COMMITTEE ON AVIATION ENVIRONMENTAL PROTECTION

(CAEP)

INITIAL ASSESSMENTS IN SUPPORT OF THE 2025 CORSIA PERIODIC REVIEW

June 2024

EXECUTIVE SUMMARY

1. BACKGROUND: REQUESTS FROM COUNCIL

1.1 At its 228th session in March 2023, the Council 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**. The Council also requested CAEP to 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**;

1.2 At its 231st session in March 2024, the Council 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**.

1.3 The "Initial Assessments in Support of the 2025 CORSIA Periodic Review" by CAEP provide initial answers to the requests from Council. These interim assessments are part of a series of planned assessments through the 234th and possibly 235th Sessions of the Council. The Appendix to this summary addresses the request from the Council at its 231st Session to provide a "schedule of subsequent updates".

2. BACKGROUND ON THE CORSIA PERIODIC REVIEW AND APPROACH

2.1 The 2022 CORSIA Periodic Review was conducted in the midst of the COVID-19 Global Pandemic that had substantial impacts on the international aviation sector and its CO_2 emissions. At the time, the Review comprised of a forward-looking assessment including the assessment of the impacts of various sector baseline options from 2024 that led to the adjustments at the 41st Assembly on the 85% sector baseline.

2.2 The 2025 CORSIA Periodic Review comprises two key components:

(1) ***updated forward-looking assessments*** based on the latest ICAO/CAEP traffic forecasts, and

(2) ***a backward-looking assessment.*** The 2025 CORSIA Periodic Review also provides a unique opportunity to look back in time and assess of how CORSIA worked during the Pilot Phase (2021-2023) in context of projections anticipated during the 2022 Review.

3. REVIEW OF CORSIA'S PILOT PHASE

3.1 Leveraging data reported to ICAO through the CORSIA Monitoring, Reporting and Verification (MRV), the CAEP collected data and tracked actual/historical CO_2 emissions from international aviation from 2019 to 2022 (with estimates for 2023). The actual/historical CO_2 emissions

were placed in context of forecasts of CO_2 emissions that were presented to the Council as part of the 2022 CORSIA Periodic Review prior to the 41st Assembly. It was observed that **actual CO_2 emissions followed a "Low" forecast in 2021 but the international aviation sector exhibited a stronger recovery in CO_2 emissions in 2022 and 2023.** The final/official 2023 data will be reported through the ICAO CORSIA Central Registry (CCR) in late 2024 and will be integrated in future assessments in support of the 2025 CORSIA Periodic Review.

3.2 Given the effects of the COVID-19 Global Pandemic on international aviation and despite the recovery since 2020, CO_2 emissions subject to offsetting requirements remained below the 2019 CORSIA Baseline in 2021, 2022 and are likely to also remain below in 2023. As a result, **the Sector Growth Factors (SGF) will likely be 0% for all three years of the CORSIA Pilot Phase**.

3.3 Despite the absence of offsetting requirements, markets started to develop and prepare to meet future expected demand for emissions reductions from CORSIA Eligible Fuels (CEF) and CORSIA eligible emissions units.

3.4 The CAEP has also identified the need to develop possible approaches to access data on unit price for CORSIA eligible emissions units (for future analysis).

4. UPDATED FORWARD LOOKING CORSIA ANALYSES

4.1 The CAEP has updated its forward-looking assessments of CO_2 emissions based on the latest (CAEP/13) ICAO/CAEP Traffic Forecasts.

4.2 CO_2 emissions from international aviation are expected to return to 2019 level by 2025 under the Mid and High CAEP/13 scenarios. CO_2 emissions from international aviation are expected to return to 2019 level in 2027 under the Low CAEP/13 scenario.

4.3 Given updated (proxy) CO_2 emissions forecasts and the 85% of 2019 CORSIA baseline starting in 2024, **offsetting requirements are expected to start in 2024 under all CAEP/13 traffic scenarios**.

