviation
(in MtCO₂)



- Base (CAEP/10 – ref.2010)* } Information available in 2013 (A38 trends) and confirmed in 2016 (A39 trends)
- Base (CAEP/11 – ref.2015)* } Information available in 2019 (A40 trends)
- ... High recovery } **January 2021 version** of Covid19 Scenarios
- ... Mid recovery }
- ... Low recovery }

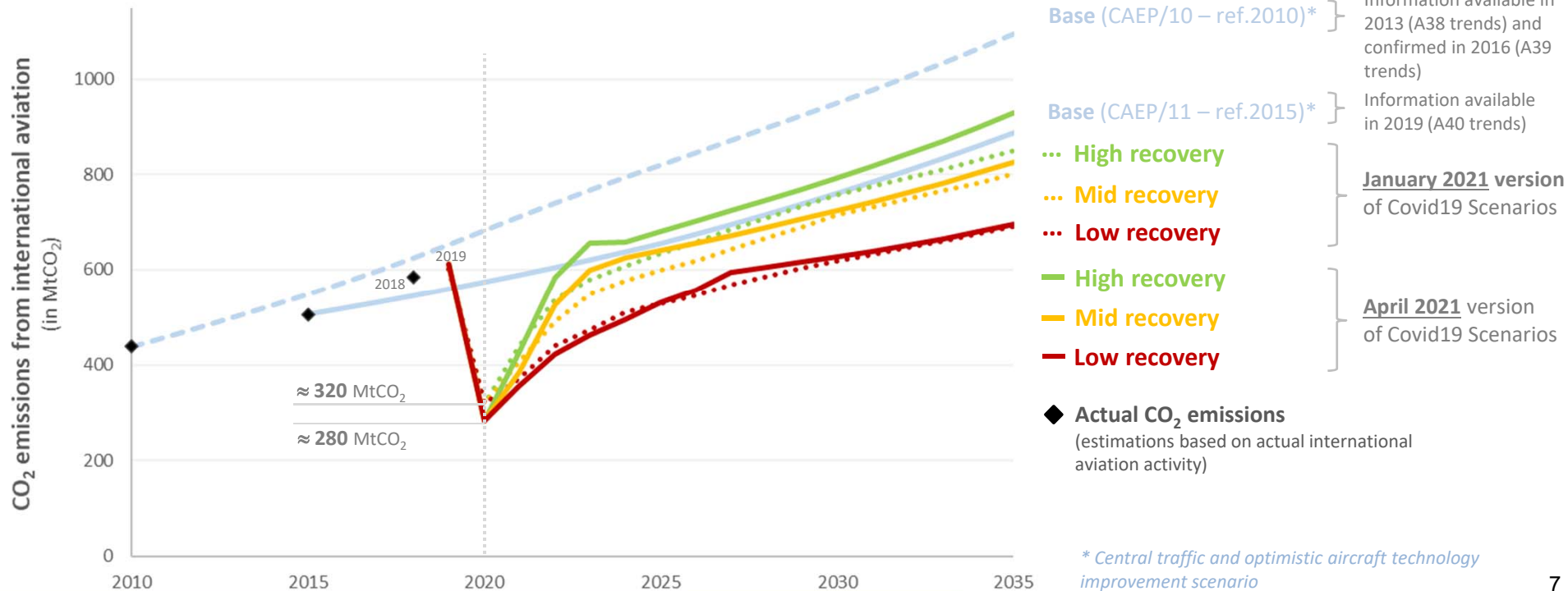
◆ **Actual CO₂ emissions**
(estimations based on actual international aviation activity)

* Central traffic and optimistic aircraft technology improvement scenario



Interim Updated Covid19 Scenarios

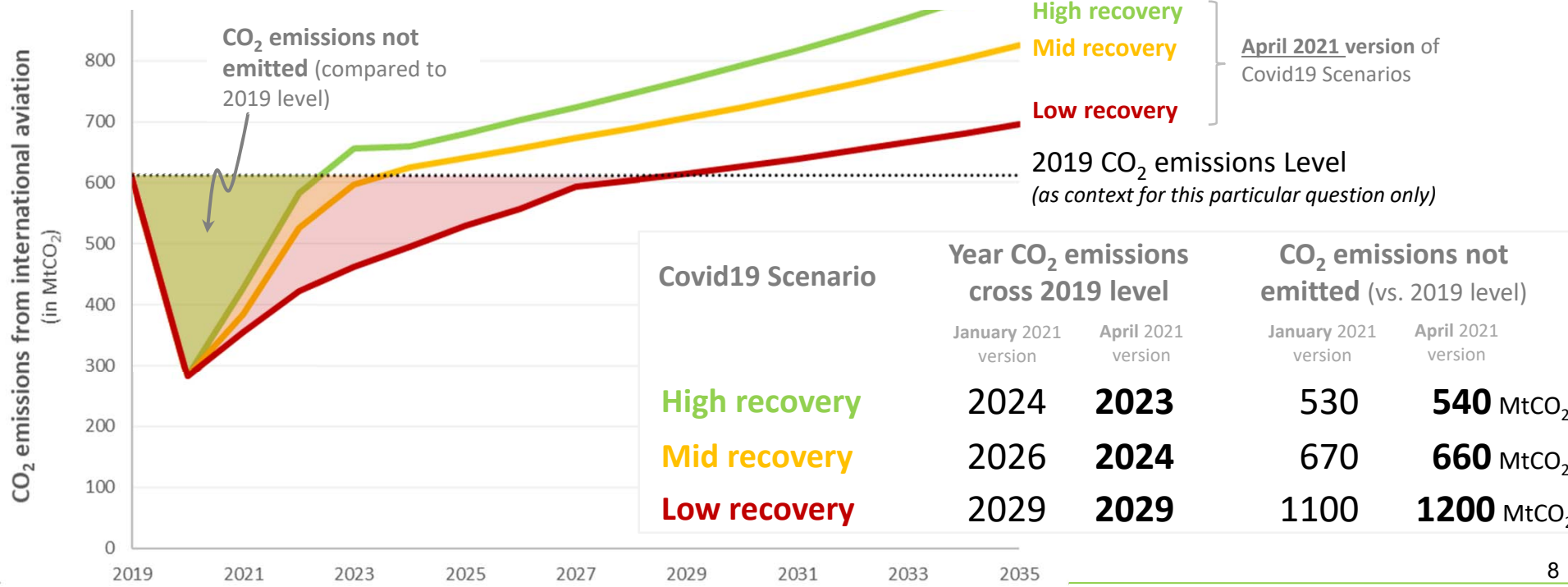
- Based on the interim updated Covid19 scenarios, CO₂ emissions in 2020 are expected to be lower than originally anticipated in January 2021 i.e., drop of approximately 54 % from 2019 to 2020 instead of 47%.
- Recovery is almost identical for Low scenario. Slightly faster recovery for High and Mid scenarios.





