ICAO
ENVIRONMENT

Council — 235th Session

Subject No. 50: Questions relating to the environment

Technical Assessments in Support of the 2025 CORSIA Periodic Review

Presented by CAEP

Referenced in C-WP/15730

Executive Summary

Review of the CORSIA's Pilot Phase (2021-2023)

- **Due to the decline in CO_2 emissions during the COVID-19 global pandemic coupled with a CORSIA baseline based on 2019 emissions, offsetting was not required during the Pilot Phase.**
- **Despite the absence of offsetting requirements, markets started to develop and prepare to meet future expected demand for emissions reductions from CORSIA eligible fuels and CORSIA emissions units.**

Updated Forward-looking CORSIA Analyses

Assessments through 2035 with a focus on the First Phase (2024-2026)

- **Given amended CO_2 emissions forecasts and 85% of 2019 CORSIA baseline, offsetting requirements are expected to start in 2024 under all CAEP/13 traffic scenarios.**
- **Cumulative offsetting requirements could range from ≈950 to 1500 $MtCO_2$ from 2024 to 2035 and from ≈105 to 150 $MtCO_2$ during the First Phase (2024-2026).**
- **Emissions reductions from CEF may address up to ≈15 % of offsetting requirements during the First Phase of CORSIA.**
- **Costs associated with addressing offsetting requirements from 2024 to 2026 could range from ≈ $1 to 5 billion** using Emissions Units (only) **to ≈ $10 to 20 billion** using a mix of Emissions Units and ER from CEF assuming that all the available CEF, according to the latest CAEP Moderate scenario, are claimed towards CORSIA.
- **The costs of addressing offsetting requirements could represent ≈ 0.07% to 1.1% of international aviation revenue from 2024 to 2026.**

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Council Requests Related to CORSIA Analyses

At its 228th session*, the Council…

…f) requested CAEP to **provide regular updates on its report on the supply, demand and pricing analysis of CORSIA eligible emissions units and to immediately inform the Council of any significant increases in demand or pricing;** […]

h) requested CAEP to:

ii. initiate its technical work on the consideration of methodologies for monitoring LTAG, as outlined in paragraphs 4.5 and 4.6 of C-WP/15471; **undertake work in order to support the Council on the 2025 CORSIA periodic review building upon the 2022 CORSIA review process (C-DEC 222/12, paragraph 10 refers), with a focus on the assessment of supply, demand, price and cost impact of the CORSIA offsetting requirements; and perform technical analyses to facilitate the development of a methodology for the periodic review;**

At its 231st session**, the Council…

…13.f) noted that in order to support the Council in undertaking the 2025 CORSIA periodic review, **the CAEP would provide the Council with further updated CORSIA analyses**, as well as the schedule of subsequent updates, during the 232nd Session, including **updated information on the price of emissions units and CORSIA eligible fuels**.

** Reference: C-DEC 228/7.* *** Reference: C-DEC 231/2.*

Council Requests Related to CORSIA Analyses (cont.)

At its 232nd session*, the Council…

[…]

c) requested CAEP to **provide subsequent updates of the CORSIA analyses to support the Council in undertaking the 2025 CORSIA periodic review, as per the schedule outlined by the CAEP in this regard, as presented to the CEC during the current Session and as contained in the reference document to C-WP/15587;**

d) **emphasized the need for further information to be provided on the supply, regional distribution and price of CORSIA Eligible Emissions Units and CORSIA Eligible Fuels, as a key input to the 2025 CORSIA periodic review and to any recommendations that would form part of the report by the Council to the 42nd Session of the Assembly**; and

e) requested CAEP to **develop guidance for States and aeroplane operators on matters related to the claiming of sustainable aviation fuels in other regulatory and voluntary greenhouse gas (GHG) schemes, and the potential impact on the availability of CORSIA Eligible Fuels**.

** Reference: C-DEC 232/6.*

Council Requests Related to CORSIA Analyses (cont.)

At its 233rd session*, the Council…

[…]

c) requested CAEP to **provide further updates on the CORSIA analyses to support the Council in undertaking the 2025 CORSIA periodic review during the 234th Session, as per the schedule outlined in Appendix C to C-WP/15630, with a particular emphasis on matters related to the overall supply, demand and price of CORSIA Eligible Fuels and CORSIA Eligible Emissions Units, as well as the related impacts on the implementation of the scheme;**

At its 234th session**, the Council…

b) recognized the significant amount of analytical work undertaken by CAEP in providing a series of updated CORSIA analyses since the 231st Session of the Council, representing important technical contributions in support of the Council's work on the 2025 CORSIA periodic review, as requested by the 41st Session of the ICAO Assembly; and

c) noted that CAEP would **provide further updates to the CORSIA analyses during the 235th Session of the Council, including on the supply of CORSIA Eligible Fuels and CORSIA Eligible Emissions Units and their prices, and subsequent costs of the scheme,** bearing in mind that the Council would need to finalize the 2025 CORSIA periodic review during the 235th Session and provide its related recommendations to the 42nd Session of the ICAO Assembly.

** Reference: C-DEC 233/3.* *** Reference: C-DEC 234/4.*

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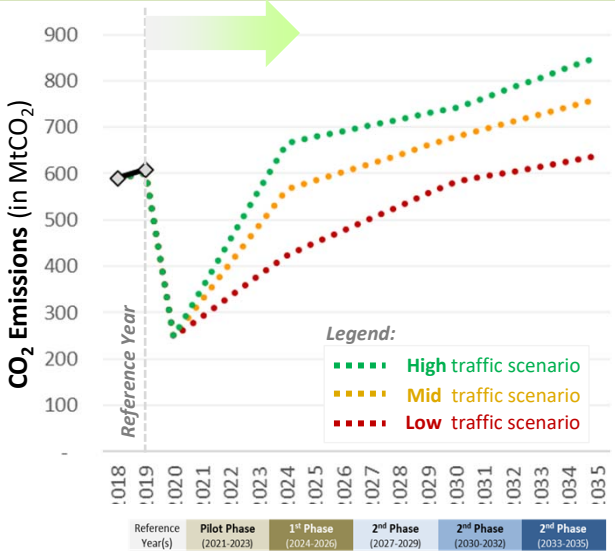
CORSIA Periodic Review: High Level Approach

- **The 2025 CORSIA Periodic Review comprises (1) a backward-looking review of how CORSIA worked during the Pilot Phase in context of projections anticipated during the 2022 Review, and (2) an update of the forward-looking assessments based on the latest available data.**

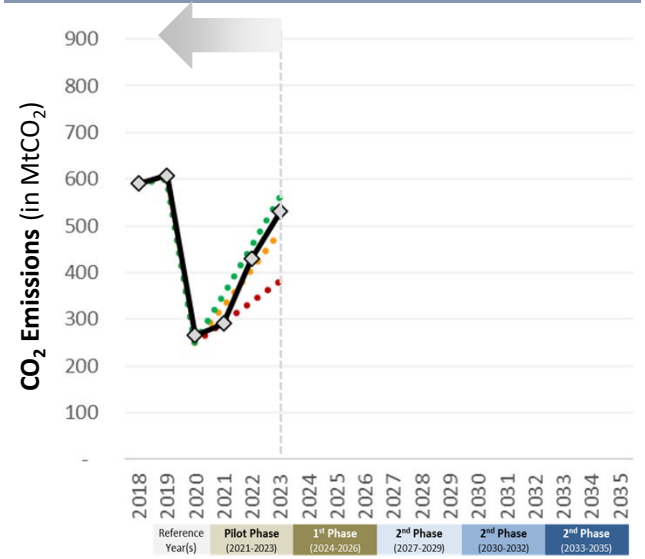
2022 CORSIA Periodic Review

Forward Looking Assessment

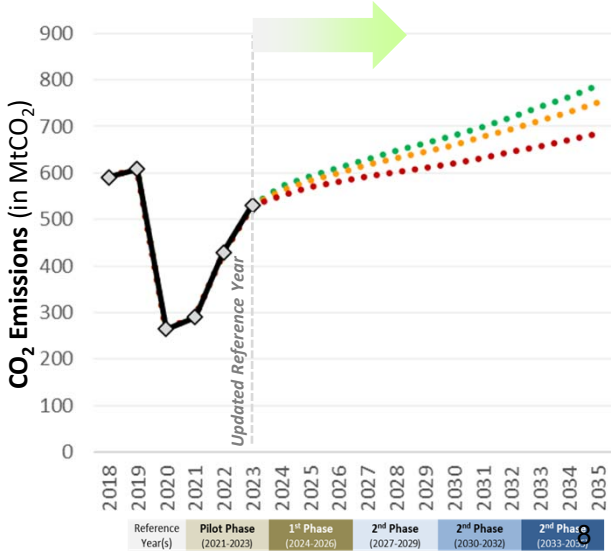


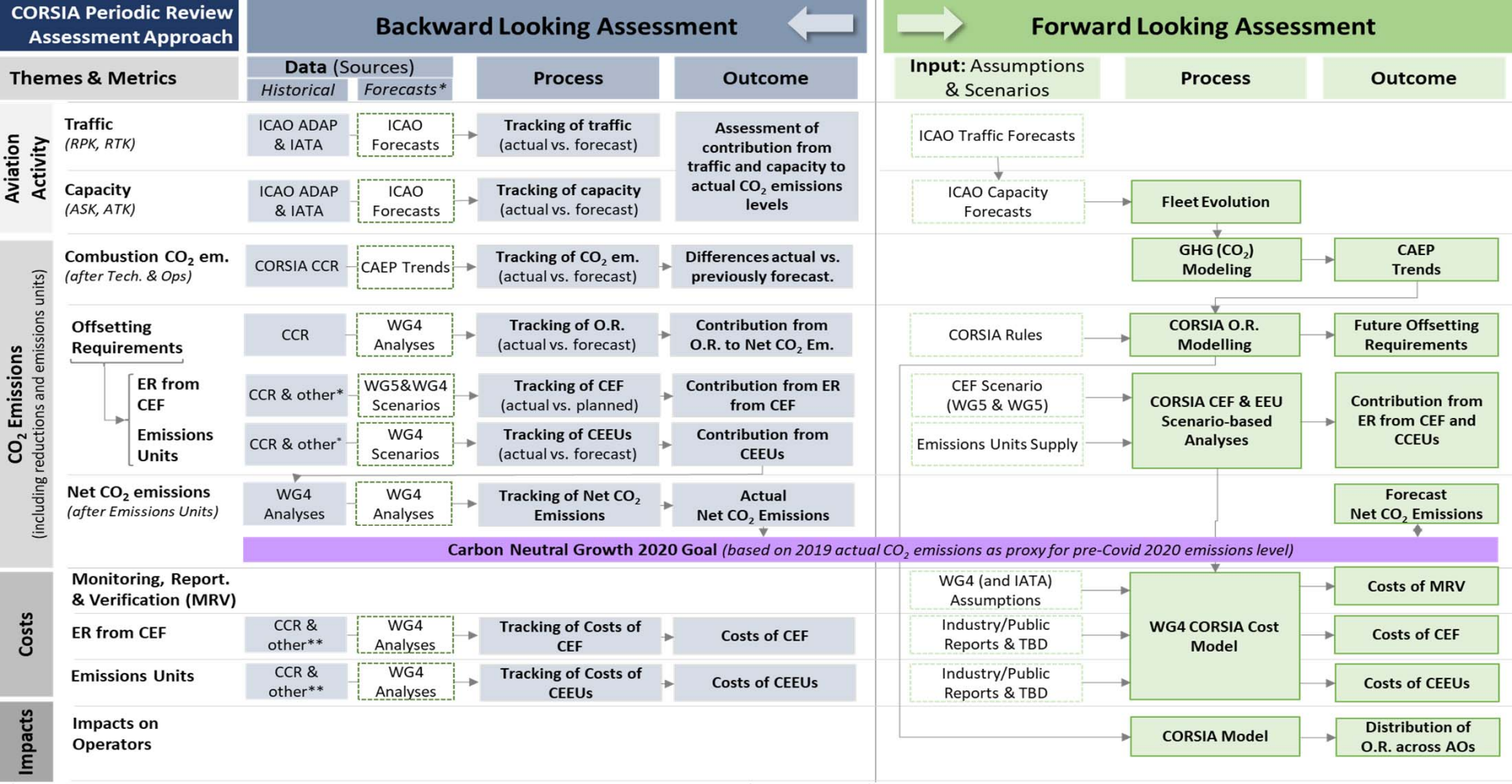
2025 CORSIA Periodic Review

Backward Looking Assessment



Updated Forward Looking Assessment





* Claimed Emissions Reductions from CEF and Cancelled Emissions Units available from the CCR (when available).

** Other sources of relevant information e.g., on price of CORSIA Eligible Fuels, price of emissions units. Note: Actual data not needed for the review of CORSIA's Pilot Phase (2021-2023) as part of the 2025 CORSIA Periodic Review given the expected lack of offsetting requirements during the Pilot Phase.

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Q1 How did actual CO_2 emissions from international aviation compare to what was anticipated during the 2022 CORSIA Periodic Review?

Q2 Given CO_2 emissions trends, how much offsetting was required under CORSIA's Pilot Phase?

Q3 How much (potential) supply of (1) Emissions Reductions from CEF and/or (2) CORSIA Eligible Emissions Units was available?

Q4 Did international aviation meet its Carbon Neutral Growth goal from 2020 (CNG2020)?

Questions Addressed in this Section

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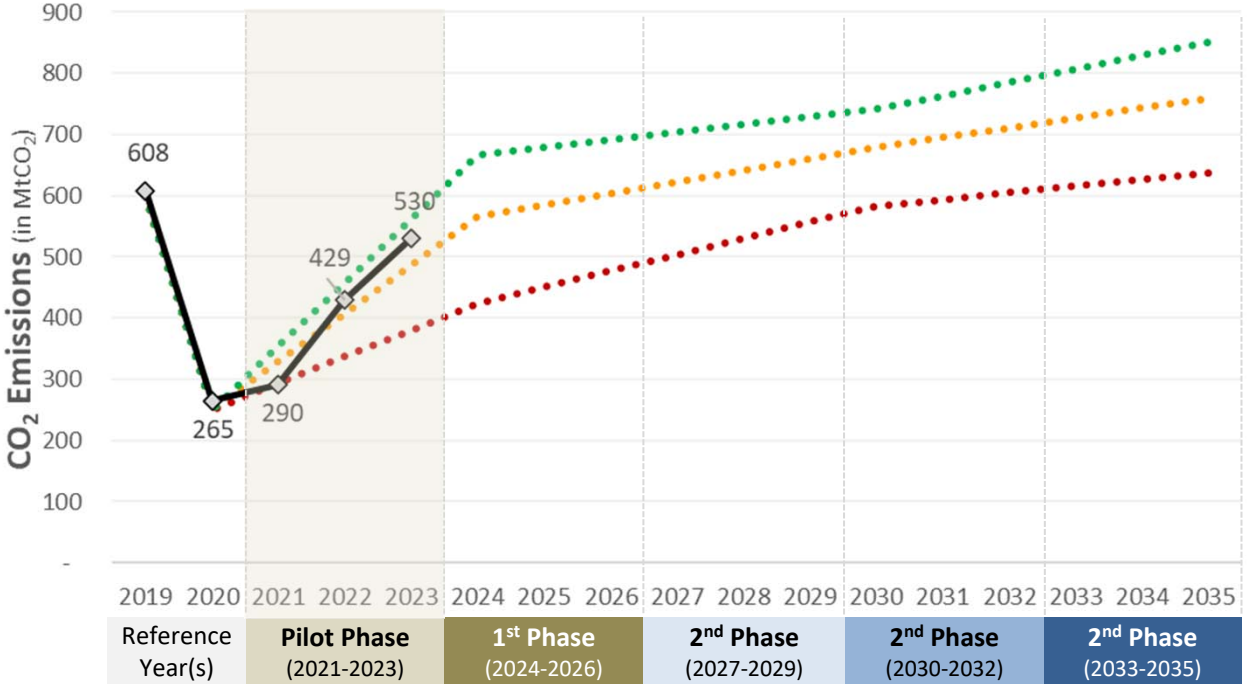
Q4 Did international aviation meet its Carbon Neutral Growth goal from 2020 (CNG2020)?