4.4 **Cumulative offsetting requirements could range from 980 to 1500 $MtCO_2$ from 2024 to 2035 and 80 to 120 $MtCO_2$ during the First Phase**. The range of offsetting requirements from 2021 to 2035 is within the range of estimates of offsetting requirements from the 2022 CORSIA Periodic Review analyses presented to Council in June 2022 where under an 85% of 2019 baseline for 2024-2035, offsetting requirements were estimated to range from 600 to 2100 $MtCO_2$.

4.5 In response to a question from a member at the 231st Session of the Council, the CAEP added in its supporting information (i.e., presentation attached to this Executive Summary) the results of the regional distribution of "*Percent Chapter 3 CO_2 emissions to offset based on **total international aviation CO_2 emissions subject to offsetting requirements** (Annex 16 Volume 4 Chapter 3)."*

4.6 To understand and assess how future offsetting requirements (focusing on the First Phase of CORSIA from 2024 to 2026) may be addressed, the CAEP has updated its scenarios for emissions reductions from CORSIA eligible fuels. As input to this process, the CAEP considered relevant technical information from CAAF/3. Two scenarios were developed, including: (1) a "Low CEF scenario" based on the LTAG-TG IS1 biomass-based fuels (only) and (2) a "CAAF/3 scenario" reaching

5% emissions reductions from SAF and LCAF in 2030 assuming an exponential growth rate from 2024-2030 with a trend extrapolation post 2030.

4.7 Given the uncertainty in how aeroplane operators may choose to address offsetting requirements (i.e., mix of emissions reductions from CEF and/or CORSIA Eligible Emissions Units), a scenario-based assessment was conducted.

4.8 Three scenarios considered:

(1) Offsetting Requirements addressed with Emissions Units (only).

(2) Offsetting Requirements addressed with Emissions Units and emission reductions from SAF (according to the "Low CEF scenario" based on the LTAG-IS1 scenario, biomass-based fuels only).

(3) Offsetting Requirements addressed with Emissions Units and emission reductions from SAF (according to "CAAF/3 scenario").

4.9 The updated scenario-based analysis suggests that **emissions reduction from CEF may address up to ≈ 7% to ≈ 11% of offsetting requirements (≈ 100 $MtCO_2$) during the First Phase of CORSIA**. The remainder (i.e., final offsetting requirements) would need to be addressed using CORSIA eligible emissions units.

4.10 Absolute quantities of emissions reductions from CEF and/or CORSIA eligible emissions units used to meet offsetting requirements were then monetized to estimate the cumulative costs of compliance from 2024 to 2026 using the following assumptions and data:

a) ***Unit Prices of Emissions Reductions from CEF:*** The cost abatement (i.e., SAF Premium / tCO_2 abated) from the emissions reductions from SAF could range from ≈ \$600-800 per tCO_2. The SAF Premium is calculated as the difference between the Unit Price of SAF (≈ \$2.0 per Liter in 2024) and the unit price of Conventional Jet Fuel (≈ \$0.7 per Liter for 2024).

b) ***Unit Prices of Emissions Units:*** The CAEP has updated its estimates of the prices of emissions units for the First Phase of CORSIA. Based on limited price information and data available, it is expected that average prices of emissions units may range from \$5.70 to \$17.20 per tCO_2 during the First Phase of CORSIA.

4.11 Combining unit price information with quantities of emissions reductions from CEF and/or CORSIA eligible emissions units, it is anticipated that the **total cumulative costs associated with addressing offsetting requirements from 2024 to 2026 could range from ≈ \$1 billion using emissions units (only) to ≈ \$8 billion using a mix of emissions units and emissions reductions from CEF** given a scenario that accounts for the CAAF/3 vision[1].

— — — — — — — —

[1] It should be noted that (1) the actual cost of emissions reductions from SAF are expected to be lower due to States' support e.g., tax credits, subsidies and (2) the total cost abatement from SAF may not be fully attributable to CORSIA as airlines/operators have purchased and used SAF towards decarbonization efforts (in the absence of CORSIA compliance requirements).

Council – 232nd Session

Subject No. 50: Questions relating to the environment

Initial Assessments in Support of the 2025 CORSIA Periodic Review

Presented by CAEP

Referenced in C-WP/…..