CO₂ Emissions Not Emitted Compared to 2019 Level

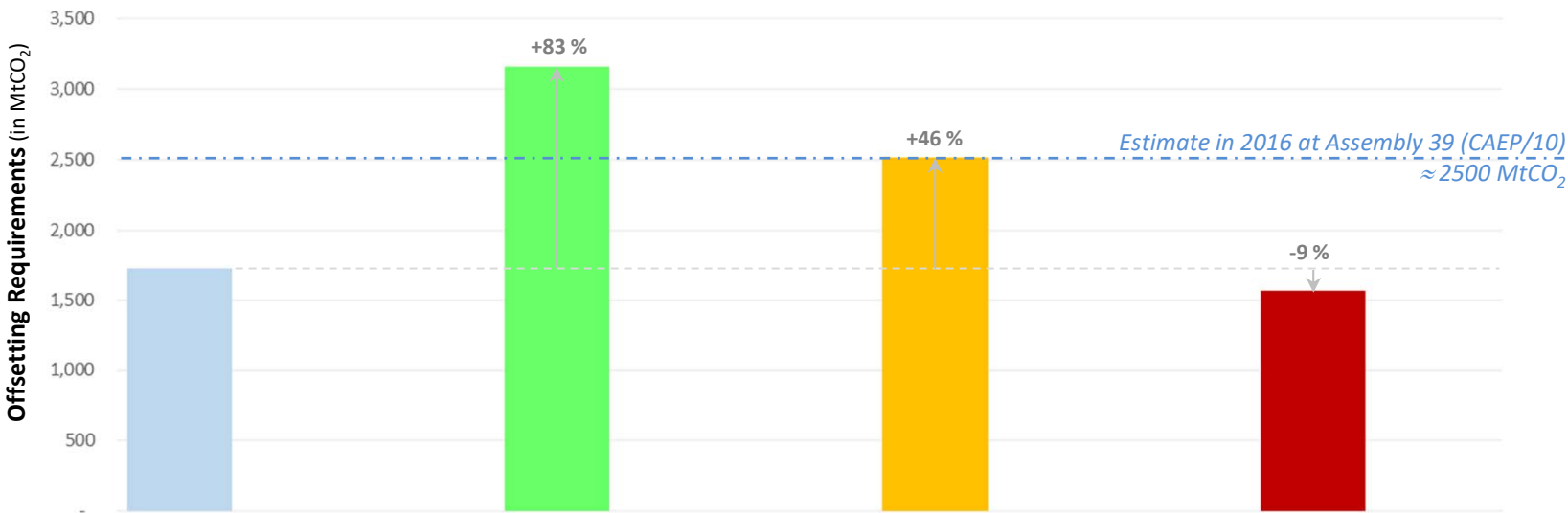
- Based on the interim updated scenarios, CO₂ emissions not emitted compared to a 2019 level could range from 540 to 1200 MtCO₂ depending on the rate of recovery.
- For context, in 2016 (pre-Covid19) offsetting requirements from 2021-2035 were estimated at approximately 2,500 MtCO₂.





- Under a scenario of average 2019-2020 baseline for 2024-2035, offsetting requirements (OR) could range from 1600 to 3200 MtCO₂.

All Phases (2021-2035)



Scenario Assumptions

CO₂ Emissions Trends

Base (CAEP/11 ref. 2015)
No Covid19 Scenario

High

Covid19 Recovery Scenario

Mid

Covid19 Recovery Scenario

Low

Covid19 Recovery Scenario

CORSIA Baseline (2021-2023)

2019 (only)

2019 (only)

2019 (only)

2019 (only)

CORSIA Baseline (2024-2035)

Avg 2019-2020

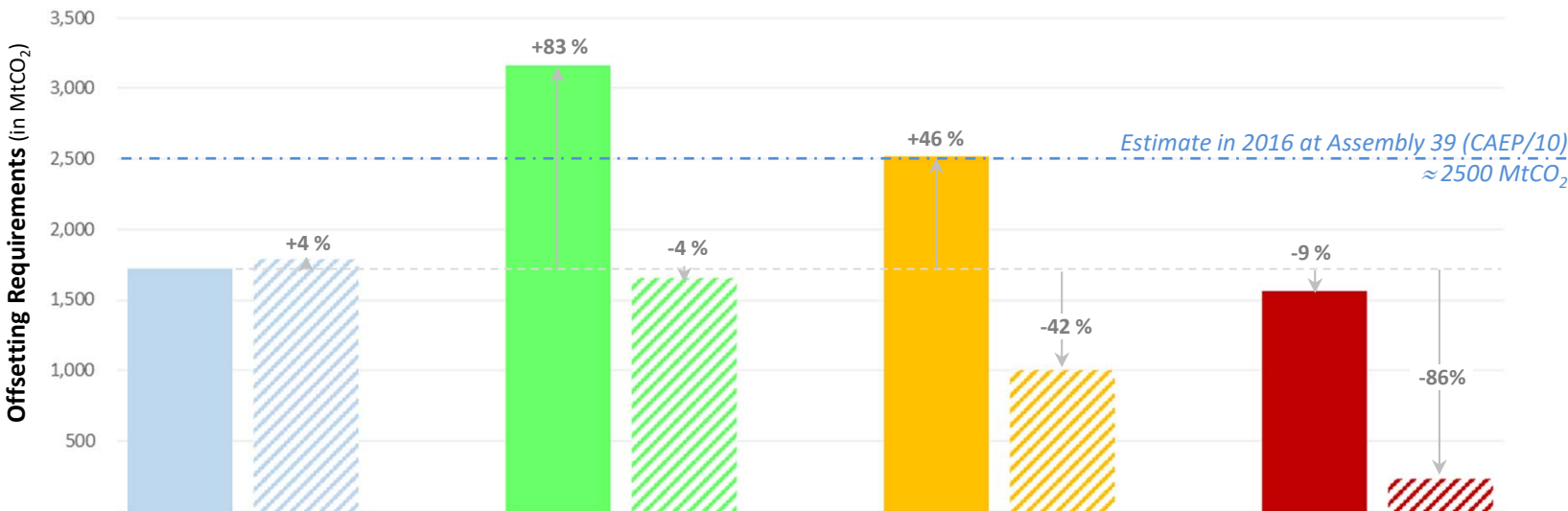
Avg 2019-2020

Avg 2019-2020

Avg 2019-2020

- Under a scenario of average 2019-2020 baseline for 2024-2035, offsetting requirements (OR) could range from 1600 to 3200 MtCO₂.
- If the baseline remains at 2019 level for 2024-2035, OR could range from 230 to 1700 MtCO₂.