CO_2 Emissions: Actual/Historical vs. Previously Anticipated during the last (2022) CORSIA Periodic Review

- **Actual CO_2 emissions followed a "Low" forecast in 2021, but the international aviation sector exhibited a stronger recovery with CO_2 emissions between the "Mid" and "High" in 2022 and 2023.**



Legend:

- **High** scenario
- **Mid** scenario
- **Low** scenario

2022 CORSIA Periodic Review based on CAEP/12 CO_2 Emissions Trends to A41.

Actual/Historical CO_2 emissions (based on CORSIA reporting through the CORSIA Central Registry)

Questions Addressed in this Section

Q1 How did actual CO_2 emissions from international aviation compare to what was anticipated during the 2022 CORSIA Periodic Review?

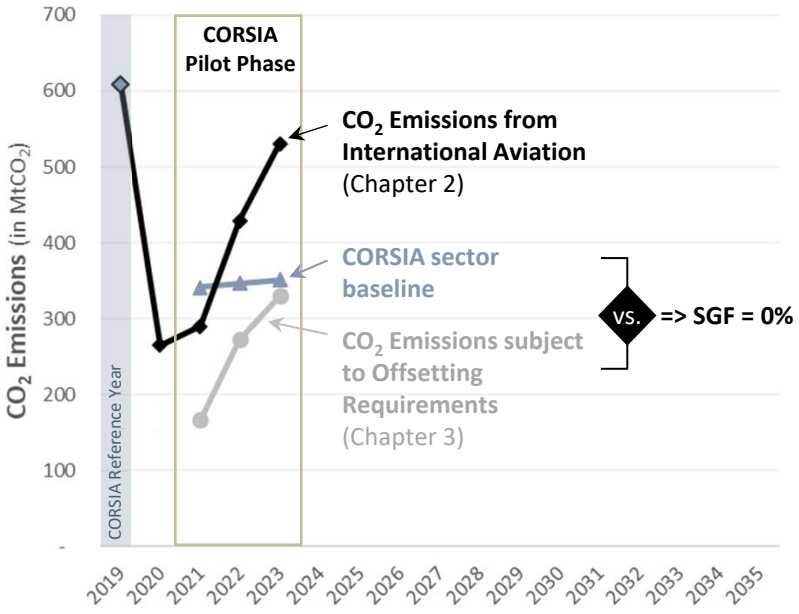
Q2 Given CO_2 emissions trends, how much offsetting was required under CORSIA's Pilot Phase?

Q3 How much (potential) supply of (1) Emissions Reductions from CEF and/or (2) CORSIA Eligible Emissions Units was available?

Q4 Did international aviation meet its Carbon Neutral Growth goal from 2020 (CNG2020)?

Q2 Offsetting Requirements during the Pilot Phase

- **Given the effects of the COVID-19 Global Pandemic on international aviation and despite the recovery since 2020, CO_2 emissions from international aviation subject to offsetting requirements remained below the 2019 CORSIA sector baseline in 2021, 2022 and 2023.**
- **As a result, the Sector Growth Factors (SGFs) were 0% for all three years of the CORSIA Pilot Phase.**
- **No offsetting was required during the Pilot Phase. As a result, there was no demand, triggered by CORSIA, for emissions reductions from CORSIA eligible fuels and/or CORSIA eligible emissions units.**



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Q2 Given CO_2 emissions trends, how much offsetting was required under CORSIA?

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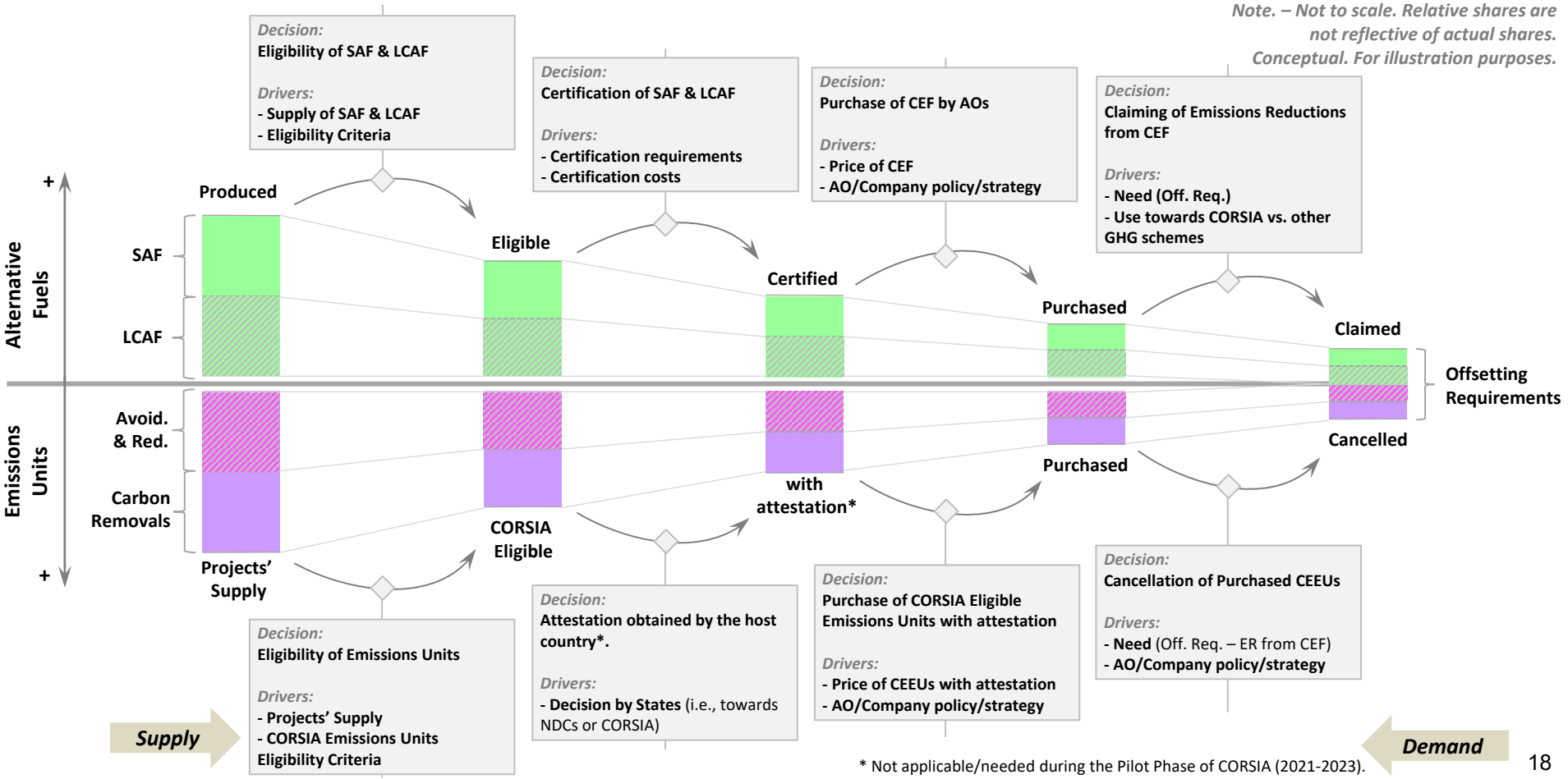
Q4 Did international aviation meet its Carbon Neutral Growth goal from 2020 (CNG2020)?

Review of the Supply of Emissions Reductions from CEF and CORSIA Eligible Emissions Units

- The absence of demand for emissions reductions from CEF and/or emissions units for CORSIA compliance purposes does not mean that there was no supply, and that the markets did not prepare to meet potential and future demand.

- The CAEP WG4 developed a framework towards the assessment of the role of emissions reductions from CEF and CORSIA eligible emissions units.

Framework towards the assessment of the role of Emissions Reductions from CEF and CORSIA Eligible Emissions Units



* Not applicable/needed during the Pilot Phase of CORSIA (2021-2023).

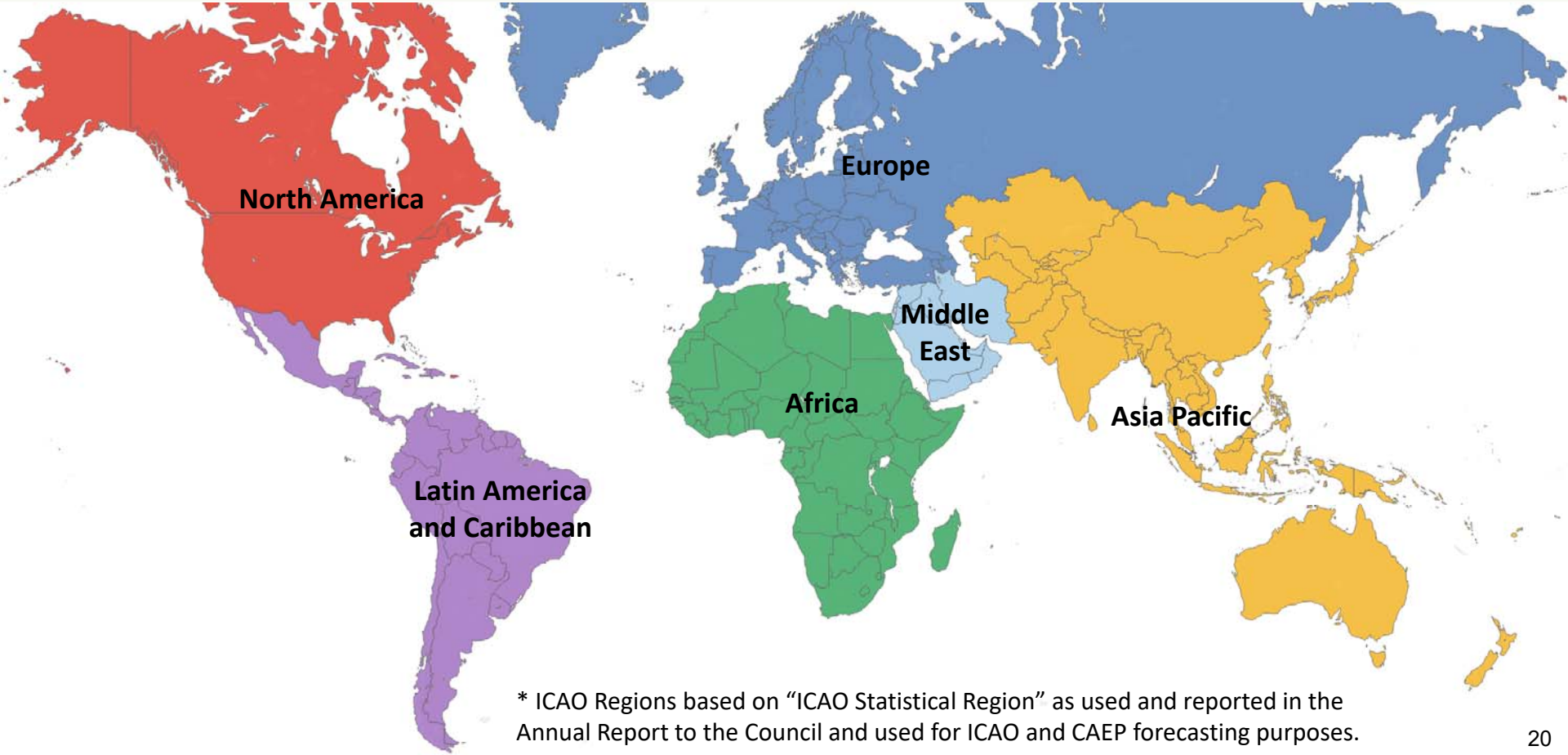
Assessment of the role of Emissions Reductions from CEF and CORSIA Eligible Emissions Units

Offsetting Requirements

0 tCO_2 during CORSIA Pilot Phase

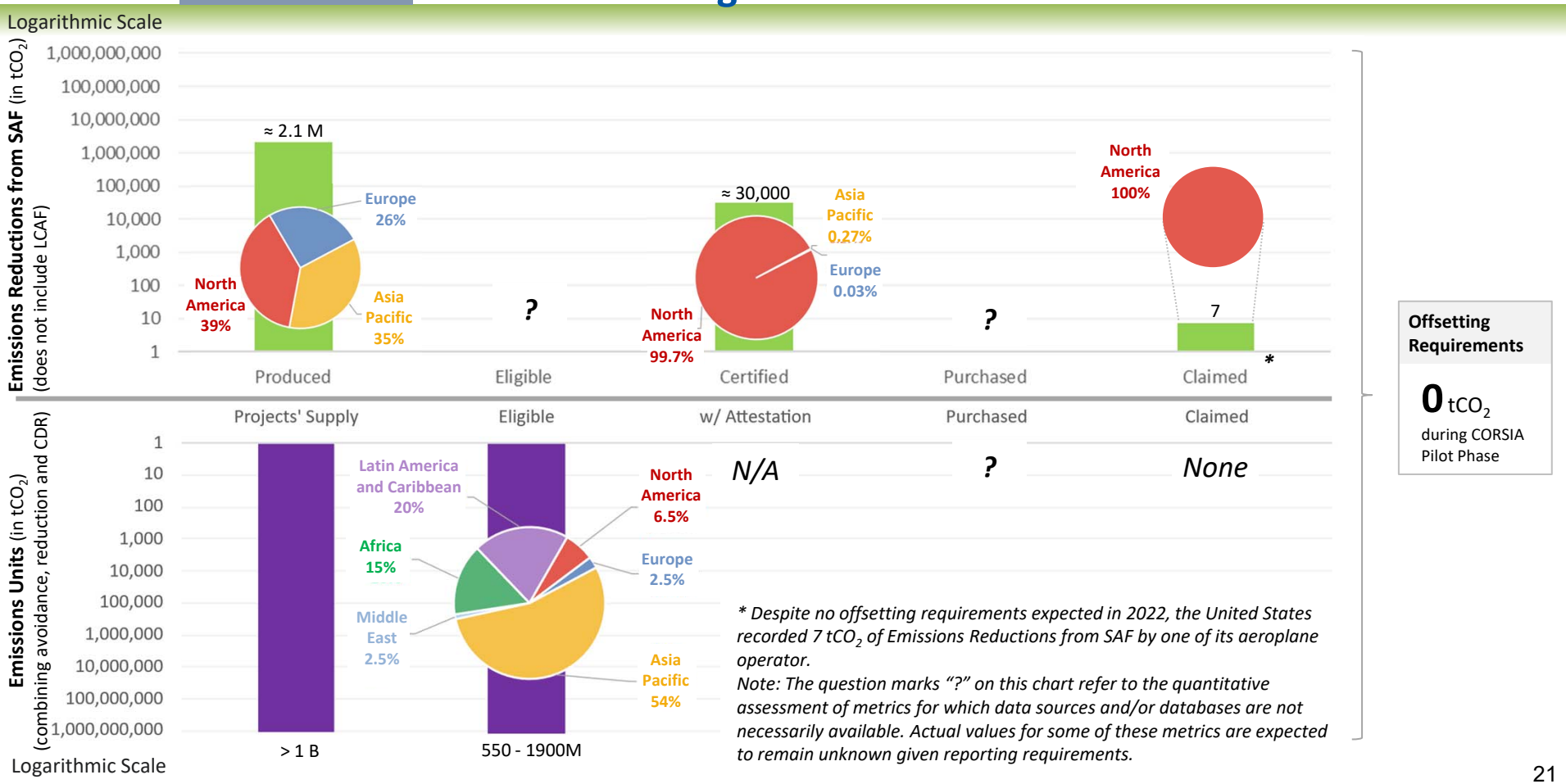
** Despite no offsetting requirements expected in 2022, the United States recorded 7 tCO_2 of Emissions Reductions from CEF by one of its aeroplane operator.*
Note: The question marks "?" on this chart refer to the quantitative assessment of metrics for which data sources and/or databases are not necessarily available. Actual values for some of these metrics are expected to remain unknown given reporting requirements.