Executive Summary

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

- **Due to the decline in CO_2 emissions during the COVID19 global pandemic coupled with a CORSIA baseline based on 2019 emissions, there were no offsetting required during the Pilot Phase** (to be confirmed in late 2024).
- **Despite the absence of offsetting requirements, markets started to develop and prepare to meet future expected demand for emissions reductions from CEF and CORSIA emissions units.**
- **Identified the need to develop possible approaches to access data on unit price for CORSIA eligible units** (for future analysis).

Updated Forward-looking CORSIA Analyses

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

- **Given updated (proxy) 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 980 to 1500 $MtCO_2$ from 2024 to 2035 and 80 to 120 $MtCO_2$ during the First Phase.**
- **Relevant technical information from CAAF/3 was considered to update scenarios for potential Emissions Reductions from CEF.**
- **Updated scenario-based analysis suggests that emissions reduction from CEF may address up to ≈7% to ≈11% of offsetting requirements during the First Phase of CORSIA.**
- **Costs associated with addressing offsetting requirements from 2024 to 2026 could range from ≈ $1 billion** using Emissions Units (only) **to ≈ $8 billion** using a mix of Emissions Units and ER from SAF given a scenario that accounts for the CAAF/3 vision.

Agenda

- **Background on CORSIA Periodic Review and Approach**

- **CORSIA Periodic Review: Review of CORSIA's Pilot Phase**
  - Historical Trends
  - Tracking Contributions from Emissions Reductions from CEF and Supply, Demand and Price of Emissions Units

- **CORSIA Periodic Review: Updated Forward Looking CORSIA Analyses**
  - Tracking and development of scenarios for Emissions Reductions from CEF and Emissions Units

- **Next Steps**

Background on Council Requests & Status of CORSIA Analyses

At its 228th session (March 2023)*, the Council…

New question from 228th session of 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;** […]

Question builds on the 2022 CORSIA Periodic Review

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;**

Status

Ongoing
Started with updates based on initial CAEP/13 forecasts.

Started
Initial analyses towards the 232nd session of the Council.

At its 231st session (March 2024)**, the Council…

New question from 231st session of 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**.

Started
Initial analyses towards the 232nd session of the Council.

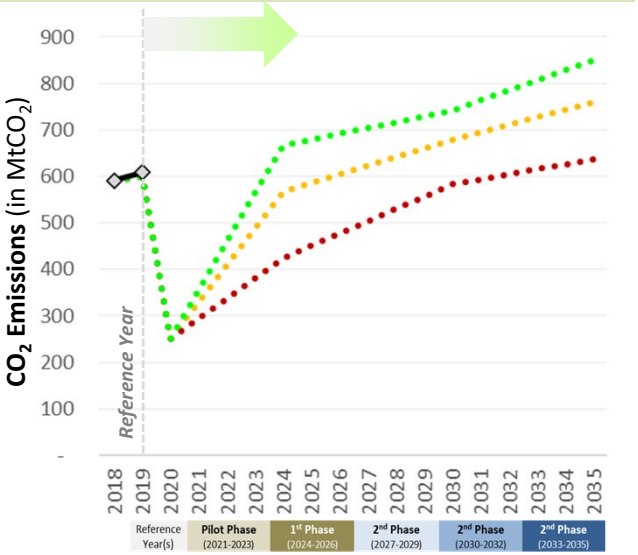
** Reference: C-DEC 228/7.* *** Reference: C-DEC 231/2.*