All Phases (2021-2035)

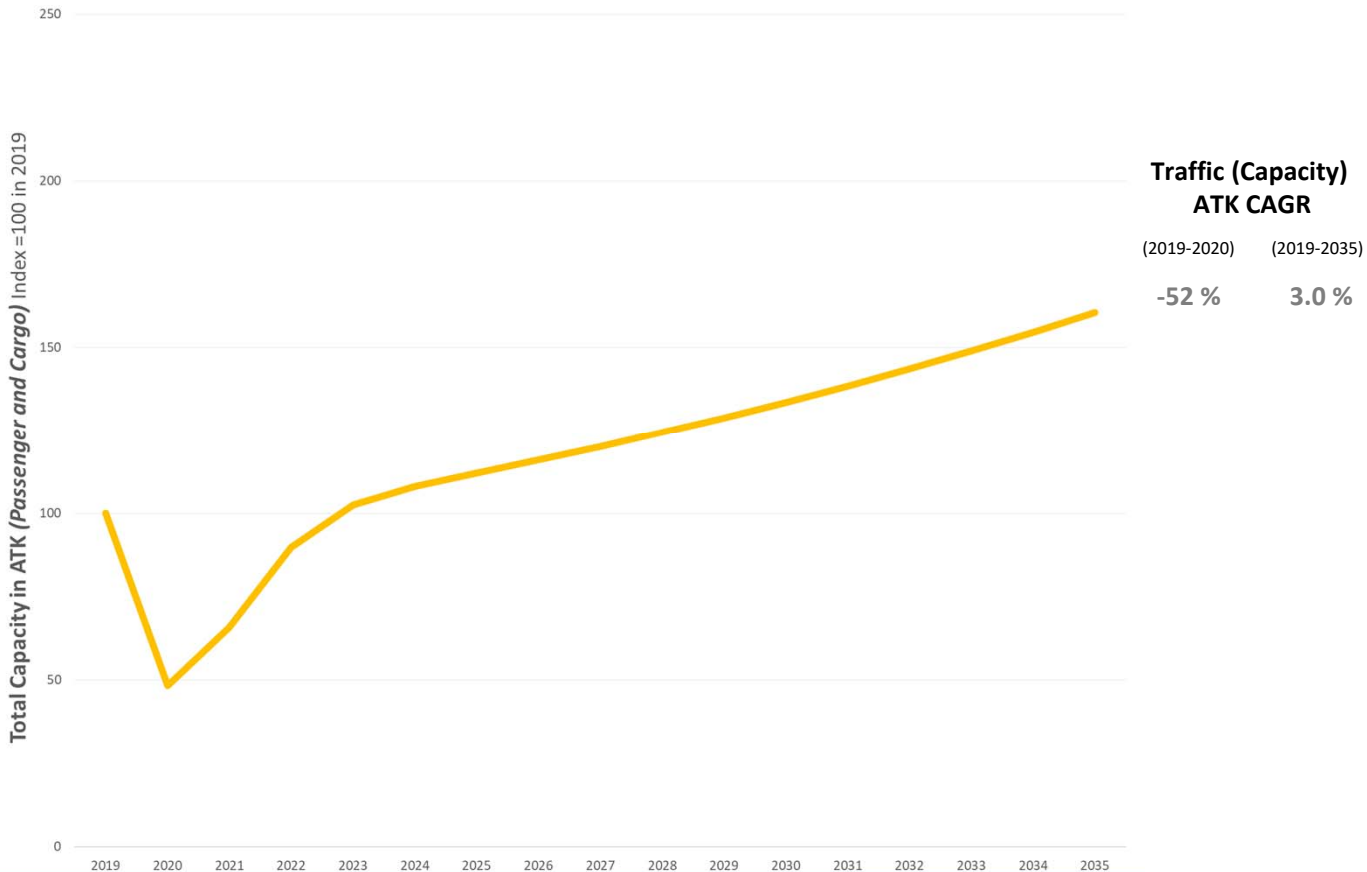


Scenario Assumptions

CO ₂ Emissions Trends	Base (CAEP/11 ref. 2015) No Covid19 Scenario		High Covid19 Recovery Scenario		Mid Covid19 Recovery Scenario		Low Covid19 Recovery Scenario	
	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)
CORSIA Baseline (2021-2023)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)
CORSIA Baseline (2024-2035)	Avg 2019 -2020	2019 (only)	Avg 2019 -2020	2019 (only)	Avg 2019 -2020	2019 (only)	Avg 2019 -2020	2019 (only)