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 the Emissions Reductions from CEF and CORSIA Eligible Emissions Units



Offsetting Requirements

0 tCO_2 during CORSIA Pilot Phase

** Despite no offsetting requirements expected in 2022, the United States recorded 7 tCO_2 of Emissions Reductions from SAF by one of its aeroplane operator.*

Note: The question marks "?" on this chart refer to the quantitative assessment of metrics for which data sources and/or databases are not necessarily available. Actual values for some of these metrics are expected to remain unknown given reporting requirements.

Questions Addressed in this Section

Q1 How did actual CO_2 emissions from international aviation compare to what was anticipated during the 2022 CORSIA Periodic Review?

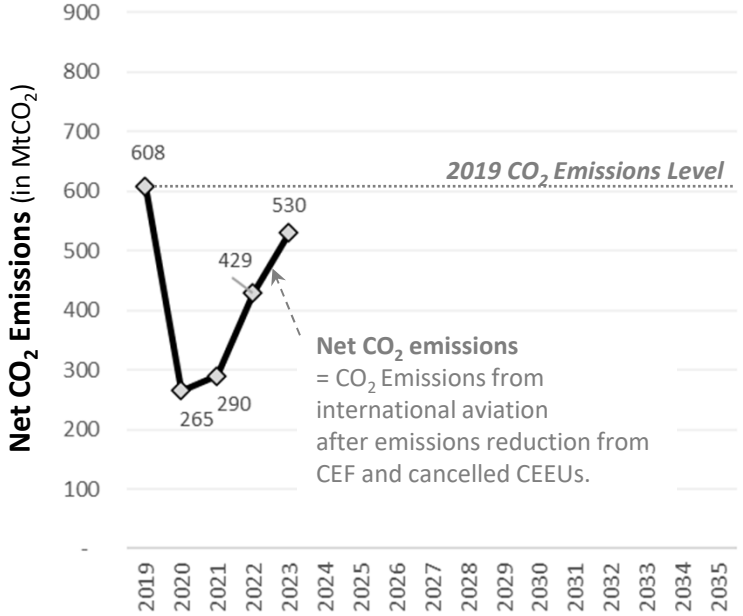
Q2 Given CO_2 emissions trends, how much offsetting was required under CORSIA?

Q3 How much (potential) supply of (1) Emissions Reductions from CEF and/or (2) CORSIA Eligible Emissions Units was available?

Q4 **Did international aviation meet its Carbon Neutral Growth goal from 2020 (CNG2020)?**

Evolution of Net CO_2 Emissions in context of Carbon Neutral Growth goal from 2020 (CNG2020)

- **Given data reported through the CCR, net CO_2 emissions remained below their 2019 level.**
- **The COVID-19 global pandemic was the primary driver of the decline in international aviation activity and resulting CO_2 emissions.**
- **International aviation sector met its mid-term goal of *"keeping net carbon emissions from 2020 at the same level"*** (assuming 2019 CO_2 emissions level as a proxy for 2020 emissions expected prior to the COVID-19 global pandemic impact on international aviation).



Summary of Observations

- **The CAEP continued its analyses in support of the 2025 CORSIA Periodic Review. Based on interim review and assessment of CORSIA's Pilot Phase (2021-2023), the CAEP:**
  - **a) observed that due to the decline in CO_2 emissions during the COVID-19 global pandemic coupled with a CORSIA baseline based on 2019 emissions, there were no offsetting required during the Pilot Phase.**
  - **b) noted that despite the lack of offsetting requirements, markets started to develop and prepare to meet potential and future demand for emissions reductions from CEF and CORSIA emissions units.**
  - **c) identified the need to develop possible approaches to access data on price information for CORSIA eligible units and CORSIA eligible fuels.**

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Q1 How CO_2 emissions from international aviation may evolve from 2024 to 2035?

Q2 Given CO_2 emissions trends, how much offsetting may be required under CORSIA?

Q3 How offsetting requirements (demand) may be met using (1) Emissions Reductions from CEF and/or (2) CORSIA Eligible Emissions Units*?

Q4 What are expected costs of compliance*?

Q5 What offsetting requirements could operators face?

Q6 Would international aviation meet its Carbon Neutral Growth goal from 2020 (CNG2020)?

** Focus on the CORSIA First Phase (2024-2026).*

Questions Addressed in this Section

Q1 **How CO_2 emissions from international aviation may evolve from 2024 to 2035?**

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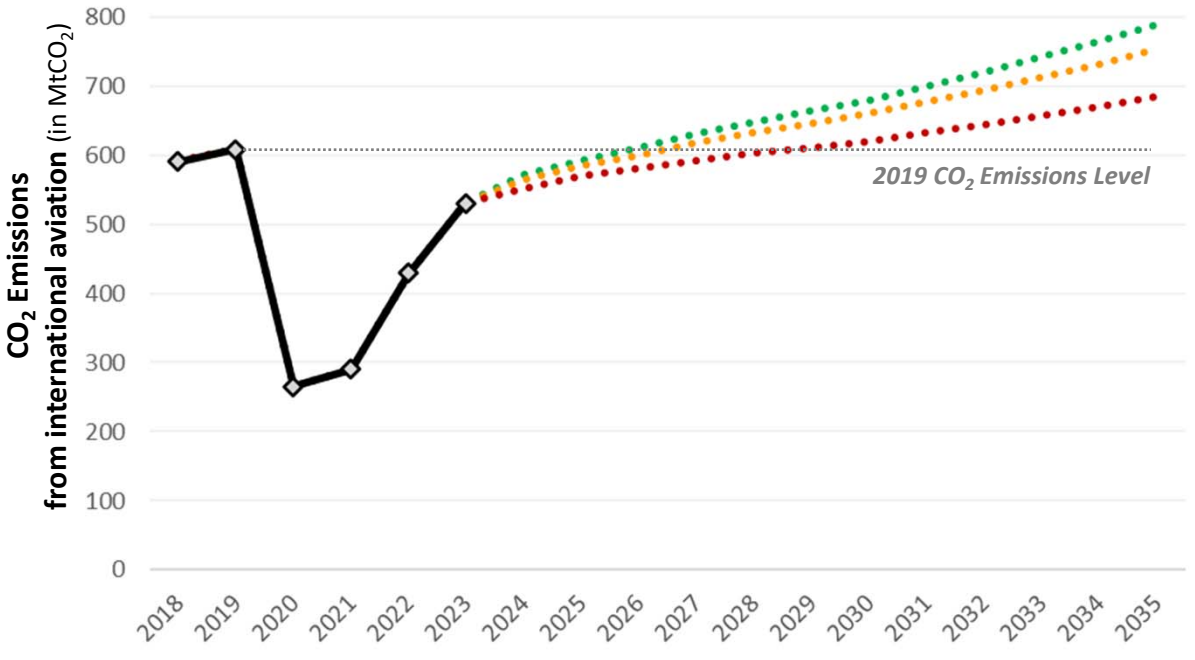
Q6 Would international aviation meet its Carbon Neutral Growth goal from 2020 (CNG2020)?

** Focus on the CORSIA First Phase (2024-2026).*

Updated CO_2 Emissions Projections

- Updated forward looking assessment of CO_2 emissions.
- CO_2 emissions are expected to return to 2019 level by 2026, 2027 and 2029 under the High, Mid and Low CAEP/13 scenarios, respectively.



Legend:

- **High** scenario
- **Mid** scenario
- **Low** scenario

2025 CORSIA Periodic Review*

Actual/Historical CO_2 emissions (based on CORSIA reporting through the CORSIA Central Registry)

* Based on CAEP/13 Trends adjusted for the purpose of CORSIA Analyses (to address consistent underestimation of CO_2 emissions from the CAEP/13 Trends compared to historical data from the CCR). *Disclaimer: "The CAEP/13 Trends are based on the CAEP/13 ICAO/CAEP Traffic Demand Forecasts. These forecasts were developed in 2022-2023 with a base year of 2018 and recommended by CAEP at its 2023 Steering Group meeting (Oct. 2023). As a result, they reflect expectations and long-term trends as of 2023. These forecasts, however, do not take into consideration the current uncertainty and potential effects of changes in trade conditions and the global, regional, and/or national economic dynamics that may affect international aviation traffic demand."*

Questions Addressed in this Section

Q1 How CO_2 emissions from international aviation may evolve from 2024 to 2035?

Q2 **Given CO_2 emissions trends, how much offsetting may be required under CORSIA?**

Q3 How offsetting requirements (demand) may be met using (1) Emissions Reductions from CEF and/or (2) CORSIA Eligible Emissions Units*?

Q4 What are expected costs of compliance*?

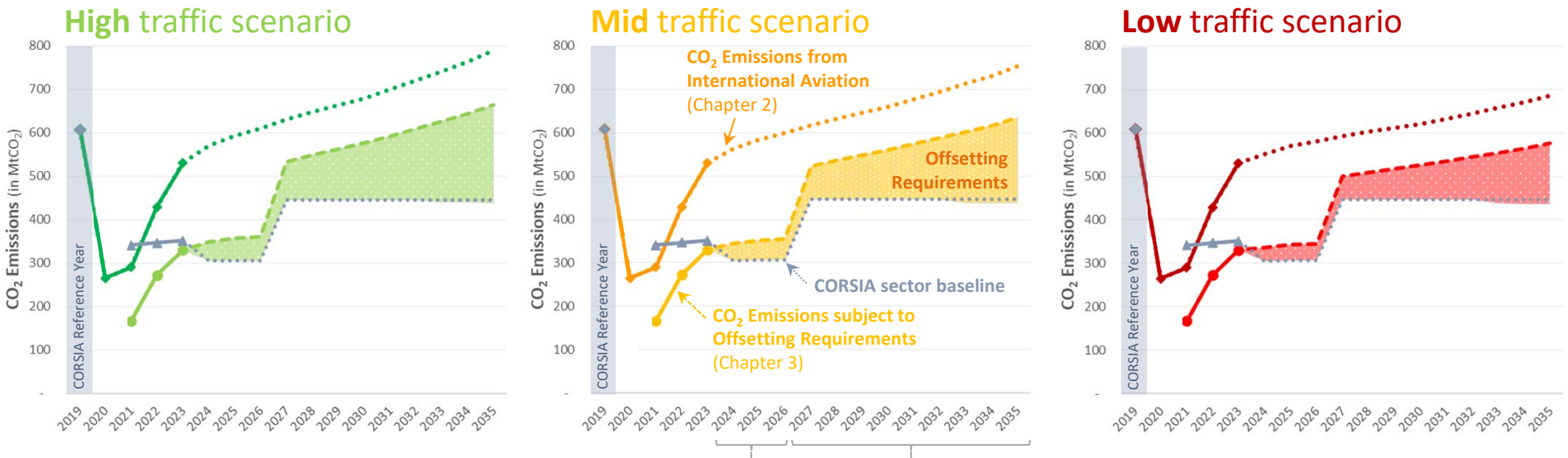
Q5 What offsetting requirements could operators face?

Q6 Would international aviation meet its Carbon Neutral Growth goal from 2020 (CNG2020)?

** Focus on the CORSIA First Phase (2024-2026).*

Estimation of Offsetting Requirements

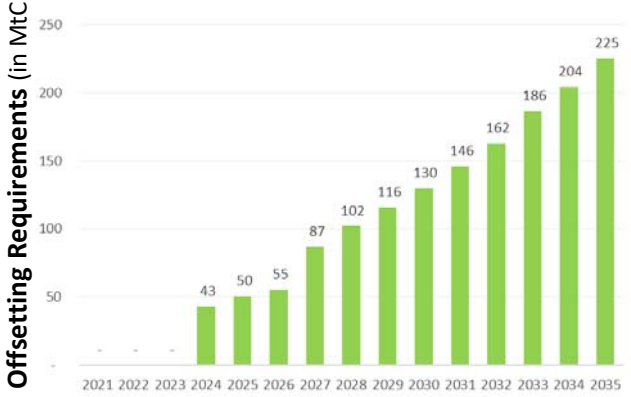
- **Total offsetting requirements across international aviation sector are influenced by the impact of the COVID-19 global pandemic, and the rate of recovery in future years.**



Estimation of Offsetting Requirements (cont.)

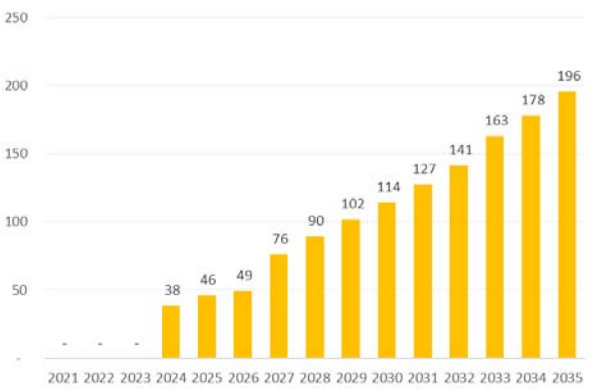
- **Offsetting requirements are expected to start in 2024 under all CAEP/13 scenarios.**

High CAEP/13 scenario



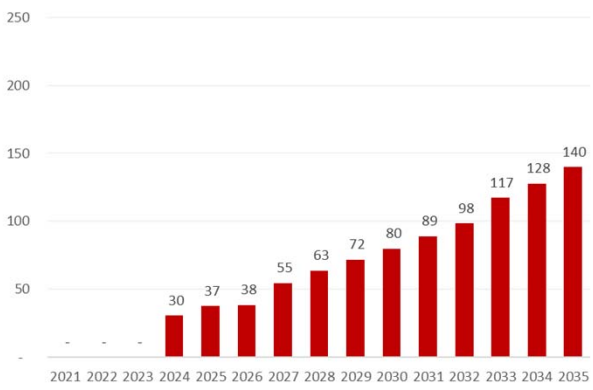
CORSIA Baseline	100% of 2019	85% of 2019												
Sectoral % Individual %	100% Sectoral 0% Individual												85% 15%	
Participation (Nb States)	88	107	115	126	129	134								

Mid CAEP/13 scenario



CORSIA Baseline	100% of 2019	85% of 2019												
Sectoral % Individual %	100% Sectoral 0% Individual												85% 15%	
Participation (Nb States)	88	107	115	126	129	134								

Low CAEP/13 scenario

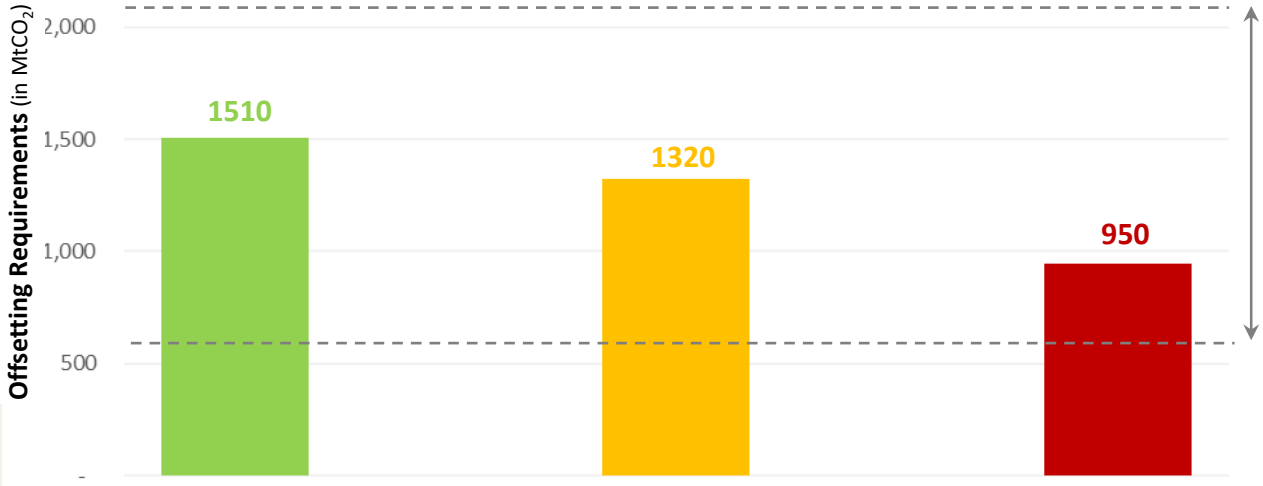


CORSIA Baseline	100% of 2019	85% of 2019												
Sectoral % Individual %	100% Sectoral 0% Individual												85% 15%	
Participation (Nb States)	88	107	115	126	129	134								

Estimation of Offsetting Requirements (cont.)