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 historical data.**

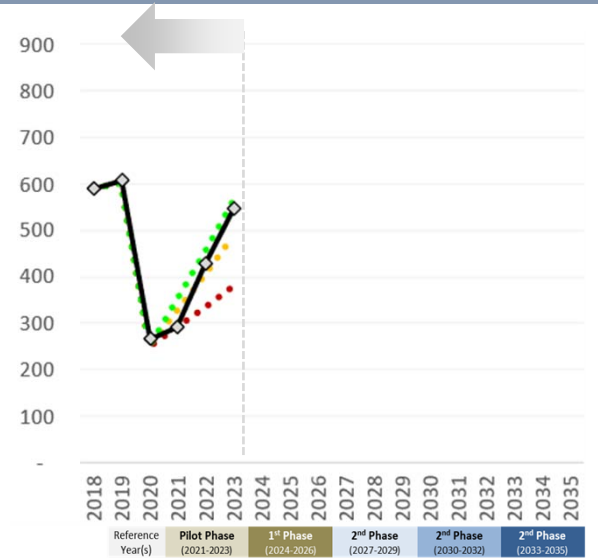
2022 CORSIA Periodic Review

Forward Looking Assessment

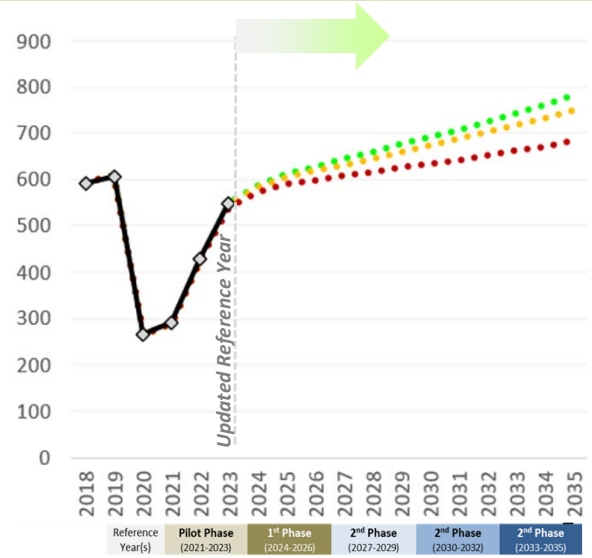


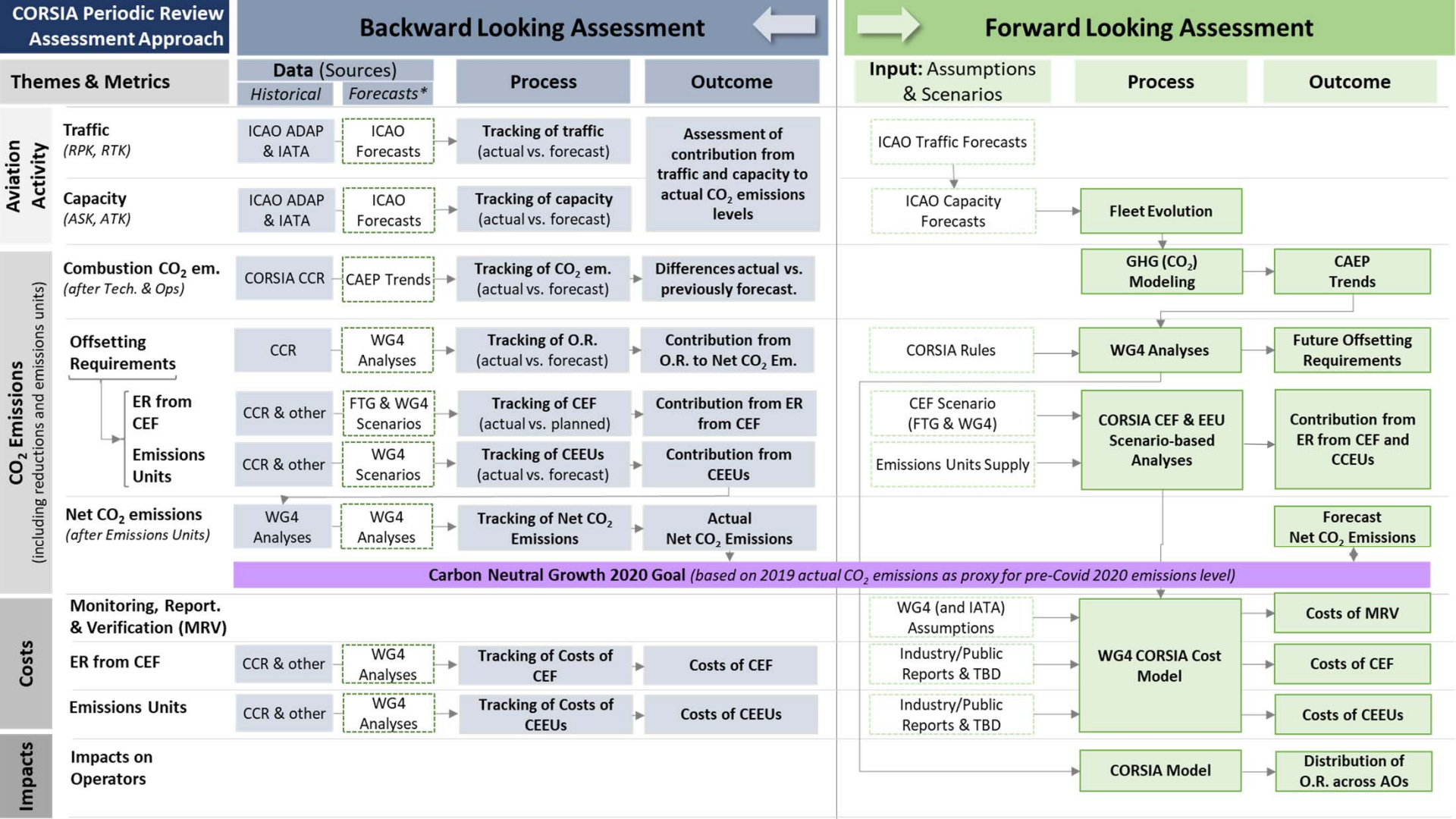
2025 CORSIA Periodic Review

Backward Looking Assessment



Updated Forward Looking Assessment



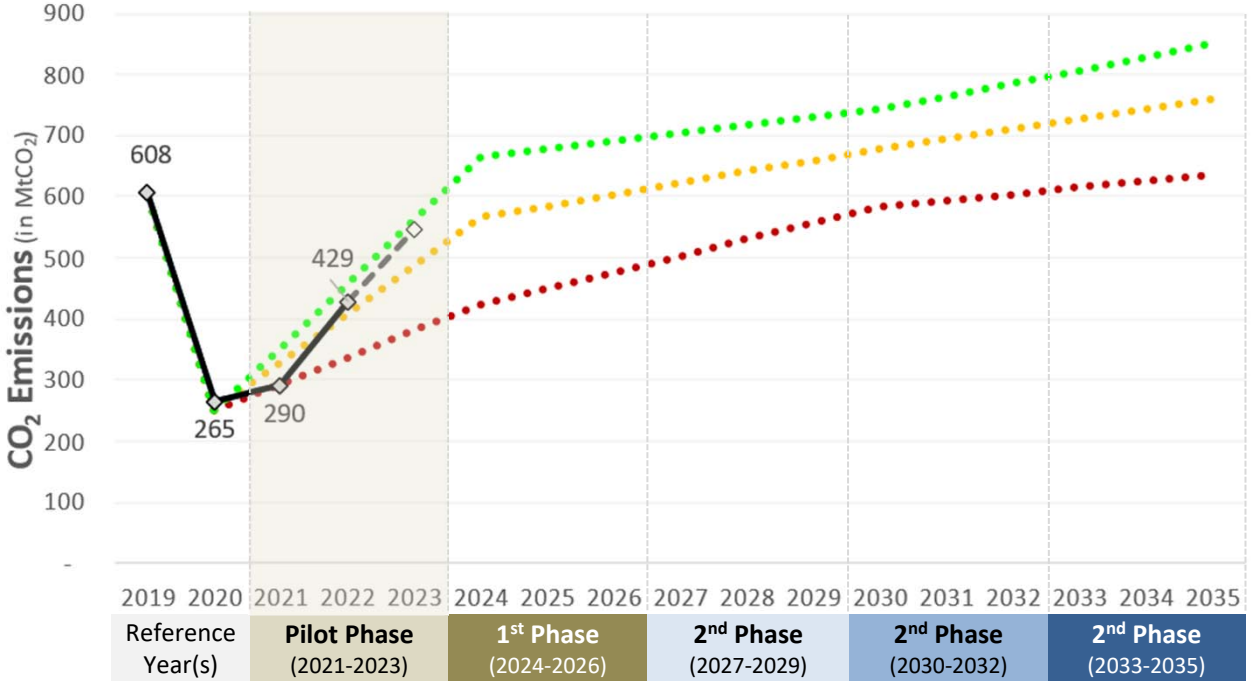

CORSIA Periodic Review Assessment Approach
Backward Looking Assessment
Forward Looking Assessment
Themes & Metrics
Data (Sources)
Historical
Forecasts*
Process
Outcome
Input: Assumptions & Scenarios
Process
Outcome
Aviation Activity
Traffic
(RPK, RTK)
ICAO ADAP & IATA
ICAO Forecasts
Tracking of traffic (actual vs. forecast)
Assessment of contribution from traffic and capacity to actual CO2 emissions levels
ICAO Traffic Forecasts
Capacity
(ASK, ATK)
ICAO ADAP & IATA
ICAO Forecasts
Tracking of capacity (actual vs. forecast)
ICAO Capacity Forecasts
Fleet Evolution
CO2 Emissions
(including reductions and emissions units)
Combustion CO2 em.
(after Tech. & Ops)
CORSIA CCR
CAEP Trends
Tracking of CO2 em. (actual vs. forecast)