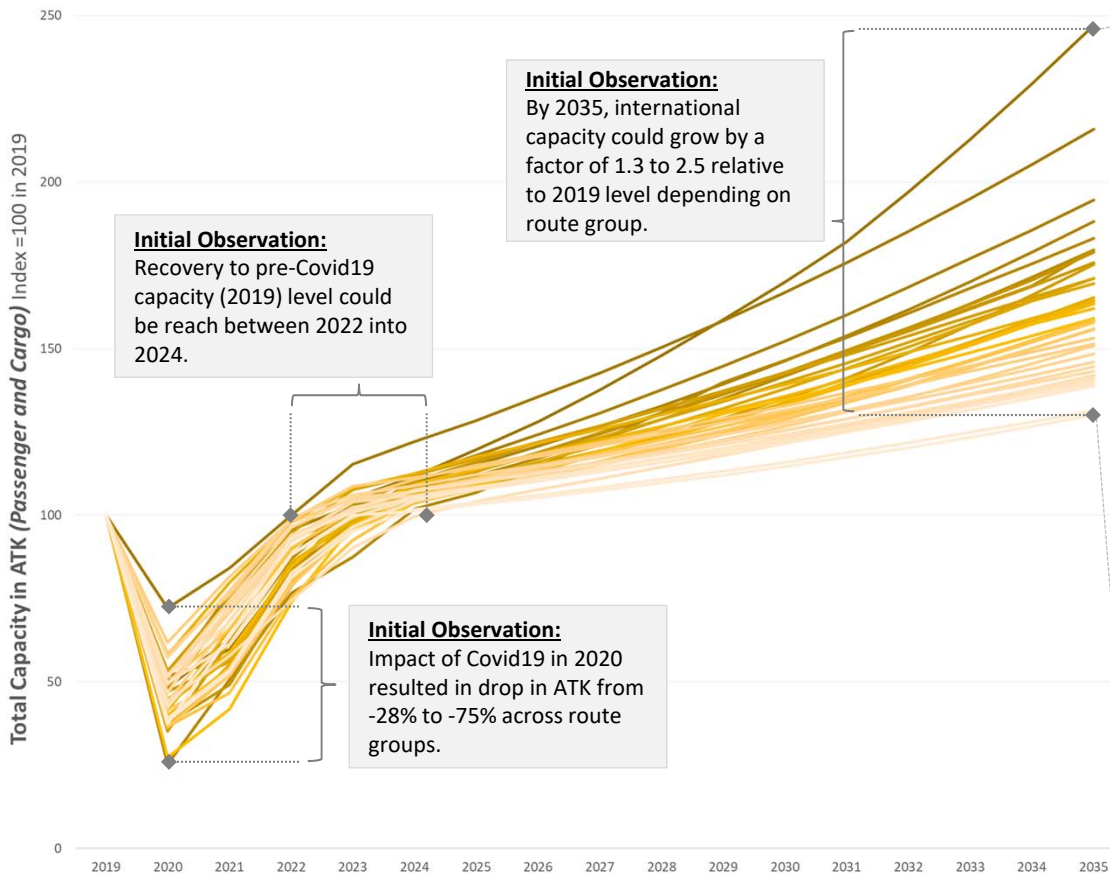
Illustration: International Aviation Capacity (ATK) - Mid Covid19 Scenario





Regional Breakdown of International Aviation Capacity (ATK)

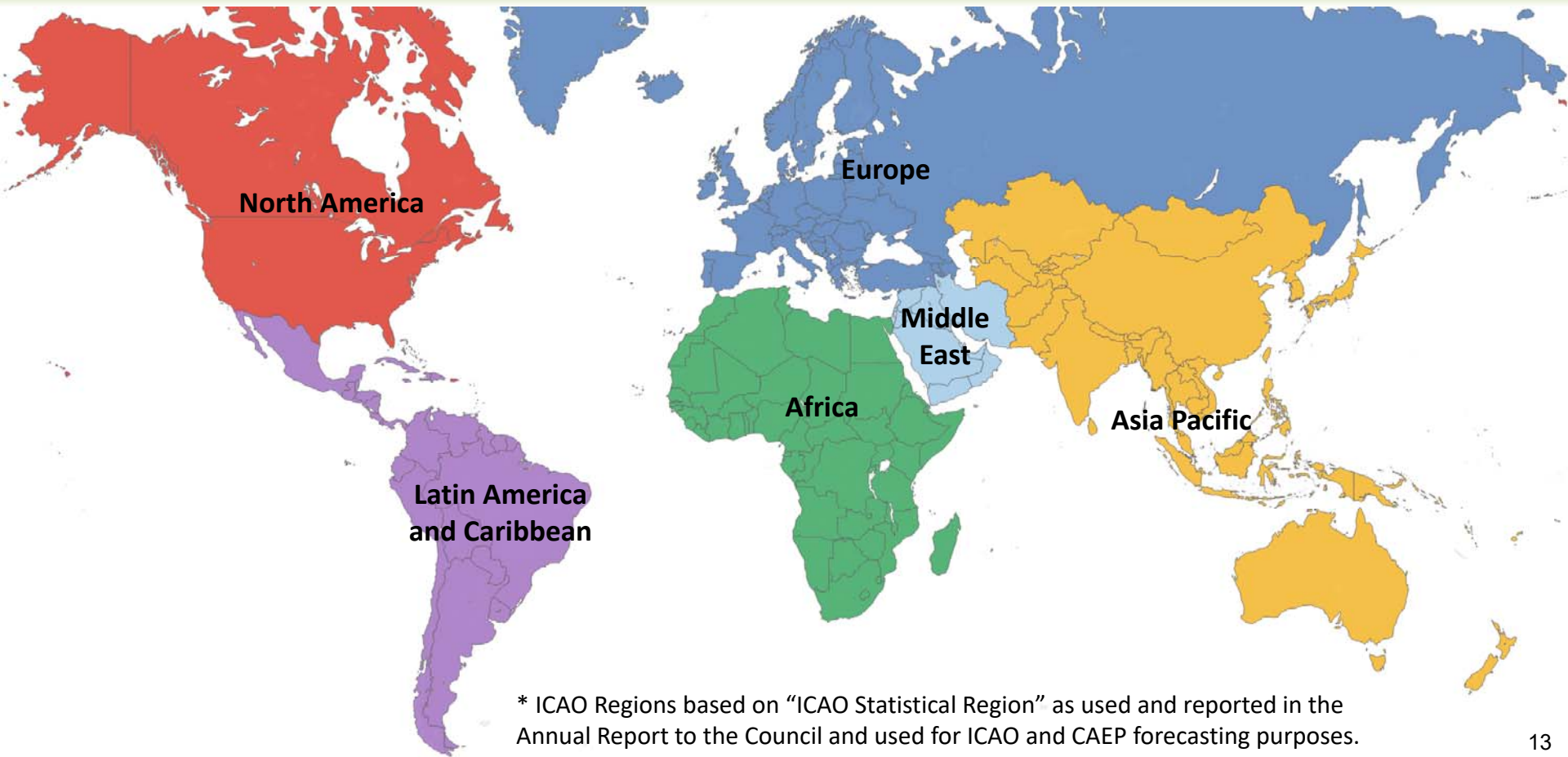
Illustration: International Aviation Capacity (ATK) - Mid Covid19 Scenario