- **Cumulative offsetting requirements (O.R.) from 2024 to 2035 could range from ≈950 to 1500 $MtCO_2$.**

All Phases
(2021-2035)



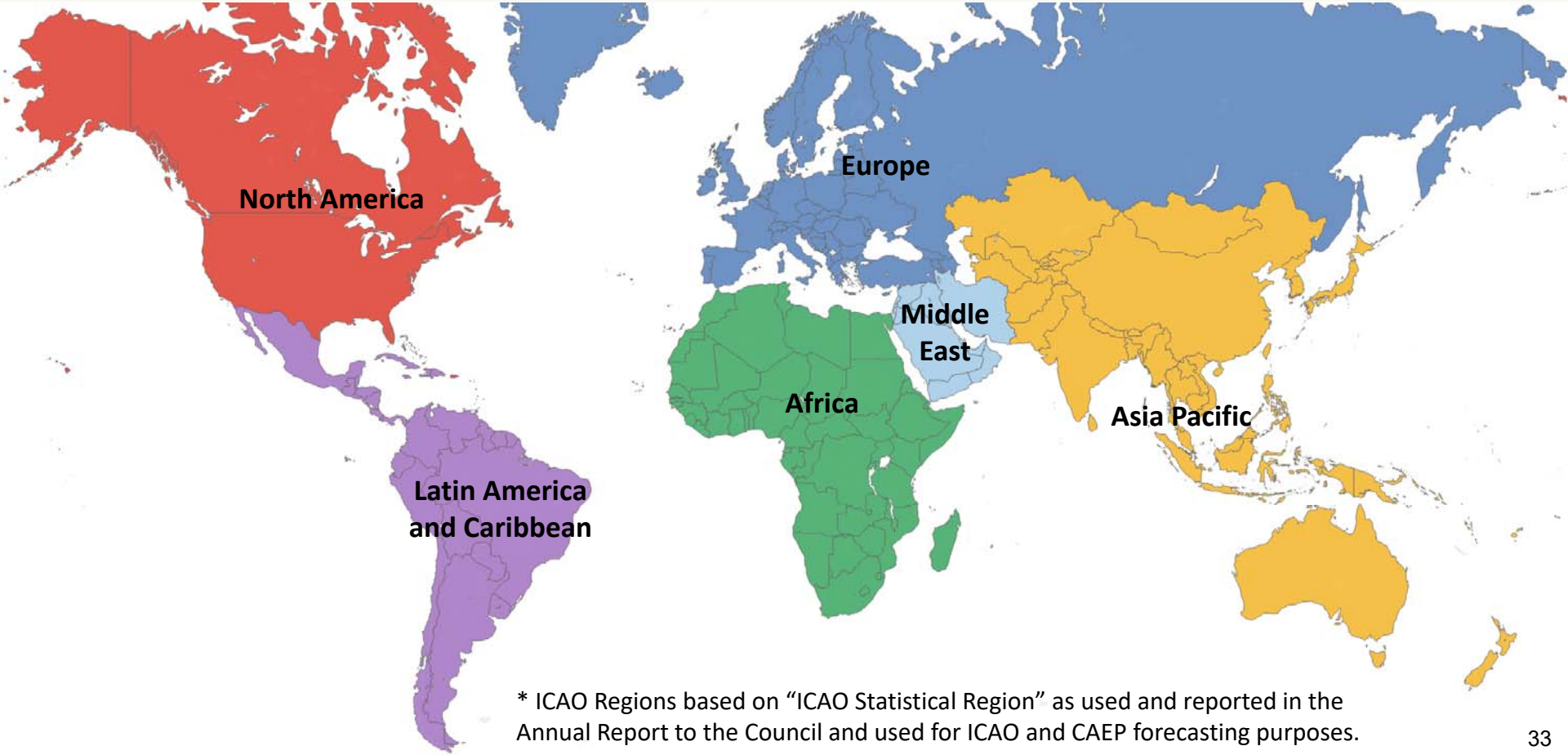
Note. – Average results from 100 runs of stochastic CORSIA model.

Scenario Assumptions			
CO_2 Emissions Trends	**High** ICAO-CAEP/13 Traffic	**Mid** ICAO-CAEP/13 Traffic	**Low** ICAO-CAEP/13 Traffic
CORSIA Baseline (2021-2023)	2019 (only)	2019 (only)	2019 (only)
CORSIA Baseline (2024-2035)	85% of 2019	85% of 2019	85% of 2019

Range of estimates from June 2022 analyses*.
i.e., "*Under an 85% of 2019 baseline for 2024-2035, O.R. could range from 600 to 2100 $MtCO_2$.*"

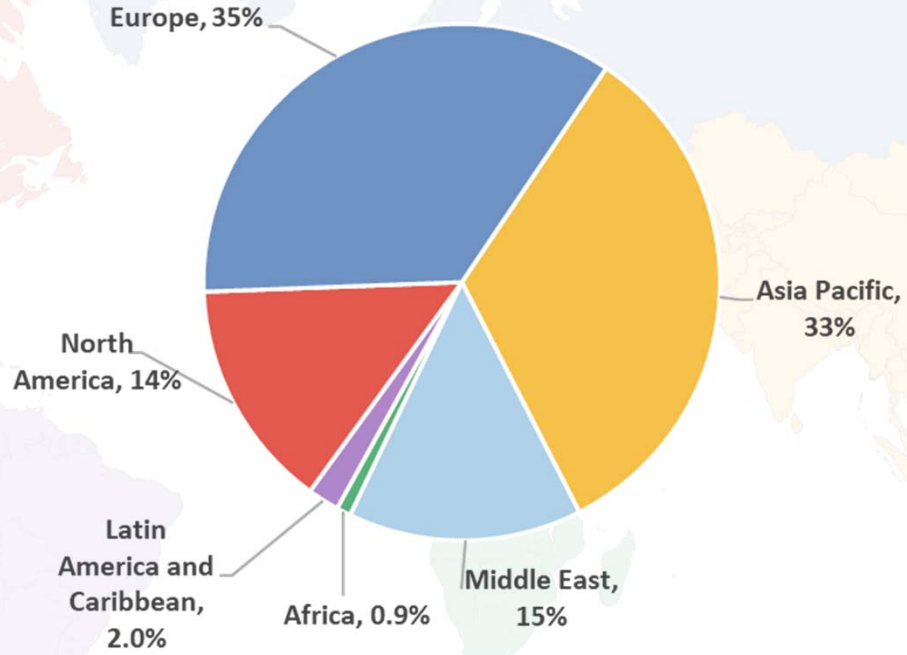
* Note: 85% baseline was evaluated in the June 2022 CORSIA analyses. However, these analyses did not include the changes to Sectoral/Individual shares agreed at Assembly 41, leading to minor differences in total O.R.

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 Demand i.e., Regional Distribution of Offsetting Requirements (2021-2035)



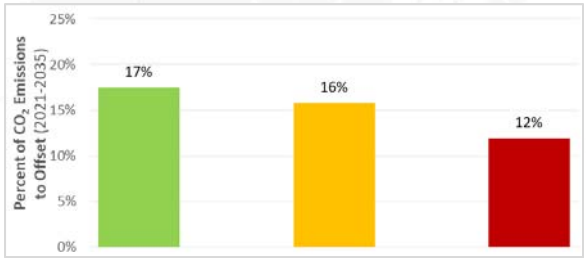
Total: ≈ 1320 $MtCO_2$

Range: 950-1510 $MtCO_2$

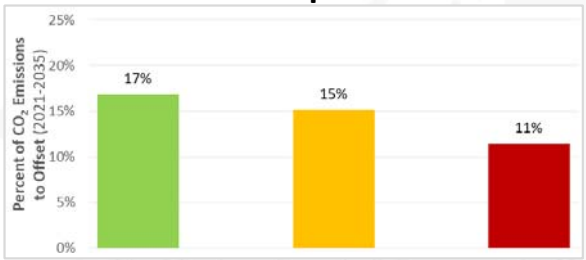
Regional Distributions of Offsetting Requirements Relative to CO_2 emissions

Percent CO_2 emissions to offset based on **total international aviation CO_2 emissions** (A16V4 Chapter 2).*

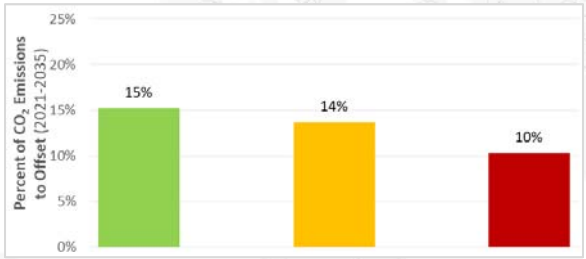
North America



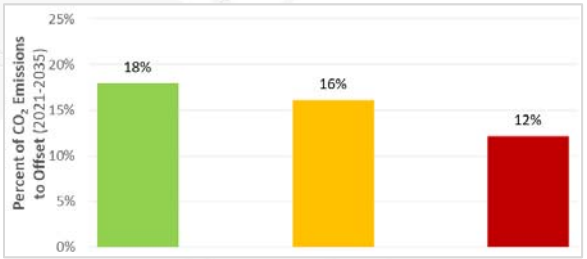
Europe



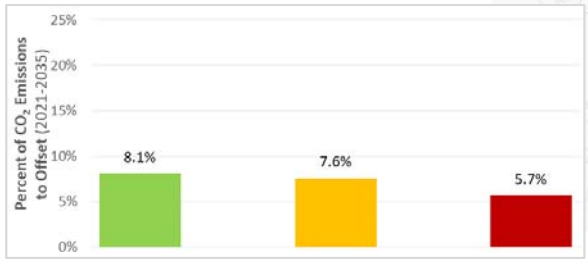
Middle East



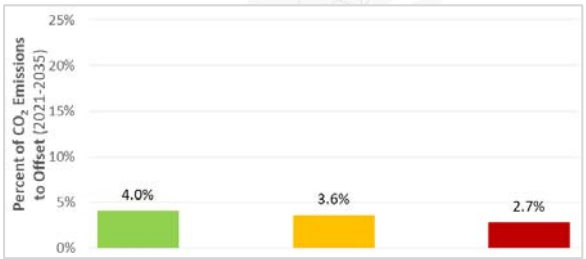
Asia Pacific



Latin America and Caribbean



Africa



* *Percent CO_2 emissions to offset calculated as: total offsetting requirements (2021-2035) divided by total CO_2 emissions from international aviation (A16V4 Chapter 2) from 2021 to 2035.*

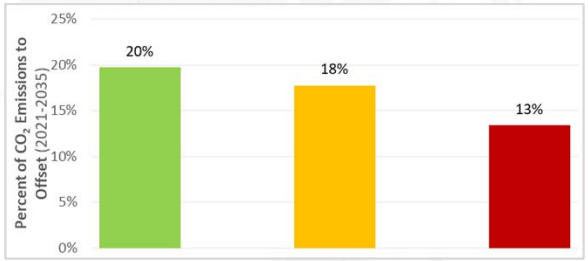
Summary of Assumptions:

CORSIA Baseline Ref. Year (Pilot):	2019
CORSIA Baseline Ref. Year (2024-2035):	85% of 2019
Sectoral/Individual :	100% in 2021-2032
Sectoral/Individual :	85% / 15% in 2033-2035
States for Chapter 3 State Pairs:	Editions 1 – 5 (Rev1)

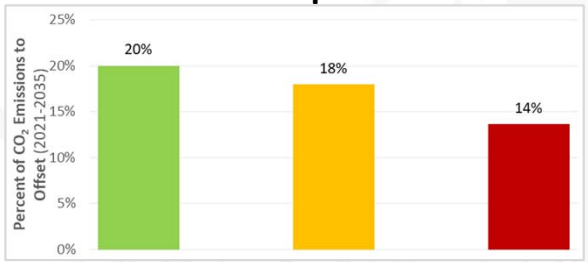
Regional Distributions of Offsetting Requirements Relative to CO_2 emissions subject to O.R.

Percent Chapter 3 CO_2 emissions to offset based on **total international aviation CO_2 emissions subject to offsetting requirements** (A16V4 Chapter 3).*

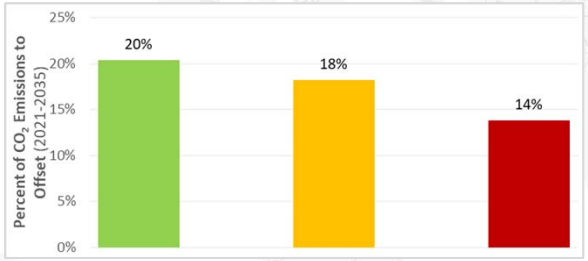
North America



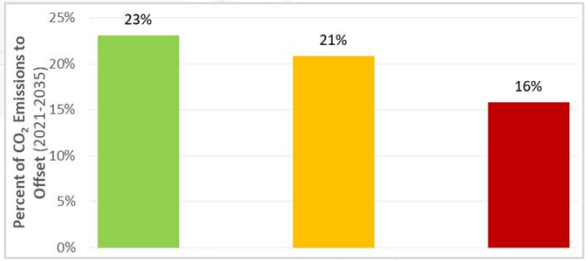
Europe



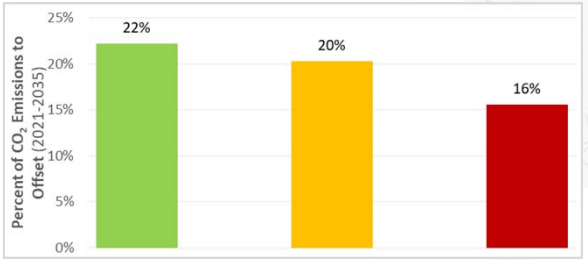
Middle East



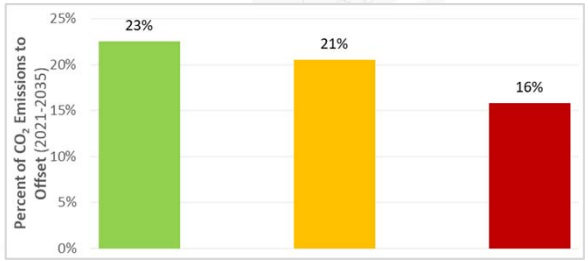
Asia Pacific



Latin America and Caribbean



Africa



* *Percent Chapter 3 CO_2 emissions to offset calculated as: total offsetting requirements (2021-2035) divided by total international aviation CO_2 emissions subject to offsetting requirements (A16V4 Chapter 3) from 2021 to 2035.*

Summary of Assumptions:

CORSIA Baseline Ref. Year (Pilot):	2019
CORSIA Baseline Ref. Year (2024-2035):	85% of 2019
Sectoral/Individual :	100% in 2021-2032
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States for Chapter 3 State Pairs:	Editions 1 – 5 (Rev1)

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Q3 How offsetting requirements (demand) may be met using (1) Emissions Reductions from CEF and/or (2) CORSIA Eligible Emissions Units*?