Differences actual vs. previously forecast.
GHG (CO2) Modeling
CAEP Trends
Offsetting Requirements
CCR
WG4 Analyses
Tracking of O.R. (actual vs. forecast)
Contribution from O.R. to Net CO2 Em.
CORSIA Rules
WG4 Analyses
Future Offsetting Requirements
ER from CEF
CCR & other
FTG & WG4 Scenarios
Tracking of CEF (actual vs. planned)
Contribution from ER from CEF
CEF Scenario (FTG & WG4)
CORSIA CEF & EEU Scenario-based Analyses
Contribution from ER from CEF and CCEUs
Emissions Units
CCR & other
WG4 Scenarios
Tracking of CEEUs (actual vs. forecast)
Contribution from CEEUs
Emissions Units Supply
Net CO2 emissions
(after Emissions Units)
WG4 Analyses
WG4 Analyses
Tracking of Net CO2 Emissions
Actual Net CO2 Emissions
Forecast Net CO2 Emissions
Carbon Neutral Growth 2020 Goal (based on 2019 actual CO2 emissions as proxy for pre-Covid 2020 emissions level)
Costs
Monitoring, Report. & Verification (MRV)
WG4 (and IATA) Assumptions
WG4 CORSIA Cost Model
Costs of MRV
ER from CEF
CCR & other
WG4 Analyses
Tracking of Costs of CEF
Costs of CEF
Industry/Public Reports & TBD
Costs of CEF
Emissions Units
CCR & other
WG4 Analyses
Tracking of Costs of CEEUs
Costs of CEEUs
Industry/Public Reports & TBD
Costs of CEEUs
Impacts
Impacts on Operators
CORSIA Model
Distribution of O.R. across AOs

Agenda

- Background on CORSIA Periodic Review and Approach
- CORSIA Periodic Review: Review of CORSIA's Pilot Phase
  - Historical Trends
  - Tracking Contributions from Emissions Reductions from CEF and Supply, Demand and Price of Emissions Units
- CORSIA Periodic Review: Updated Forward Looking CORSIA Analyses
  - Tracking and development of scenarios for Emissions Reductions from CEF and Emissions Units
- Next Steps

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

- **Actual CO_2 emissions followed a "Low" forecast in 2021 but the international aviation sector exhibited a stronger recovery in CO_2 emissions in 2022 and 2023** (final/official 2023 data to be confirmed and available in late 2024).



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)

Estimated CO_2 emissions for 2023 (based on Proxy CAEP/13 Trends) Historical CO2 emissions data for 2023 expected to be published in the CCR on Oct. 31, 2024.