FESG Route Group			ATK CAGR	
			(2019-2020)	(2019-2035)
Middle East	<->	South West Asia	-52%	5.8%
China	<->	Middle East	-28%	4.9%
China & South West Asia	<->	North Asia	-49%	4.2%
Africa	<->	Middle East	-50%	4.0%
Latin America/Caribbean	<->	China	-75%	3.9%
Intra Africa			-48%	3.7%
China & South West Asia	<->	Pacific South East Asia	-58%	3.7%
Intra Pacific South East Asia			-63%	3.7%
Middle East	<->	North Asia & Pacific South East Asia	-53%	3.6%
North America	<->	South West Asia	-65%	3.6%
Intra China & South West Asia			-47%	3.4%
Africa	<->	Asia/Pacific	-53%	3.4%
North Asia	<->	Pacific South East Asia	-62%	3.4%
Central America/Caribbean	<->	South America	-64%	3.2%
Africa & Middle East	<->	South America	-57%	3.2%
China	<->	North America	-42%	3.2%
North America	<->	Pacific South East Asia	-59%	3.1%
Europe	<->	Middle East	-55%	3.1%
Europe	<->	Pacific South East Asia	-60%	3.1%
Latin America/Caribbean	<->	North Asia & Pacific South East Asia	-73%	2.9%
Europe	<->	North Africa	-61%	2.9%
Africa & Middle East	<->	Central America/Caribbean	-64%	2.9%
Europe	<->	South West Asia	-50%	2.9%
Central America/Caribbean	<->	Europe	-63%	2.8%
Intra Middle East			-59%	2.8%
China	<->	Europe	-42%	2.7%
North America	<->	North Asia	-38%	2.6%
Central America/Caribbean	<->	North America	-56%	2.6%
Middle East	<->	North America	-51%	2.5%
North America	<->	South America	-43%	2.4%
Europe	<->	North America	-48%	2.3%
Intra North Asia			-53%	2.3%
Intra North America			-48%	2.2%
Intra Central America/Caribbean			-56%	2.2%
Europe	<->	North Asia	-48%	2.2%
Europe	<->	Sub Saharan Africa	-50%	2.2%
Intra South America			-57%	2.1%
Europe	<->	South America	-61%	2.1%
Intra Europe			-62%	1.7%
Africa	<->	North America	-63%	1.7%



Background on ICAO Regions*



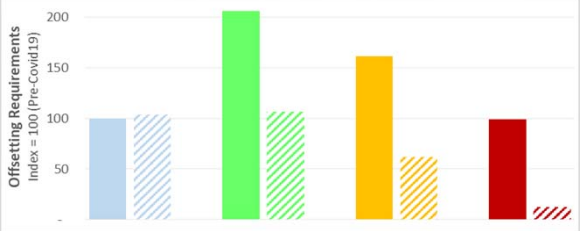
* ICAO Regions based on “ICAO Statistical Region” as used and reported in the Annual Report to the Council and used for ICAO and CAEP forecasting purposes.



Regional Breakdown of Offsetting Requirements by ICAO Regions

North America

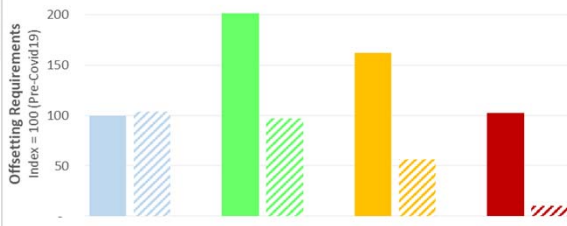
Share of total CO₂ emissions (2021-2035)*: **13%**
 Share of growth in CO₂ em. (2021-2035)**: **11%**
 Share of Offsetting Req. (2021-2035)***: **14%**



CO ₂ Emissions Trends	Base		High		Mid		Low	
	2019 (emg)	2019 (emg)	2019 (emg)	2019 (emg)	2019 (emg)	2019 (emg)	2019 (emg)	2019 (emg)
CORSIA Baseline (2021-2023)	Aug 2019 (emg)	2019 (emg)	Aug 2019 (emg)	2019 (emg)	Aug 2019 (emg)	2019 (emg)	Aug 2019 (emg)	2019 (emg)
CORSIA Baseline (2024-2035)	2020 (emg)	2019 (emg)	2020 (emg)	2019 (emg)	2020 (emg)	2019 (emg)	2020 (emg)	2019 (emg)

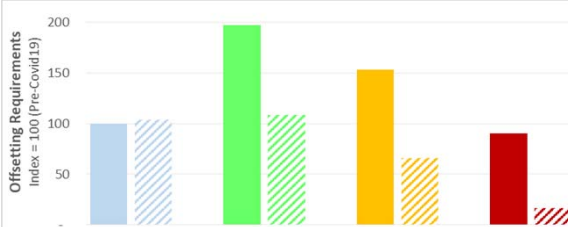
Europe

Share of total CO₂ emissions (2021-2035)*: **32%**
 Share of growth in CO₂ em. (2021-2035)**: **19%**
 Share of Offsetting Req. (2021-2035)***: **31%**



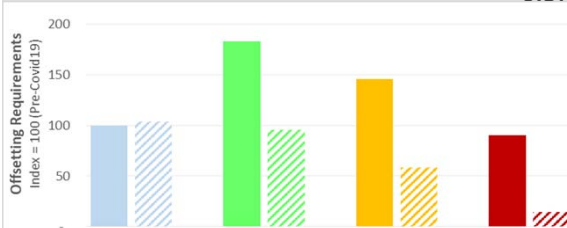
Middle East

Share of total CO₂ emissions (2021-2035)*: **16%**
 Share of growth in CO₂ em. (2021-2035)**: **22%**
 Share of Offsetting Req. (2021-2035)***: **16%**



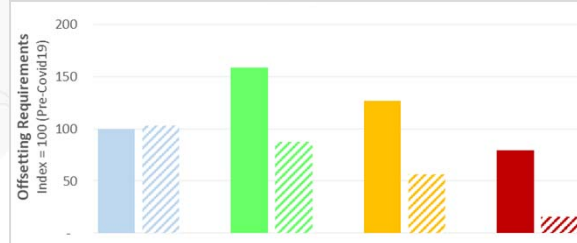
Africa

Share of total CO₂ emissions (2021-2035)*: **3%**
 Share of growth in CO₂ em. (2021-2035)**: **3%**
 Share of Offsetting Req. (2021-2035)***: **0.5%**



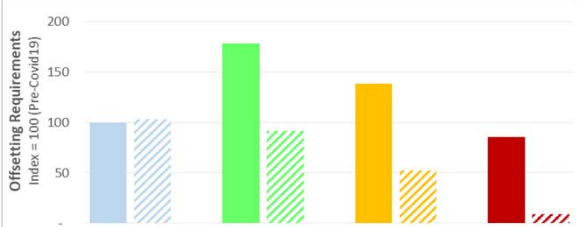
Asia Pacific

Share of total CO₂ emissions (2021-2035)*: **29%**
 Share of growth in CO₂ em. (2021-2035)**: **37%**
 Share of Offsetting Req. (2021-2035)***: **34%**



Latin America and Caribbean

Share of total CO₂ emissions (2021-2035)*: **3%**
 Share of growth in CO₂ em. (2021-2035)**: **2%**
 Share of Offsetting Req. (2021-2035)***: **1.5%**



Illustrative traffic scenario: Covid19 Mid.