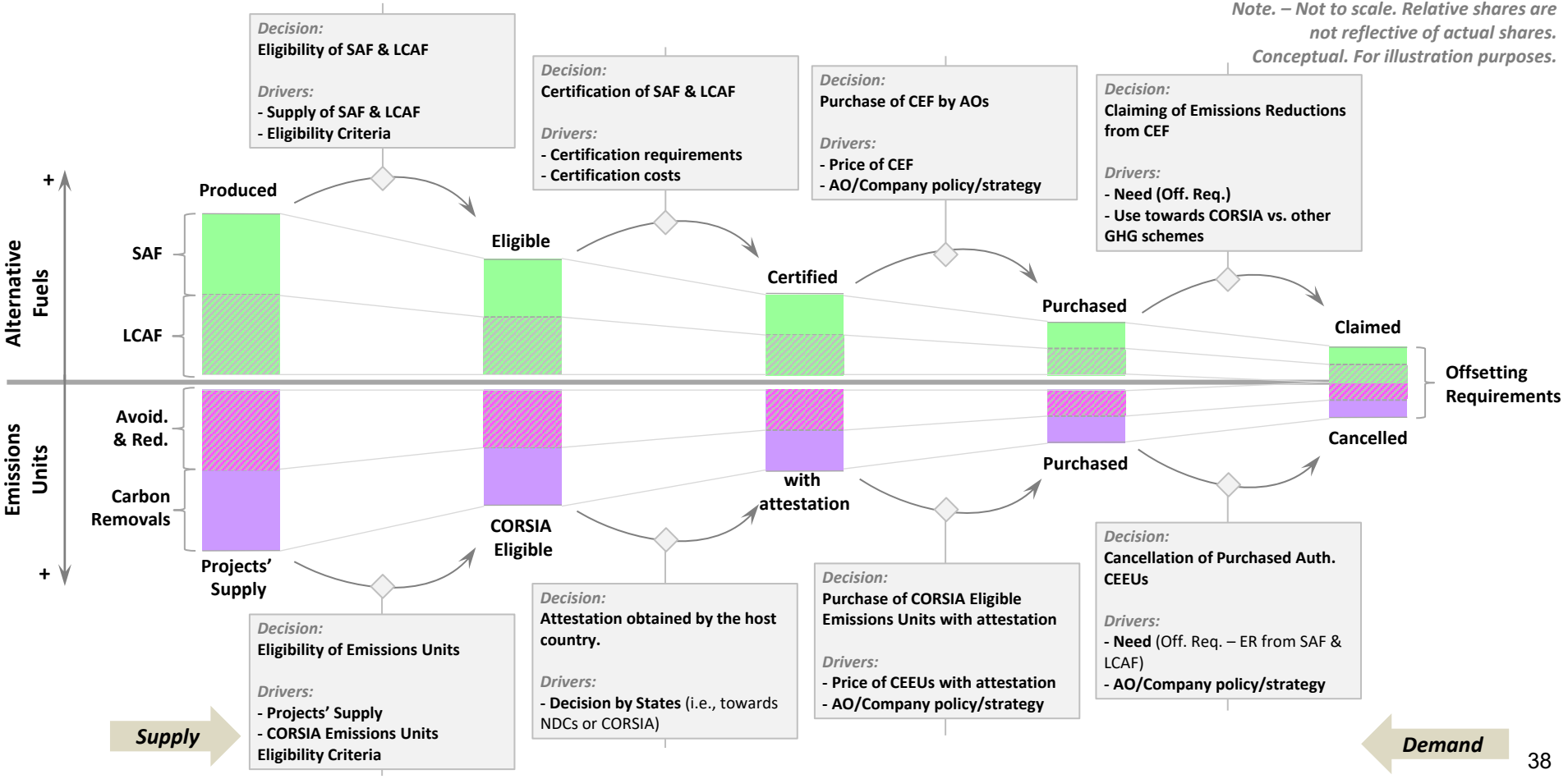
Q4 What are expected costs of compliance*?

Q5 What offsetting requirements could operators face?

Q6 Would international aviation meet its Carbon Neutral Growth goal from 2020 (CNG2020)?

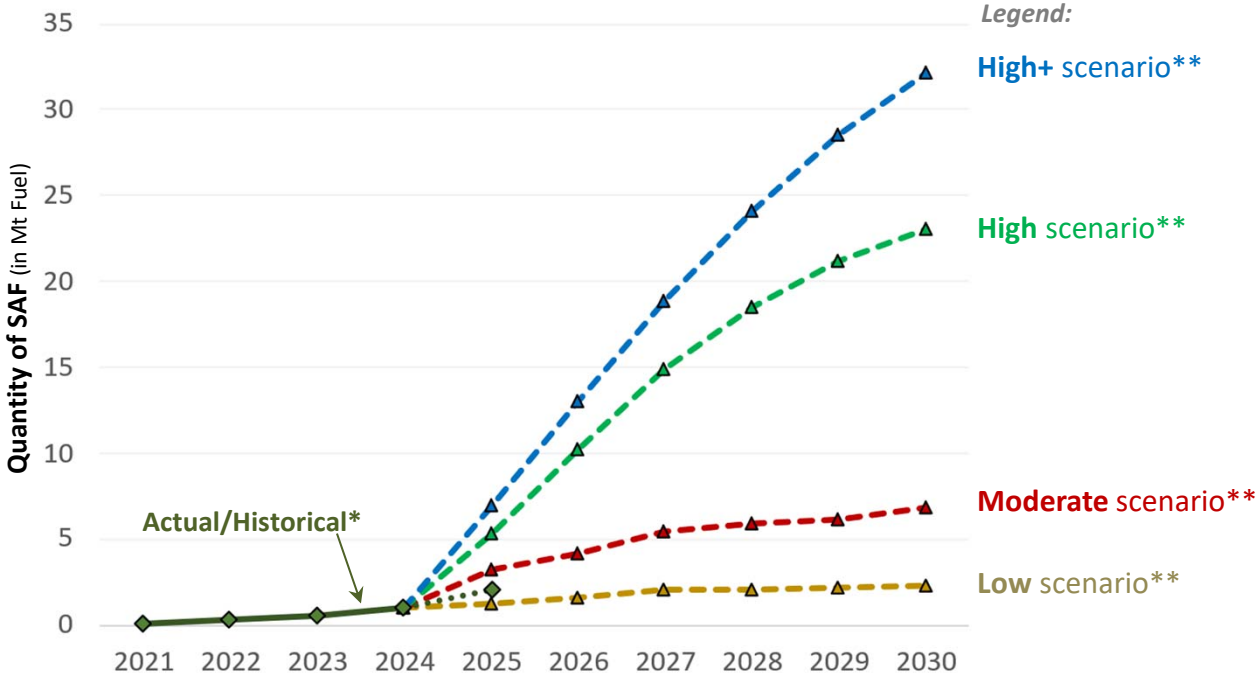
** Focus on the CORSIA First Phase (2024-2026).*

Framework towards the assessment of the role of Emissions Reductions from CEF and CORSIA Eligible Emissions Units



Scenario-based Projections of the Production of SAF

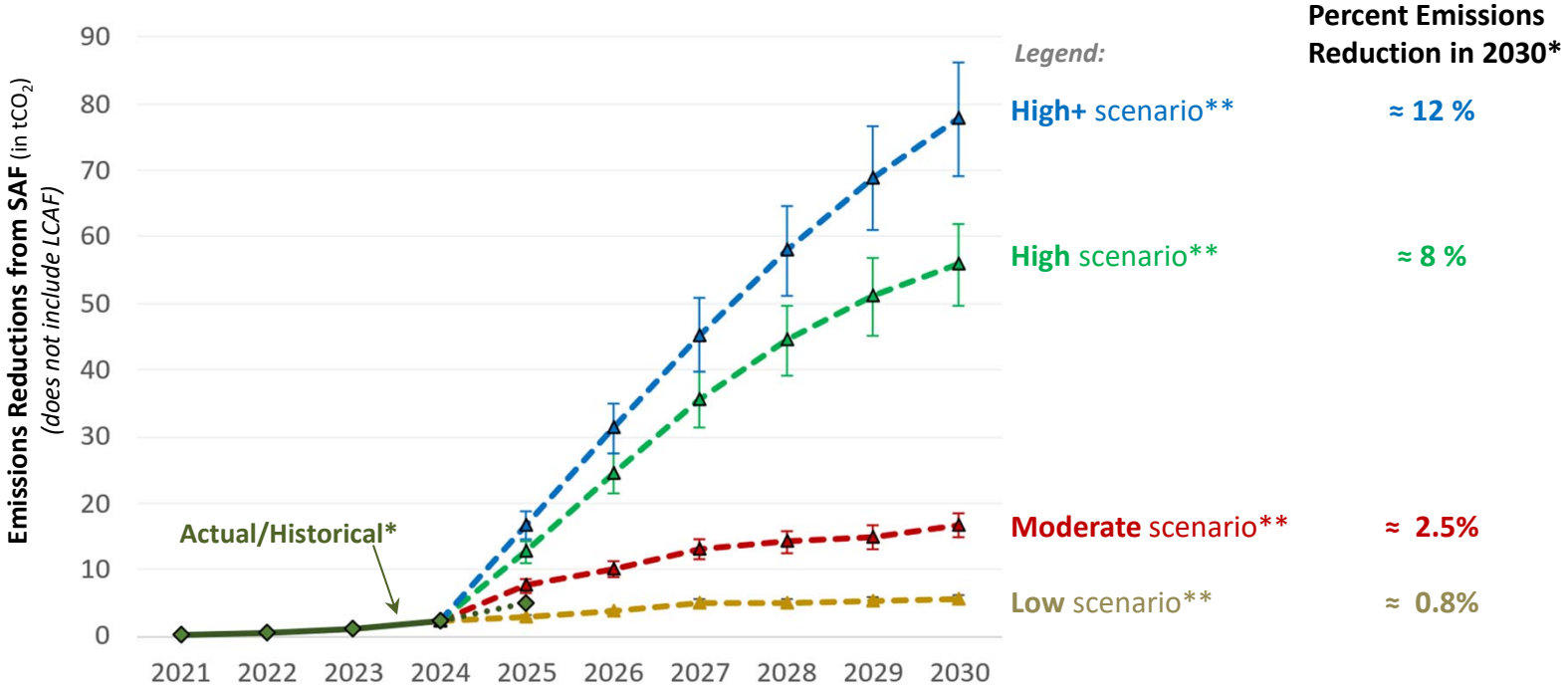
- **The CAEP considered the latest short term SAF production data through 2030.**
- **For the First Phase of CORSIA (2024-2026), global SAF production may reach "Moderate scenario" levels.** The High and High+ scenarios are assessed as unlikely in 2025-2026.



References: *Historical data reported by IATA. ** CAEP WG5 short term production database (version April, 2025).

Scenario-based Projections of Emissions Reductions from SAF

- **Estimations of emissions reductions from SAF require assumptions on the life cycle value of the fuel. Average ERF of ≈75% was assumed with a range from ≈65%** (based on CAEP LTAG F1 scenario) **and ≈85%** (based on CEF Certified towards CORSIA in 2023-2024).



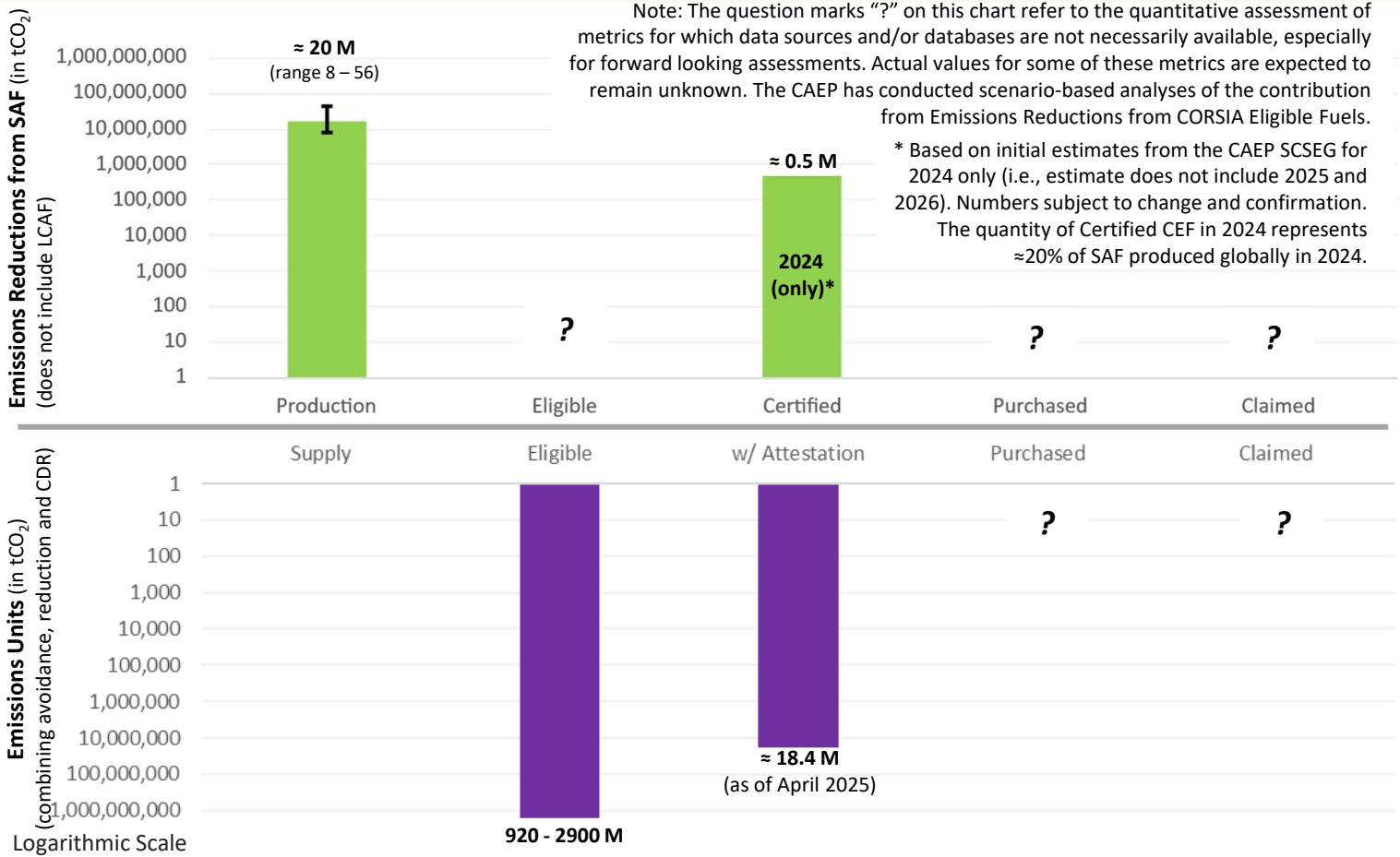
* Calculated as total global SAF production (given a scenario) divided by estimated CO_2 emissions from international aviation in 2030 (Mid traffic scenario).

ICAO ENVIRONMENT

Updated Forward Looking CORSIA Analyses Q3

Assessment of the role of Emissions Reductions from SAF and CORSIA Eligible Emissions Units (Focus on 2024-2026)

Logarithmic Scale



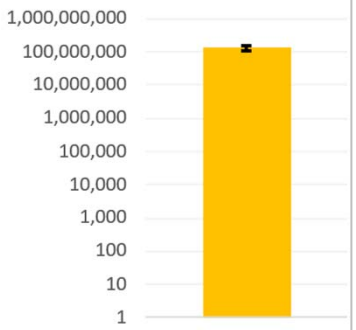
Note: The question marks "?" on this chart refer to the quantitative assessment of metrics for which data sources and/or databases are not necessarily available, especially for forward looking assessments. Actual values for some of these metrics are expected to remain unknown. The CAEP has conducted scenario-based analyses of the contribution from Emissions Reductions from CORSIA Eligible Fuels.

* Based on initial estimates from the CAEP SCSEG for 2024 only (i.e., estimate does not include 2025 and 2026). Numbers subject to change and confirmation. The quantity of Certified CEF in 2024 represents ≈20% of SAF produced globally in 2024.