Review: CORSIA Pilot Phase

- Given the effects of the COVID-19 Global Pandemic on international aviation and despite the recovery since 2020, CO_2 emissions subject to offsetting requirements remained below the 2019 CORSIA Baseline in 2021, 2022 and are likely to also remain below in 2023.

- As a result, the Sector Growth Factors will (likely) be 0% for all three years of the CORSIA Pilot Phase.

- No offsetting requirements are expected during the Pilot Phase and hence no demand for emissions reductions from CEF and/or emissions units.

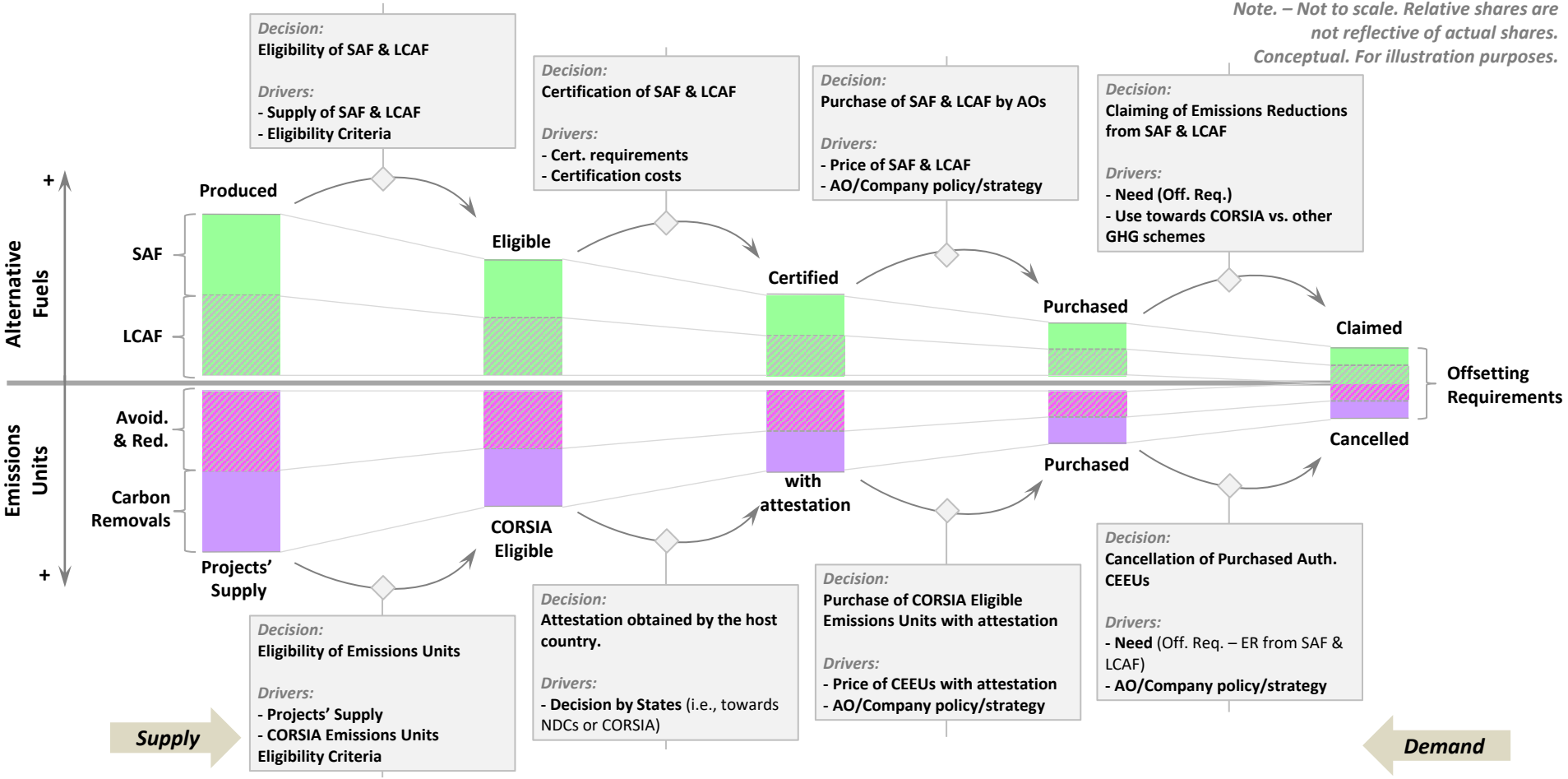
Review: CORSIA Pilot Phase

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

- The CAEP 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 Potential Role of Emissions Reductions from CEF and CORSIA Eligible Emissions Units