* Share of total international aviation CO₂ emissions (A16V4 Chapter 2) from 2021 to 2035. Shares very similar across Covid19 scenarios.

** Share of growth in international aviation CO₂ emissions (A16V4 Chapter 2) from 2021 to 2035 compared to a 2019 level. Shares of growth in CO₂ emissions inversely proportional to Covid19 scenarios' sector growth rates. Details available upon request.

Regions with higher share of growth in CO₂ emissions compared to share in CO₂ emissions are expected to grow faster than regions with lower share of growth in CO₂ emissions compared to share in CO₂ emissions.

*** Share of offsetting requirements based on Mid Covid19 scenario (average of both baseline options). Totals do not add to 100% as approx. 4% of emissions are yet to be attributed. Pending ongoing work.

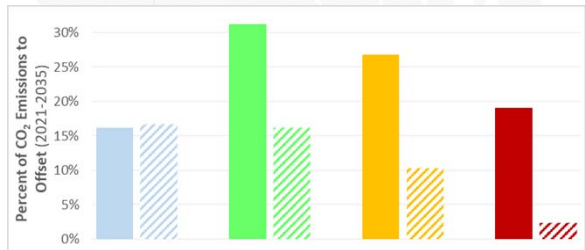
Summary of Assumptions:

CORSIA Baseline Ref. Year (Pilot):	2019
CORSIA Baseline Ref. Year (2024-2035):	Avg. 2019-2020 or 2019 (only)
Sectoral/Individual :	80% / 20% in 2030-2032
Sectoral/Individual :	30% / 70% in 2033-2035
States for Chapter 3 State Pairs:	Edition 1 (July 2020)

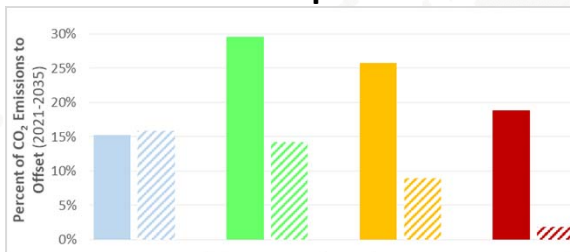


Regional Breakdown of Offsetting Requirements by ICAO Regions

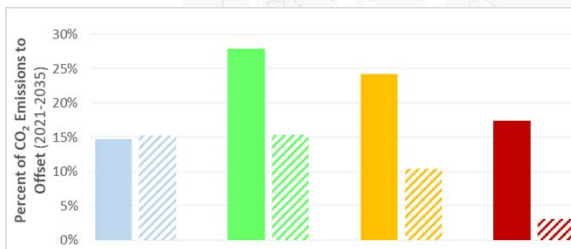
North America



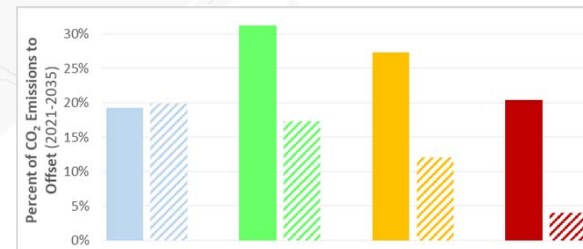
Europe



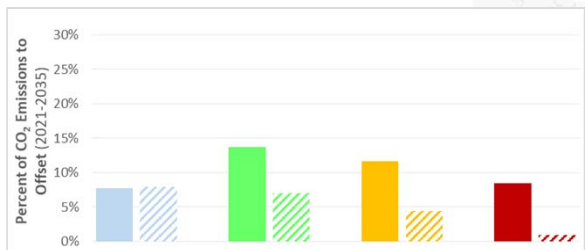
Middle East



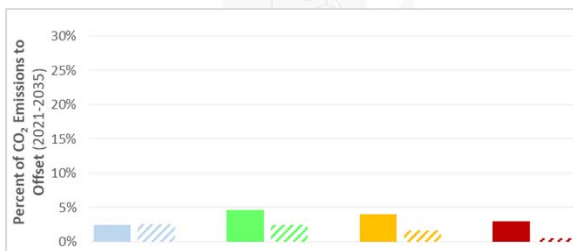
Asia Pacific



Latin America and Caribbean



Africa



Summary of Assumptions:

CORSIA Baseline Ref. Year (Pilot):	2019
CORSIA Baseline Ref. Year (2024-2035):	Avg. 2019-2020 or 2019 (only)
Sectoral/Individual :	80% / 20% in 2030-2032
Sectoral/Individual :	30% / 70% in 2033-2035
States for Chapter 3 State Pairs:	Edition 1 (July 2020)

* Percent CO₂ emissions to offset defined as: total offsetting requirements (2021-2035) divided by total international aviation CO₂ emissions (A16V4 Chapter 2) from 2021 to 2035.



- **The work on regional breakdown of offsetting requirements by ICAO Region is still ongoing, but initial results in all regions show similar relative changes in offsetting requirements between 2021 and 2035 compared to their expected quantities of offsetting requirements before Covid19 (i.e., all regions are expected to be affected by Covid19 in a similar manner).**
- **The percent of CO₂ emissions offset is driven by the participation of States in CORSIA and this is also similar across all regions, except certain regions where there is a relatively higher number of States that are exempted and not voluntarily participating.**



Final Offsetting Requirements: Consideration of Emissions Reductions from CORSIA Eligible Fuels