Offsetting Requirements

≈ 135 $MtCO_2$

during the First Phase of CORSIA



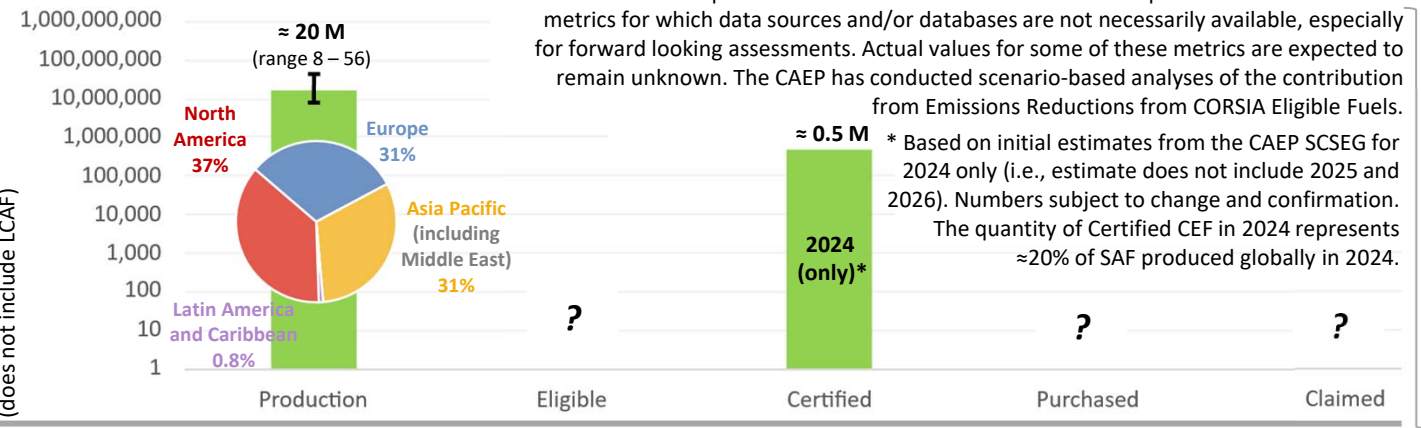
ICAO ENVIRONMENT

Updated Forward Looking CORSIA Analyses Q3

Regional Breakdown of the Emissions Reductions from SAF and CORSIA Eligible Emissions Units (Focus on 2024-2026)

Logarithmic Scale

Emissions Reductions from SAF (in tCO_2) (does not include LCAF)



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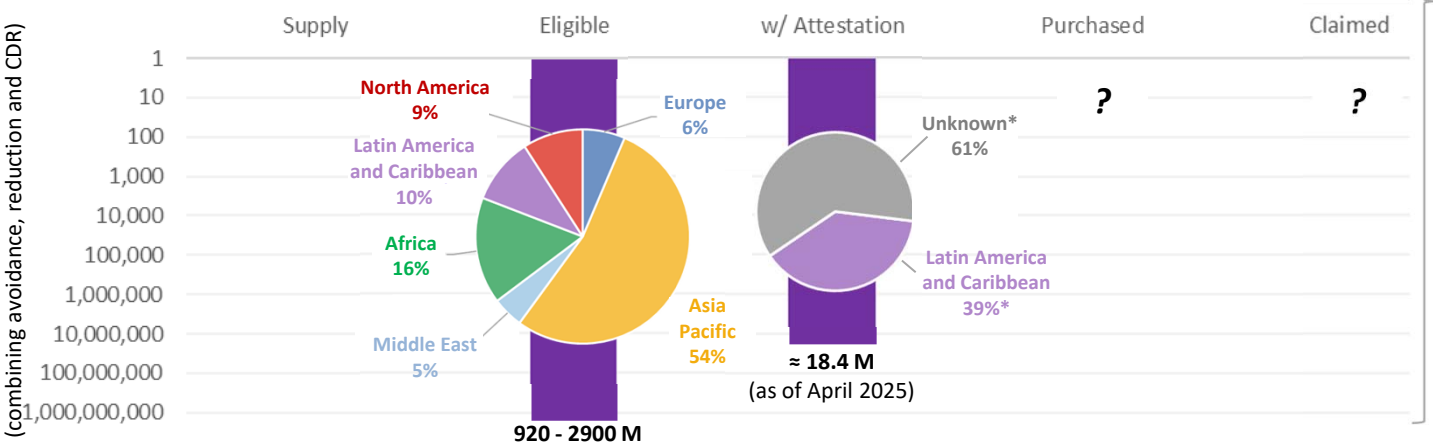
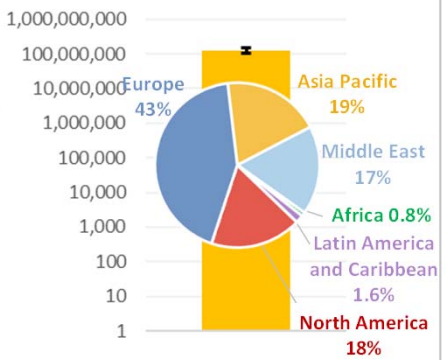
* Based on initial estimates from the CAEP SCSEG for 2024 only (i.e., estimate does not include 2025 and 2026). Numbers subject to change and confirmation. The quantity of Certified CEF in 2024 represents ≈20% of SAF produced globally in 2024.

Emissions Units (in tCO_2) (combining avoidance, reduction and CDR)



Offsetting Requirements

≈ 135 $MtCO_2$ during the First Phase of CORSIA



Logarithmic Scale

* Comprehensive geographical distribution not available in the TAB report and surveys. Estimates based on regional distribution information from program registries.

Assessment of the Potential Allocation of SAF/CEF to CORSIA vs. other GHG Schemes*

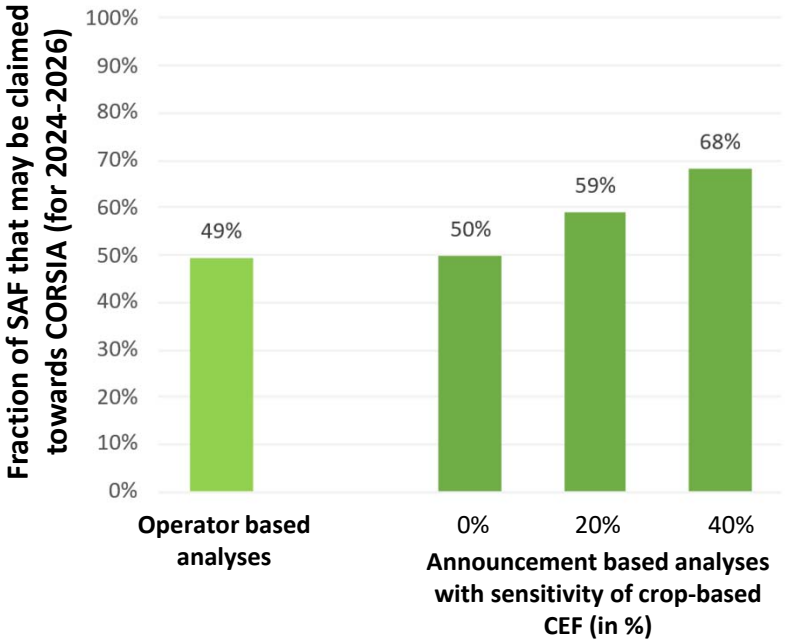
- **While CORSIA is the only global market-based measure applying to CO_2 emissions from international aviation*, emissions reductions from CORSIA eligible fuels may be claimed towards other GHG schemes.**

- **The CAEP started to:**
  - **identify and review of other relevant GHG schemes,**
  - **assess of the use of SAF/CEF by aeroplane operators,**
  - **quantify the likelihood of claiming SAF/CEF towards CORSIA vs. other GHG schemes.**

* **"CORSIA is the only global market-based measure applying to CO_2 emissions from international aviation"** (ICAO Resolution A41-22 par. 18). Note: Through C-DEC 232/6 action e), the Council requested CAEP to consider "other […] GHG schemes", which requires considering specific country and/or regional schemes for purpose of technical analyses.

Summary of Results of Assessment of the Potential Allocation of SAF/CEF to CORSIA vs. other Schemes

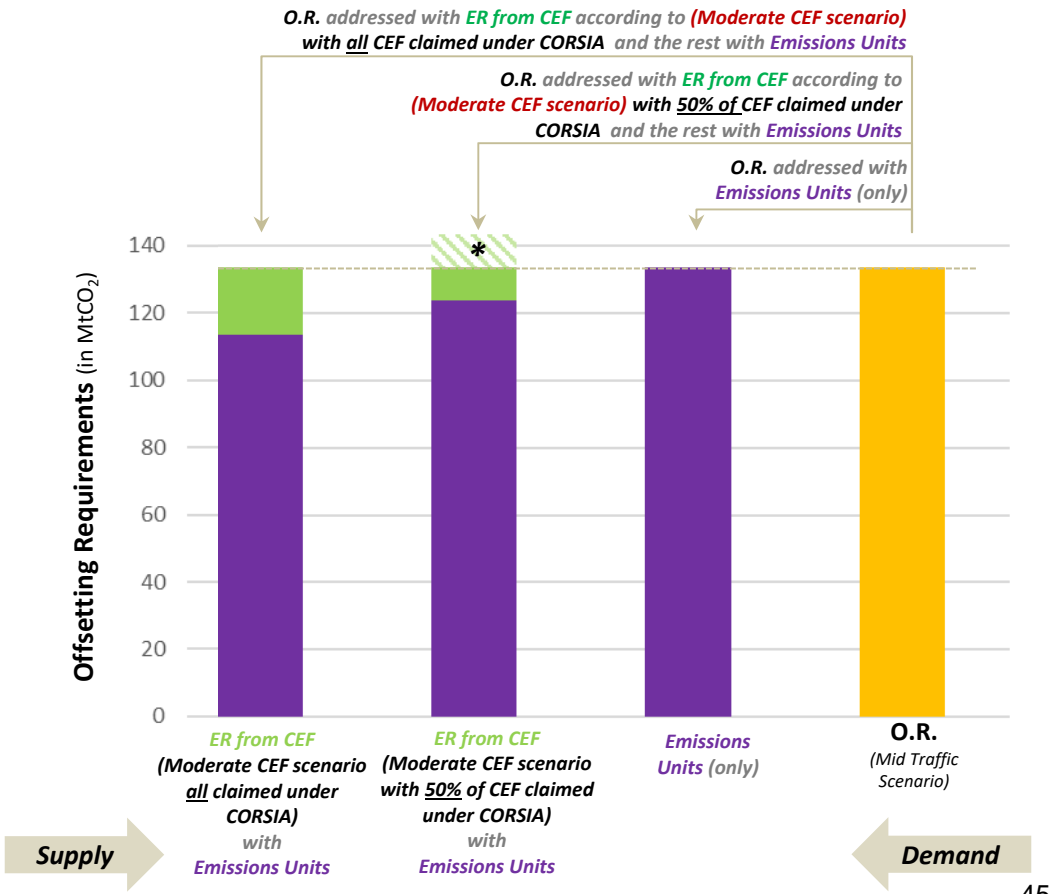
- **The CAEP conducted two complementary assessments of the historical, current and expected use of SAF/CEF:**
  - **Operator based analyses using operator reported SAF usage (Tier 1 data), announcements of SAF uptake (Tier 2 data).**
  - **Multi-factor assessment including; SAF announcements, SAF production across States and emissions distribution.**
- **First order assessments* indicate that ≈ 50% of SAF, produced globally, may be claimed towards CORSIA** (the remainder towards other schemes or not claimed)**. This percentage may increase with increasing fractions of crop-based CEF available, however the share of crop-based CEF is likely to remain limited during the first phase of CORSIA.**
- **For the purpose scenario-based analyses, a 50% fraction was assumed for the first phase. Additional tracking and future work is needed/expected to further refine future assessments.**



* Note: This analysis does not include a constraint on the share of CEF certified in 2024 (pending confirmation by SCSEG). Such constraints will be added in future CAEP assessments.

How Offsetting Requirements may be Addressed with SAF and/or Emissions Units?

- **Given the uncertainty in how aeroplane operators may choose to address offsetting requirements** (i.e., mix of ER from CEF and/or Emissions Units)**, a scenario-based assessment was conducted.**
- **Illustration using the Moderate SAF production scenario with full and partial claiming towards CORSIA.**
- **Emissions reduction from CEF may address up to ≈15 % of offsetting requirements during the First Phase of CORSIA.**



How Offsetting Requirements may be Addressed with SAF and/or Emissions Units?

- **Cumulative Final Offsetting Requirements (i.e., demand for emissions units) during the First Phase (2024-2026) expected to vary due to traffic and emissions reductions from CEF scenarios.**

Cumulative ER from CEF and Cumulative Final Offsetting Requirements 2024-2026

CEF Scenarios*

Traffic Scenarios	High +	High	Moderate	Low	No ER from CEF
High Traffic Scenario	25 $MtCO_2$ 124 $MtCO_2$	20 $MtCO_2$ 129 $MtCO_2$	10 $MtCO_2$ 139 $MtCO_2$	5 $MtCO_2$ 144 $MtCO_2$	0 $MtCO_2$ 149 $MtCO_2$
Mid Traffic Scenario	25 $MtCO_2$ 108 $MtCO_2$	20 $MtCO_2$ 113 $MtCO_2$	10 $MtCO_2$ 123 $MtCO_2$	5 $MtCO_2$ 128 $MtCO_2$	0 $MtCO_2$ 133 $MtCO_2$
Low Traffic Scenario	25 $MtCO_2$ 81 $MtCO_2$	20 $MtCO_2$ 86 $MtCO_2$	10 $MtCO_2$ 96 $MtCO_2$	5 $MtCO_2$ 101 $MtCO_2$	0 $MtCO_2$ 106 $MtCO_2$

CEF scenarios assessed as unlikely to be achieved for the First Phase of CORSIA (2024-2026 compliance cycle)

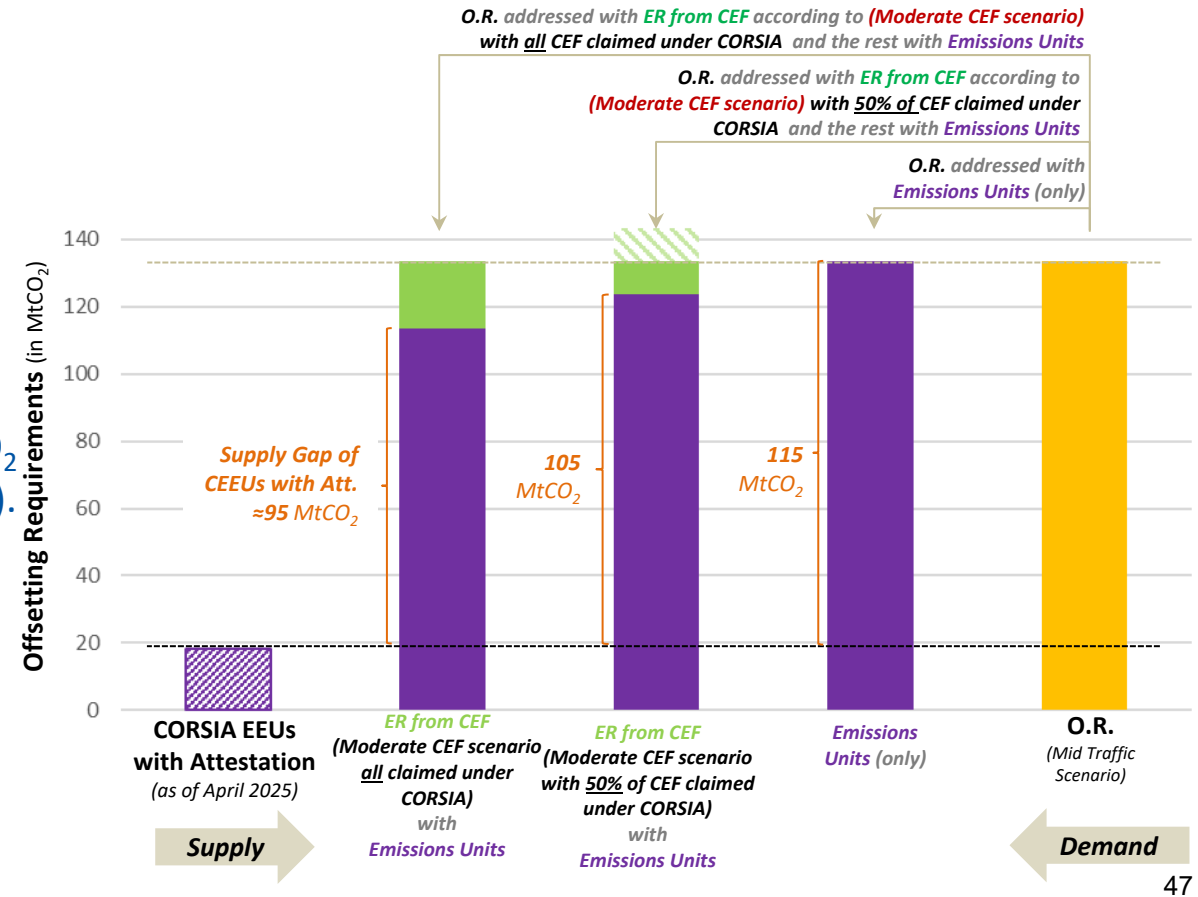
+ Traffic (CO_2 Emissions) –

+ Emissions Reductions from CEF –

* References and assumptions: Emissions Reductions from CEF based on 2025 CAEP Short Term SAF Production projections and partial allocation (50% split) of CEF towards CORSIA.

How Offsetting Requirements may be Addressed with SAF and/or Emissions Units?

- **As of April 2025, the known supply of CORSIA EEUs with attestation reached ≈18.4 million units.**
- **After taking into account the potential contribution from emissions reductions from CEF, there is a gap in the supply of CORSIA EEUs with attestation of ≈95-115 million units** (70-130 $MtCO_2$ across traffic forecasts and CEF scenarios).
- **It is expected but also critical that more CEEUs with attestations become available before Feb. 2028** (i.e., transforming the available supply of CEEUs into supply of CEEUs with attestation to meet offsetting requirements during the First Phase).



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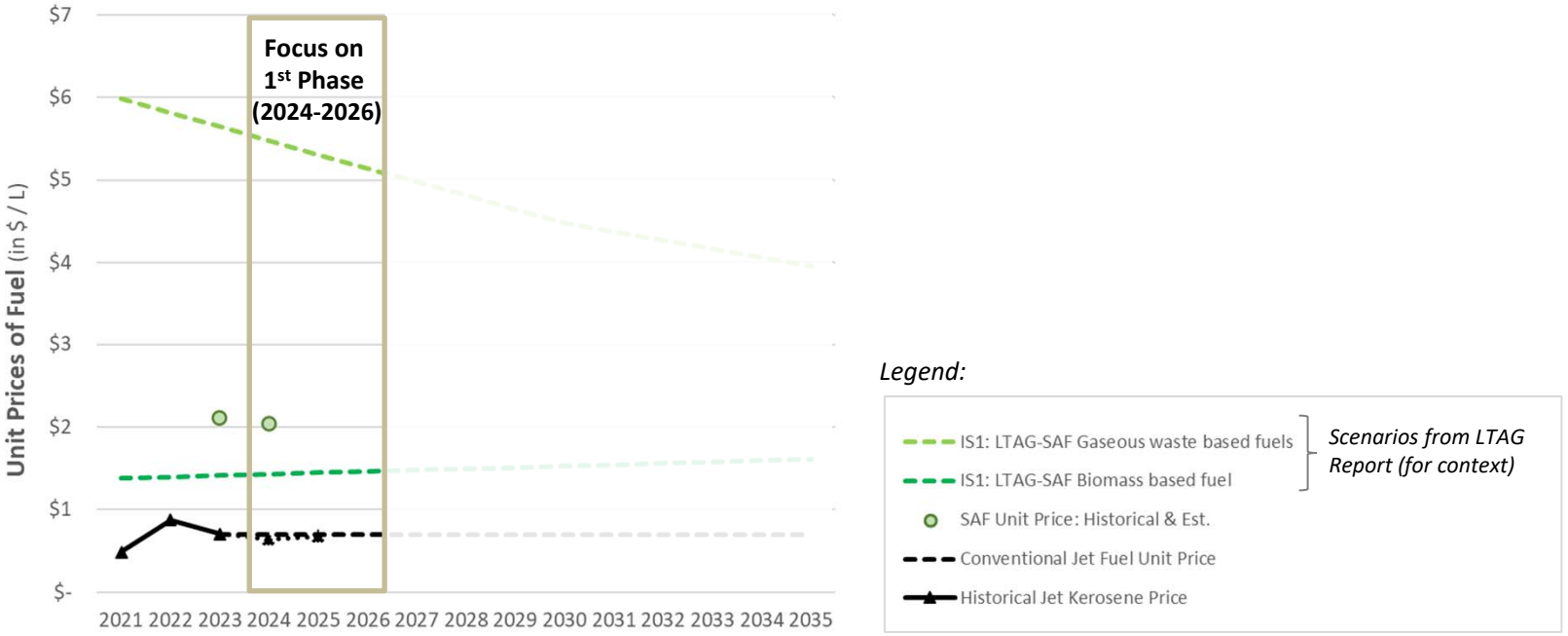
Q5 What offsetting requirements could operators face?

Q6 Would international aviation meet its Carbon Neutral Growth goal from 2020 (CNG2020)?

** Focus on the CORSIA First Phase (2024-2026).*

Summary of Estimates of Price of SAF

- **Conventional jet fuel price is estimated at ≈ $0.7 per Liter for 2024*.**
- **The unit price of SAF is ≈ $2.0 per Liter** (≈ 2.8x the price of conventional jet fuel).

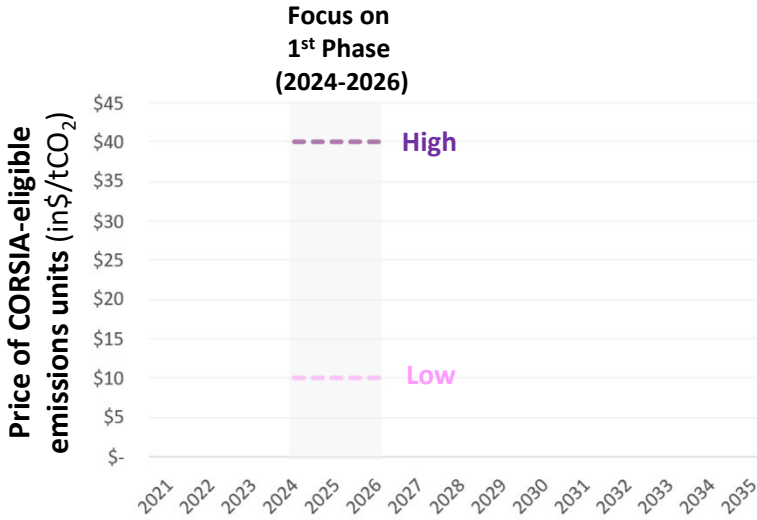


* IATA, Industry Statistics, Industry Statistics, Fact Sheet, December 2024, www.iata.org/en/iata-repository/pressroom/fact-sheets/industry-statistics,
** Sources: IATA, Quantum Commodity Intelligence, Argus, EASA.

Summary of Estimates of Price of Emissions Units

- The CAEP has updated its estimates of price of emissions units.
- Supply for emissions units from the TAB were considered.
- Updated demand estimates as presented in previous slides were also considered.
- For price, the CAEP noted that:
  - The market for CORSIA-eligible units remains at a nascent stage.
  - Actual transactions of CEEUs for the first phase were recently reported (unit prices ≈ $21-22 /$tCO_2$). CEEU supply with attestation is currently limited to one project (i.e., Guyana ART TREES) making it a situation of monopoly that may affect the unit prices.
  - Unit prices could decline as supply with attestation become available.
  - Operators are also waiting to receive confirmation of demand and offsetting requirements for 2024.
  - Need to continue to monitor supply, demand and unit prices in the coming months.

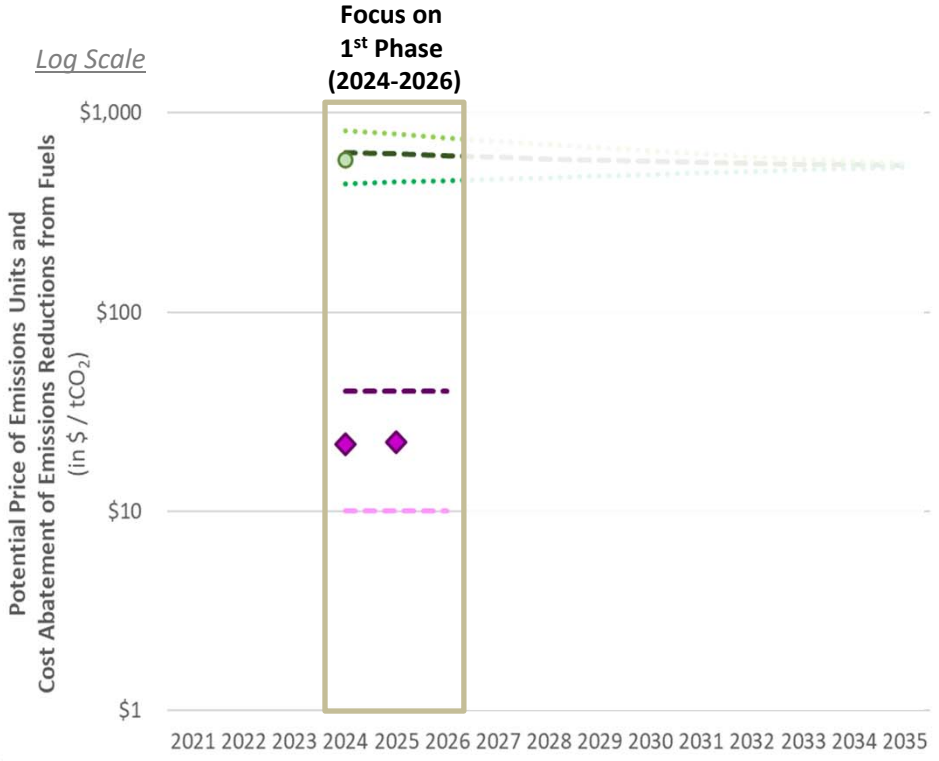
CAEP/13 scenario-based price of CORSIA-eligible emissions units through 2026



Note: Caveats and limitations apply.
Details available from CAEP.

Summary of Unit Prices

- **Cost abatement (i.e., SAF Premium / tCO_2 abated) from the Emissions Reductions from SAF ranges from ≈ $600-800 per tCO_2. Prices of CORSIA eligible emissions units may range from $10 to $40 per tCO_2 during the First Phase of CORSIA.**



Legend:

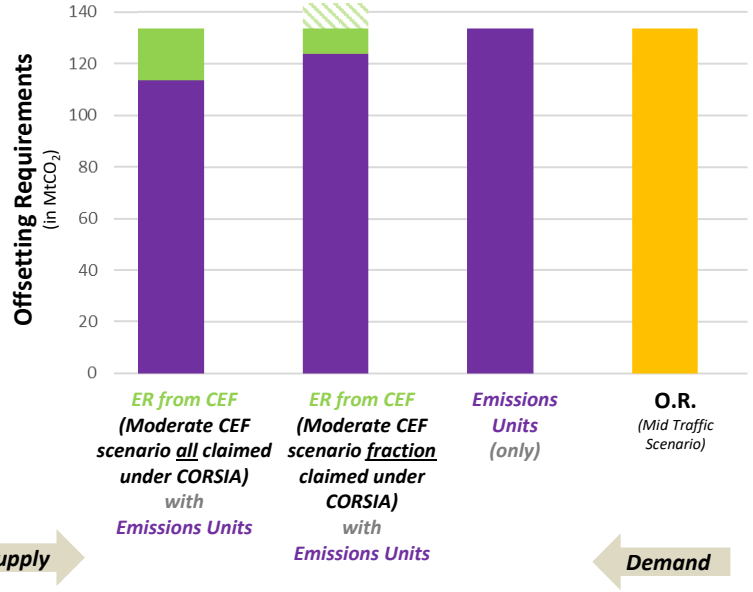
- Price ER from CEF (Mid) based on historical data and trend btw High and Low
- Price ER from CEF (High) Weighted LTAG-IS1 (F1) Scenario
- Price ER from CEF (Low) LTAG-IS1 (F1) Biomass based fuel only (High Price)
- Historical (SAF)
- CORSIA EEUs (High)
- CORSIA EEUs (Low)

Note: LTAG-TG Cost Abatements based on updated 0.7 $/L for Conventional Jet Fuel.

Addressing Offsetting Requirements during the First Phase of CORSIA with Cost Implications

How Offsetting Requirements may be Addressed with SAF and/or Emissions Units?

(Scenario-based analysis)

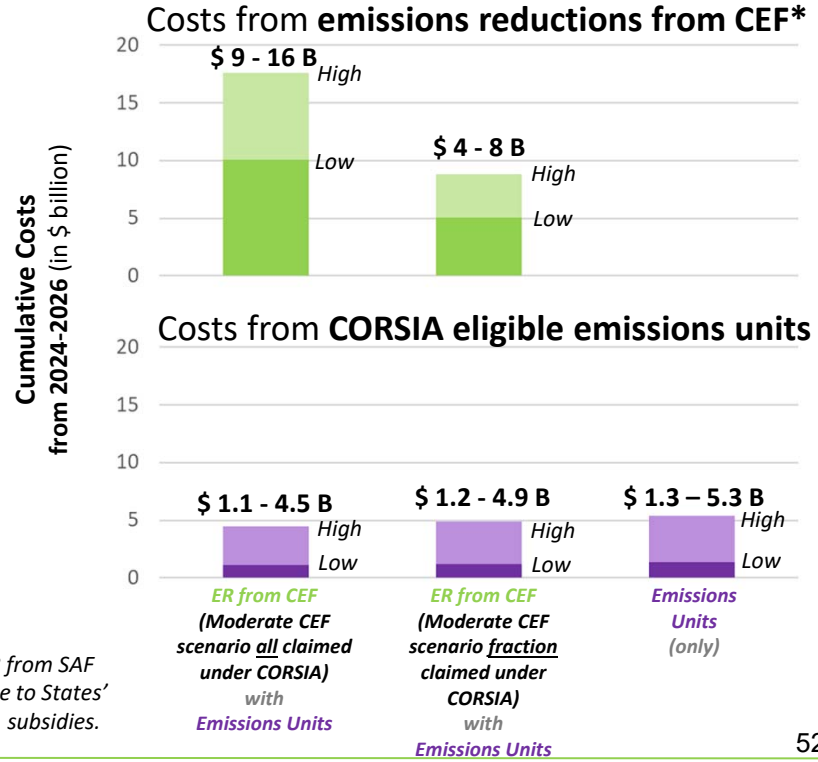


Prices of ER from SAF and Emissions Units:
Data & Assumptions

**Note: Actual cost of ER from SAF expected to be lower due to States' support e.g., tax credits, subsidies.*

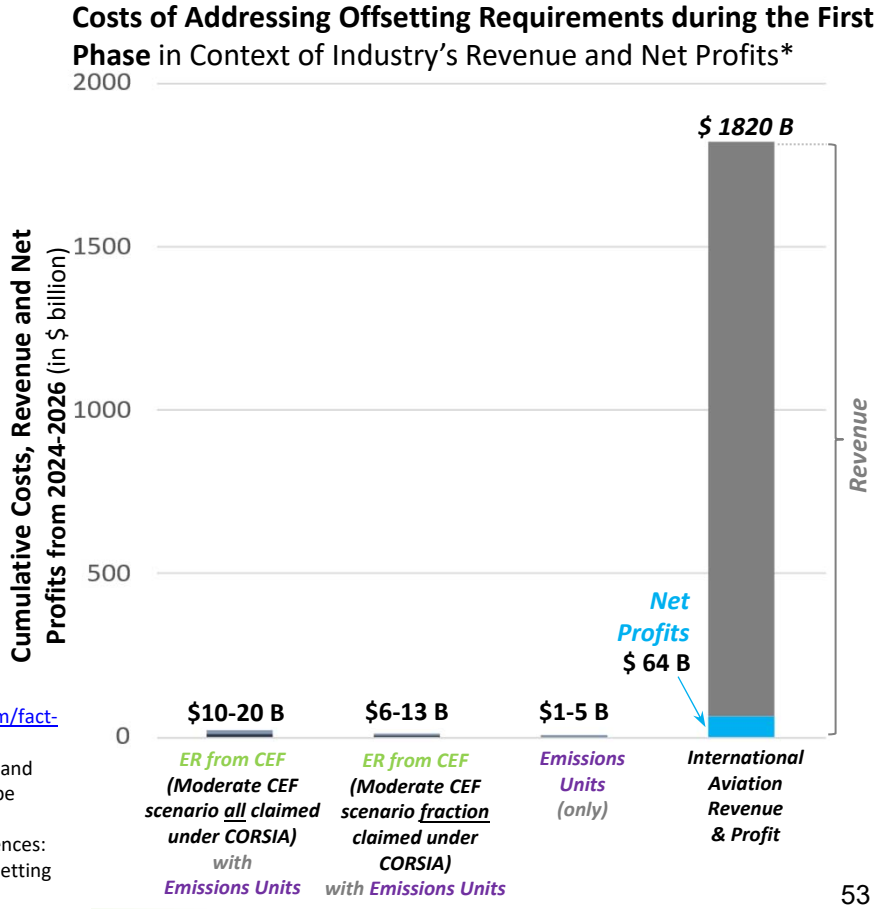
How much would it cost to address Offsetting Requirements during the First Phase ?