Offsetting Requirements

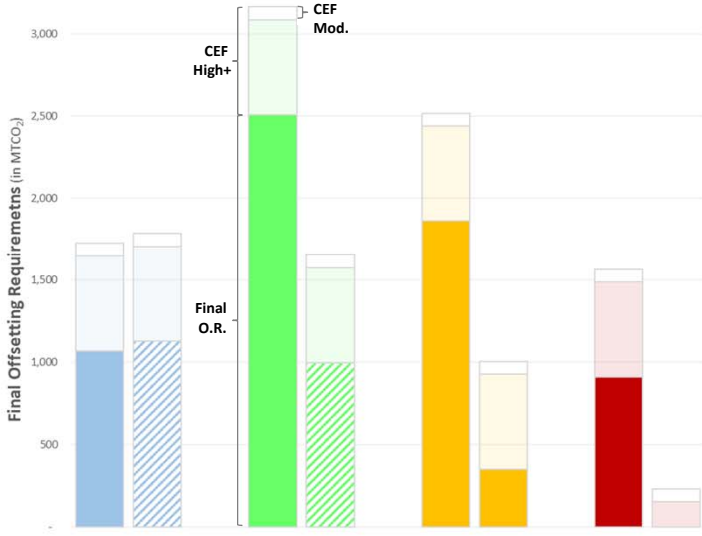
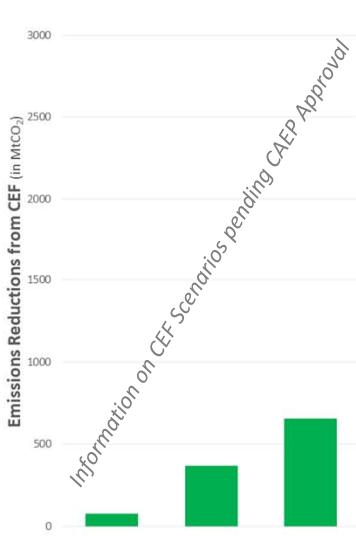
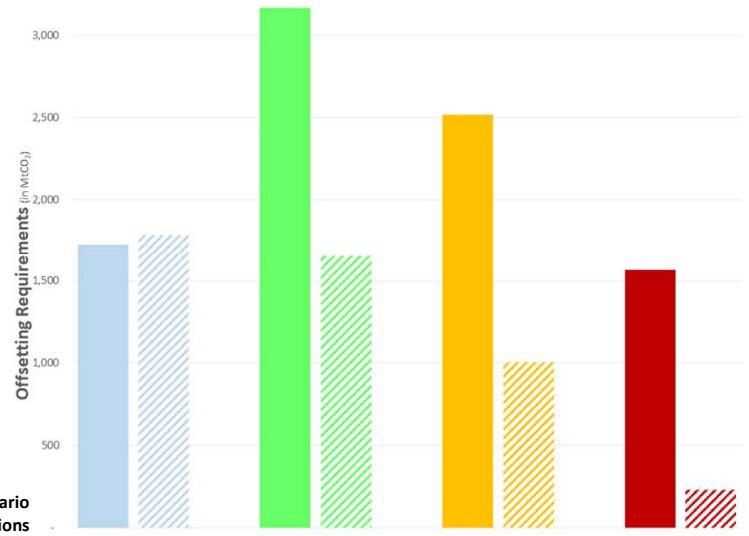
(per Annex 16 Volume IV, section 3.2)

Emissions Reductions from CEF

(per Annex 16 Volume IV, section 3.3)

Final Offsetting Requirements

(per Annex 16 Volume IV, section 3.4)



Scenario Assumptions

CO ₂ Emissions Trends	Base		High		Mid		Low		Base		High		Mid		Low	
	No Covid19 Scenario		Covid19 Recovery Scenario		Covid19 Recovery Scenario		Covid19 Recovery Scenario		No Covid19 Scenario		High		Mid		Low	

CORSIA Baseline (2021-2023)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)	2019 (only)
-----------------------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------

CORSIA Baseline (2024-2035)	Avg. 2019 -2020	2019 (only)	Avg. 2019 -2020	2019 (only)	Avg. 2019 -2020	2019 (only)	Avg. 2019 -2020	2019 (only)	Avg. 2019 -2020	2019 (only)	Avg. 2019 -2020	2019 (only)	Avg. 2019 -2020	2019 (only)	Avg. 2019 -2020	2019 (only)
-----------------------------	-----------------	-------------	-----------------	-------------	-----------------	-------------	-----------------	-------------	-----------------	-------------	-----------------	-------------	-----------------	-------------	-----------------	-------------

CORSIA Eligible Fuels (CEF)	Moderate	High	High+
-----------------------------	----------	------	-------

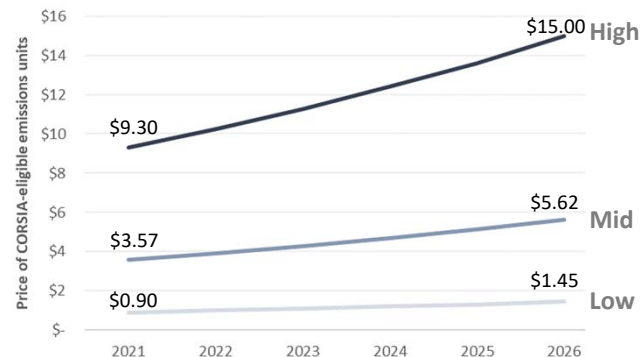
Scenarios for Emissions Reductions from CEF based on CAEP Global SAF scenarios and assumption that operator would claim emissions reductions from SAF proportionally across international sector (i.e., CORSIA) and domestic schemes i.e., assuming 64% split towards international which is international share of global CO₂ emissions in 2018.



- CAEP compiled existing data on historical weighted average prices for carbon offsets similar to CORSIA-eligible emissions units, transacted voluntarily between 2015-2019. The average price for these units has remained fairly stable over time.
- Volume-weighted averages aggregate a wide range of prices that uniquely vary by, e.g., project attributes (sector or type, size, non-CO_{2e} benefits, geography, methodology), emissions unit programme, and vintage, as well as contractual arrangements.
- Several factors make this task significantly challenging:
 - The nascent stage of the market for CORSIA – eligible units.
 - In recent years, the majority of carbon offset transactions were over-the-counter, making price information largely opaque.
 - A platform with robust data on price of carbon offsets does not exist for this market.
 - Decisions taken by Parties to the Paris Agreement under the UNFCCC will impact supply and demand in the future, and therefore will have an impact on price.