(Scenario-based analysis)



Costs of Addressing Offsetting Requirements during the First Phase in Context of Industry's Revenue

- **Costs associated with addressing offsetting requirements from 2024 to 2026 could range from ≈ $1 to 5 billion using Emissions Units (only). These costs are lower than those anticipated in 2016 before CORSIA was agreed**.**
- **Costs could reach up to ≈ $10 to 20 billion using a mix of Emissions Units and ER from CEF assuming that all the CEF, according to the latest CAEP Moderate scenario, are claimed towards CORSIA.**
- **These total costs associated with addressing offsetting requirements could represent ≈ 0.07% to 1.1% of international aviation revenue from 2024 to 2026*.**
- These costs could represent ≈2% to 32% of net profits from 2024 to 2026*.



* IATA estimated global aviation industry revenues of $ 965 billion with projected revenues for 2025 at $1007 billion. References: IATA, Industry Statistics, December 2024, Fact Sheet, https://www.iata.org/en/iata-repository/pressroom/fact-sheets/industry-statistics/ and Global Outlook for Air Transport https://www.iata.org/en/iata-repository/publications/economic-reports/global-outlook-for-air-transport-december-2024/. Extrapolating for 2026 and assuming a 60% ratio for international aviation, cumulative revenues from international aviation were estimated to be approx. $ 1800 billion.

**In 2016, the CAEP estimated the costs from a global MBM to range from $2.2 to $6.2 billion (in 2025 alone). References: CAEP analysis presented at EAG/15 (January 2016); and IATA, "Comments on the Cost Impact of a Global Carbon Offsetting Mechanism", https://www.icao.int/Meetings/a39/Documents/WP/wp_153_rev1_en.pdf

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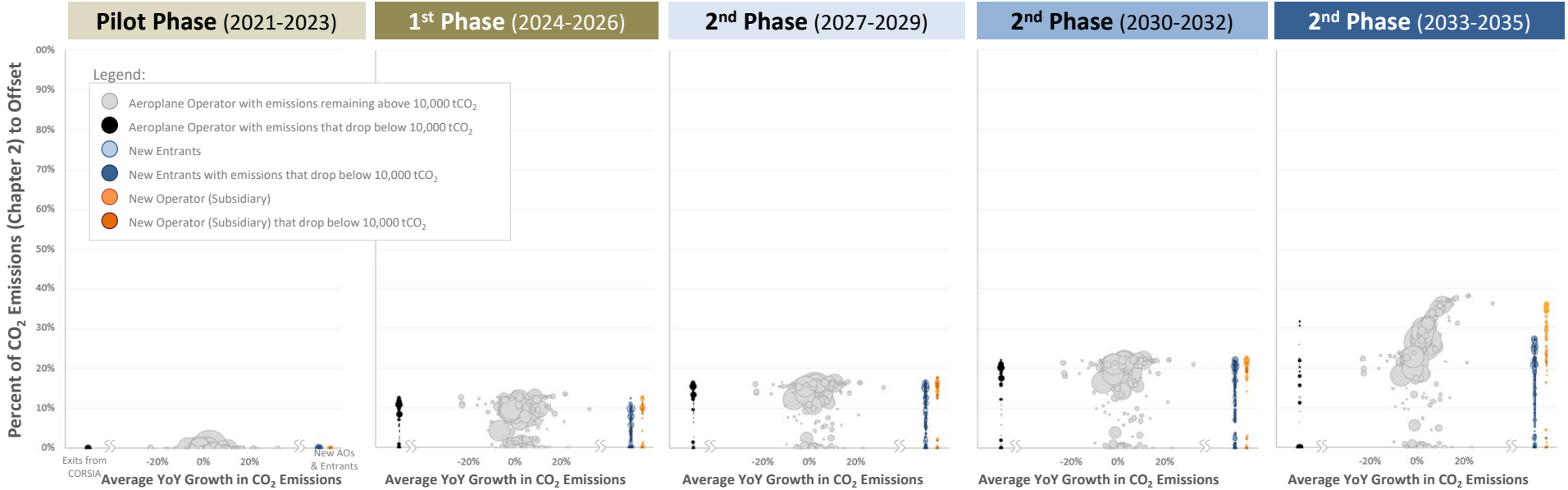
** Focus on the CORSIA First Phase (2024-2026).*

Assessment of CORSIA's impact on Aeroplane Operators

- **Offsetting requirements** (and differences across operators) **evolve over time and are driven by (1) phased implementation of CORSIA** (i.e., States' participation)**, (2) Sector Growth Factor** (e.g., CORSIA baseline) **and (3) transition to individual approach from 2033.**



	Pilot Phase (2021-2023)	1st Phase (2024-2026)	2nd Phase (2027-2029)	2nd Phase (2030-2032)	2nd Phase (2033-2035)
Share of **CO_2 Emissions** across all CORSIA Phases:	**14 %**	**19 %**	**21 %**	**22 %**	**24 %**
Share of **Offsetting Requirements** (all phases):	**0 %**	**8 %**	**23 %**	**30 %**	**39%**

Assumptions: Traffic and Emissions Profile (CAEP/13 Mid Covid19 Scenario), CORSIA Baseline Ref. Year (2019 for 2021-2023 and 85% of 2019 for 2024-2035), Sectoral/Individual (100% / 0% in 2021-2032, 85% / 15% in 2033-2035), States for Chapter 3 State Pairs (Editions 1 through 5/Rev1), New Entrant baseline option E.

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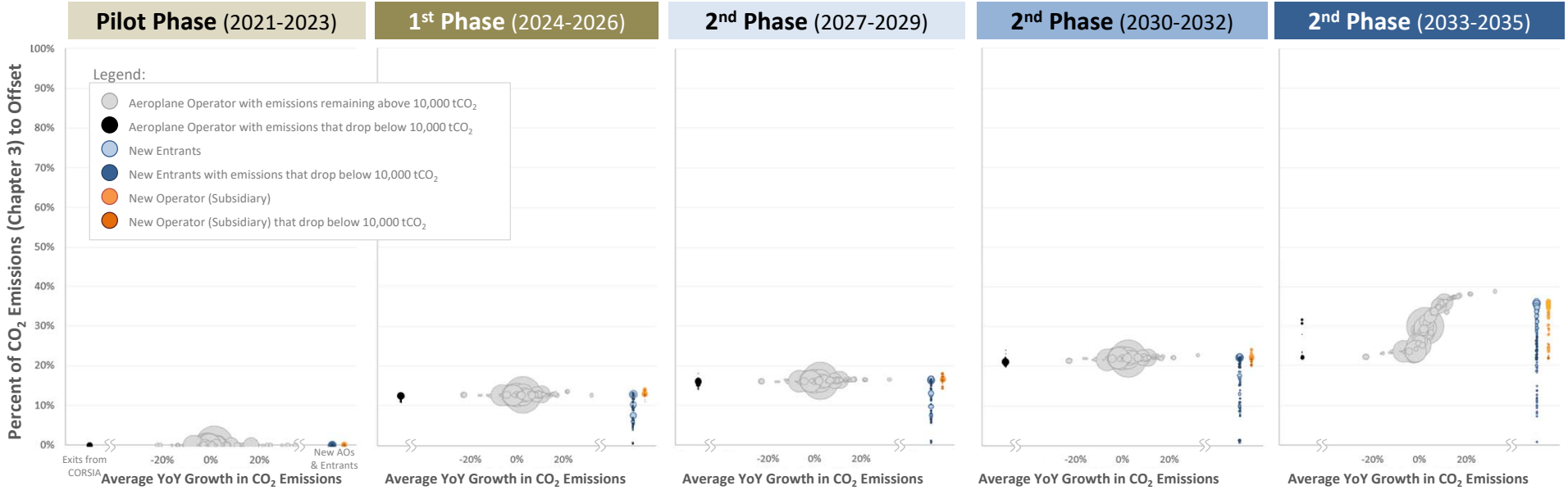

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Share of **CO_2 Emissions** across all CORSIA Phases:	**14 %**	**19 %**	**21 %**	**22 %**	**24 %**
Share of **Offsetting Requirements** (all phases):	**0 %**	**8 %**	**23 %**	**30 %**	**39%**

Assumptions: Traffic and Emissions Profile (CAEP/13 Mid Covid19 Scenario), CORSIA Baseline Ref. Year (2019 for 2021-2023 and 85% of 2019 for 2024-2035), Sectoral/Individual (100% / 0% in 2021-2032, 85% / 15% in 2033-2035), States for Chapter 3 State Pairs (Editions 1 through 4/Rev1), New Entrant baseline option E.

Questions Addressed in this Section

Q1 How CO_2 emissions from international aviation may evolve from 2024 to 2035?

Q2 Given CO_2 emissions trends, how much offsetting may be required under CORSIA?

Q3 How offsetting requirements (demand) may be met using (1) Emissions Reductions from CEF and/or (2) CORSIA Eligible Emissions Units*?

Q4 What are expected costs of compliance*?

Q5 What offsetting requirements could operator face?

Q6 Would international aviation meet its Carbon Neutral Growth goal from 2020 (CNG2020)?

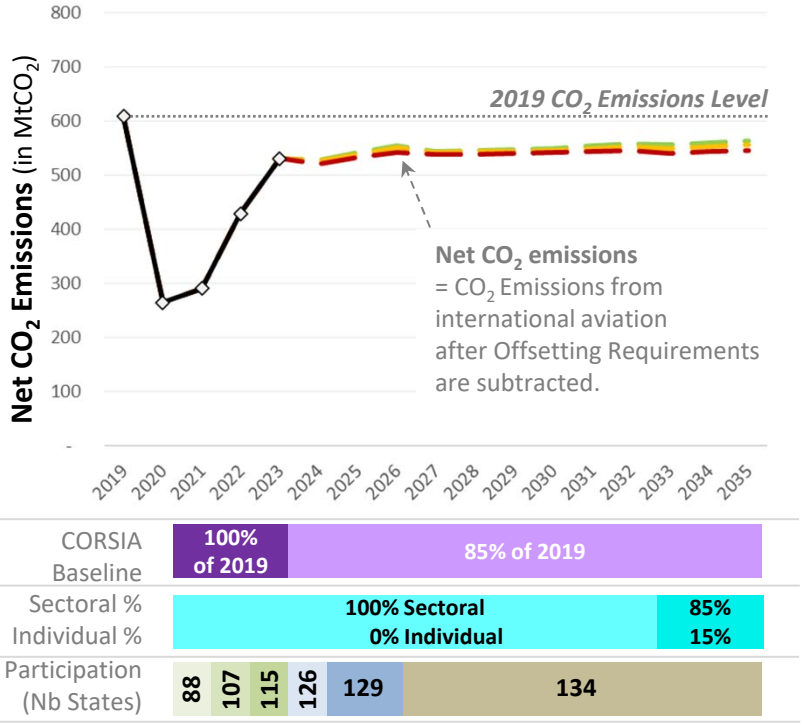
** Focus on the CORSIA First Phase (2024-2026).*

Projections of Net CO_2 Emissions through 2035

- **Net CO_2 emissions may be ≈550 to 560 $MtCO_2$ in 2035** (≈ -7.4% to -10.2% below the 2019 level).

- **Given scenarios of expected CORSIA implementation, international aviation sector would meet its mid-term goal of *"keeping net carbon emissions from 2020 at the same level"*** (assuming 2019 level as a proxy for pre-COVID 2020 expected emissions).

- ***Note: Net CO_2 emissions would not stabilize at 85% of 2019 emissions level due to partial participation in CORSIA.***



Summary of Observations

- **Based on its updated forward-looking assessments through 2035 with focus on First Phase (2024-2026), the CAEP noted that:**
  - **a) Given amended CO_2 emissions forecasts and 85% of 2019 CORSIA baseline, offsetting requirements are expected to start in 2024 under all traffic scenarios.**
  - **b) Cumulative offsetting requirements could range from 950 to 1500 $MtCO_2$ from 2024 to 2035 and 105 to 150 $MtCO_2$ during the First Phase.**
  - **c) Emissions reduction from CEF may address up to ≈15 % of offsetting requirements during the First Phase of CORSIA.**
  - **d) Costs associated with addressing offsetting requirements from 2024-2026 could range from:**
    - **≈ $1 to 5 billion using Emissions Units only,**
    - **≈ $6 to 13 billion using a mix of Emissions Units and ER from CEF assuming that 50% of CEF according to the latest CAEP Moderate scenario are claimed towards CORSIA,** or
    - **≈ $10 to 20 billion using a mix of Emissions Units and ER from CEF assuming that all the CEF according to the latest CAEP Moderate scenario are claimed towards CORSIA.**
  - **e) Net CO_2 emissions may be ≈550 to 560 $MtCO_2$ in 2035** (≈ -7.4% to -10.2% below the 2019 level) which would result in the **international aviation sector meeting its mid-term goal of *"keeping net carbon emissions from 2020 at the same level"*** (assuming 2019 level as a proxy for pre-COVID 2020 expected emissions).

Contents

- Background
- Assessment Approach in Support of the 2025 CORSIA Periodic Review
- Review of CORSIA's Pilot Phase (2021-2023)
- Updated Forward Looking CORSIA Analyses
- Observations & Conclusions

Conclusions & Needed Next Steps

- **CORSIA is working as designed and anticipated.**
- **Pilot Phase (2021-2023):**
  - **no offsetting required during the Pilot Phase.**
  - **despite the lack of offsetting requirements, markets started to develop and prepare to meet potential and future demand for emissions reductions from CEF and CORSIA emissions units.**
- **First Phase (2024-2026):**
  - **Offsetting requirements are expected to start in 2024 under all traffic scenarios.**
  - **Cumulative offsetting requirements could range from 950 to 1500 $MtCO_2$ from 2024 to 2035 and 105 to 150 $MtCO_2$ during the First Phase.**
  - **Emissions reduction from CEF may address up to ≈15 % of offsetting requirements during the First Phase of CORSIA.**
  - **Costs associated with addressing offsetting requirements from 2024 to 2026 could range from ≈ $1 to 5 billion** using Emissions Units (only) **to ≈ $10 to 20 billion** using a mix of Emissions Units and ER from CEF assuming that all the available CEF, according to the latest CAEP Moderate scenario, are claimed towards CORSIA.

- **Needed Next Steps:**
  - **CORSIA Implementation: More CEEUs with attestations are needed before Feb. 2028** (i.e., transforming the available supply of CEEUs into supply of CEEUs with attestation to meet offsetting requirements during the First Phase).
  - **CAEP: Continue to regularly monitor demand, supply (and price) of emissions units and ER from CEF** (i.e., extend request from Council from 228th session).

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