- Scenario-based analysis using available historical data of voluntarily transacted offsets to provide indicative low, medium, and high price estimates for CORSIA eligible emissions units from 2021 to 2026.
 - Low-price scenario: lowest volume-weighted price project type
 - Mid-price scenario: global average price for voluntarily transacted offsets
 - High-price scenario: highest volume-weighted price project type
 - Assumed 9.5% year-on-year increase in emissions units prices (per tonne) across all scenarios
- Caveats:
 - These scenario-based price estimates are based on available historical data on price of voluntarily transacted offsets
 - These scenarios-based price estimates are not indicative of future prices
 - At this moment is not possible to quantify potential impact from: Host Party accounting for internationally transferred mitigation outcomes may have on price, emerging voluntary “net zero” corporate targets and other factors outside of ICAO

CAEP/12 Scenario-based price of CORSIA-eligible emissions units*, 2021-2026



* As background, CAEP/10 scenarios for price of emissions units assumed; IEA High scenario \$20 in 2021 and \$27.8 in 2026, IEA Low scenario \$8.7 in 2021 and \$12.2 in 2026, and Alternative Low scenario \$6.4 in 2021 and \$8.4 in 2026. Reference: ICAO Environment Advisory Group Meeting (EAG/15), January 20-21, 2016 available at: https://www.icao.int/Meetings/HLM-MBM/Documents/EAG15_CAEP%20Technical%20Analyses.pdf



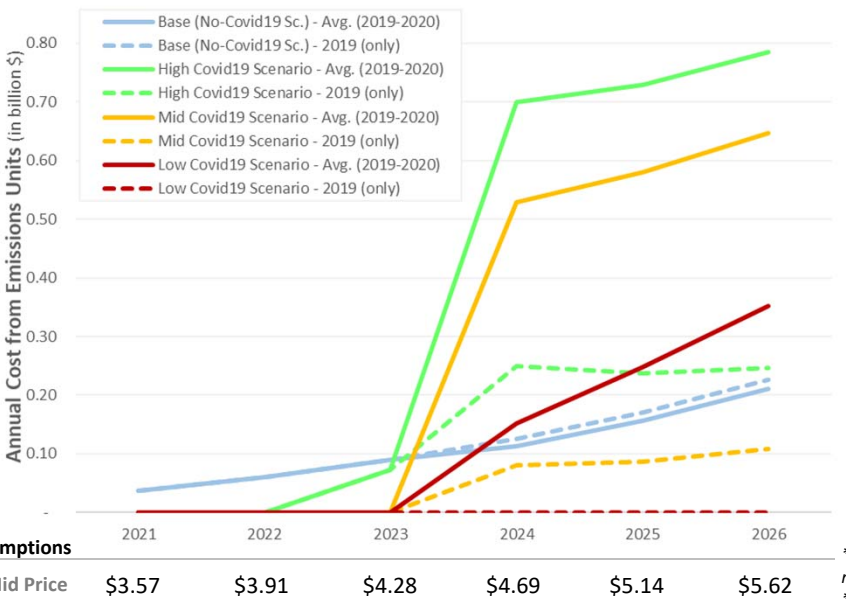
Estimations of Costs Associated with Offsetting Requirements through 2026

- Cumulative cost from emissions units could range from \$0.8 to 2.3 billion and \$0 to 0.8 billion under an Average 2019-2020 baseline and 2019 baseline respectively (for mid-price scenario). For context and order of magnitude comparison, the global (domestic and international) aviation industry cumulative revenues** from 2015-2020 was ≈ \$3,700 billion.
- Total cost can vary due to price of emissions units and be reduced (by \$50-400 million) if emissions reductions from CEFs are claimed.

Annual Cost of Emissions Units

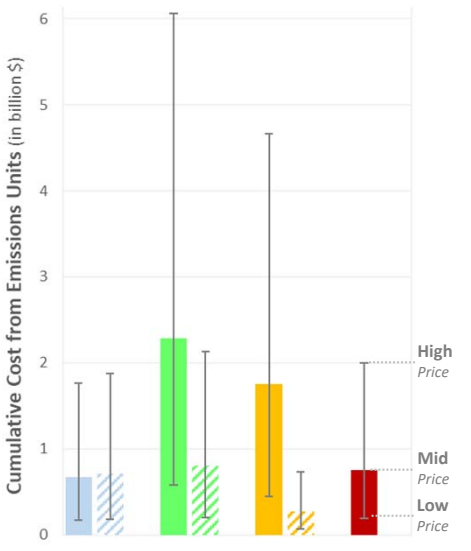
= Offsetting Requirements * Price CORSIA Eligible Emissions Units

(Mid Price Scenario) before potential Emissions Reductions from CEF are taken into account.



Cumulative Cost of Emissions Units

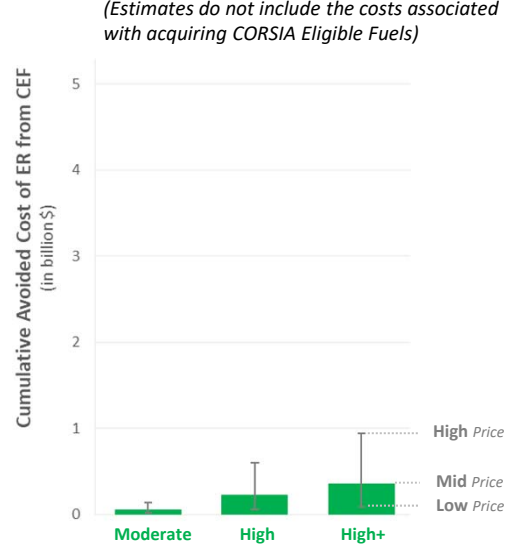
from 2021 to 2026



Cumulative Avoided Cost of Emissions Reductions from CEFs*

from 2021 to 2026

(Estimates do not include the costs associated with acquiring CORSIA Eligible Fuels)



* Cumulative avoided costs of emissions reductions from CEFs represent the costs avoided if Emissions Reductions from CEF were not claimed under CORSIA and Emissions Units were used to meet offsetting requirements.

**Reference: IATA, Industry Statistics, Fact Sheet, available at: www.iata.org/en/iata-repository/pressroom/fact-sheets/industry-statistics/



- **CAEP plans on providing a further update of analyses of the impacts of Covid19 on CORSIA at the 224th session of the Council, including;**
 - updates to traffic and CO₂ emissions forecasts for the 40 CAEP-FESG international route groups,
 - updates on the supply and price of Emissions Units towards the analysis of the cost implications of CORSIA offsetting requirements as more information is gathered and forecasts of price are refined*, and
 - responses to questions from the 222nd session of the Council.

*As part of subsequent analysis on price, CAEP could include further research into compliance carbon markets utilizing existing emissions units programmes, which underwent a similar shift from pre-compliance to compliance-drive purchasing within the last decade.



ICAO

ENVIRONMENT



ICAO

North American
Central American
and Caribbean
(NACC) Office
Mexico City

South American
(SAM) Office
Lima

ICAO
Headquarters
Montréal

Western and
Central African
(WACAF) Office
Dakar

European and
North Atlantic
(EUR/NAT) Office
Paris

Middle East
(MID) Office
Cairo

Eastern and
Southern African
(ESAF) Office
Nairobi

Asia and Pacific
(APAC) Sub-office
Beijing

Asia and Pacific
(APAC) Office
Bangkok



THANK YOU