Note. – Not to scale. Relative shares are not reflective of actual shares. Conceptual. For illustration purposes.



Review: CORSIA Pilot Phase (2021-2023)

Offsetting Requirements

0 tCO_2 during CORSIA Pilot Phase

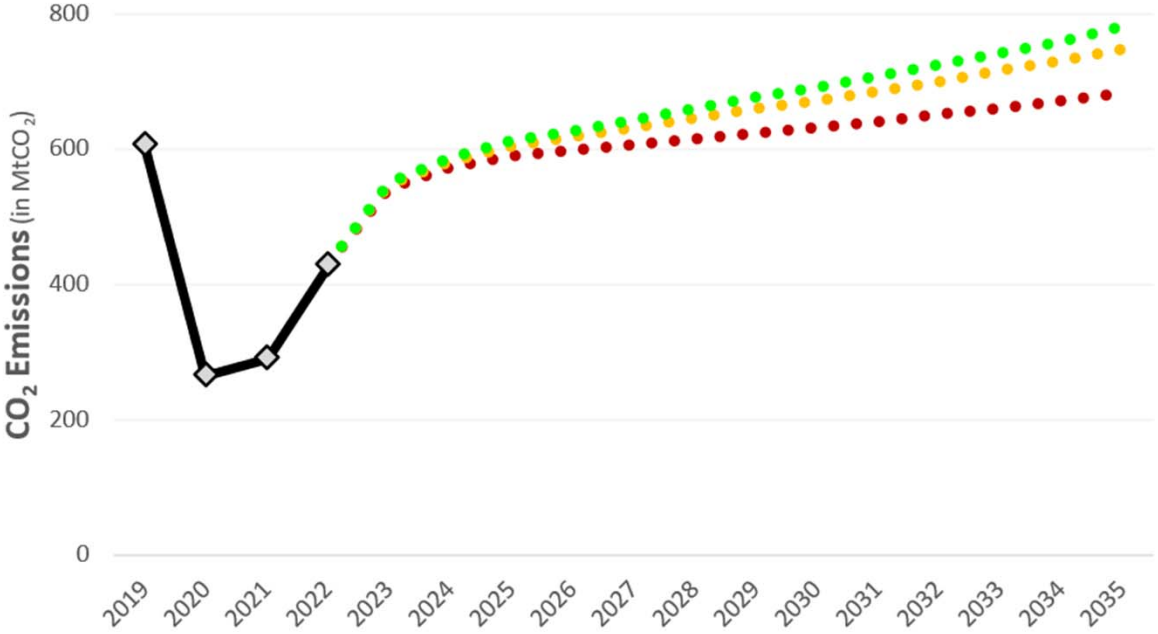
* Not necessarily exhaustive (2021-2022 data only). ** Not necessarily exhaustive (2021-2022 data only). Despite no offsetting requirements expected in 2022, the United States recorded 9 tCO_2 of Emissions Reductions from SAF by one of its aeroplane operator.

Agenda

- Background on CORSIA Periodic Review and Approach
- CORSIA Periodic Review: Review of CORSIA's Pilot Phase
  - Historical Trends
  - Tracking Contributions from Emissions Reductions from CEF and Supply, Demand and Price of Emissions Units
- CORSIA Periodic Review: Updated Forward Looking CORSIA Analyses
  - Tracking and development of scenarios for Emissions Reductions from CEF and Emissions Units
- Next Steps

CO_2 Emissions Trends: Initial Updates*

- Updated forward looking assessment of CO_2 emissions.
- CO_2 emissions are expected to return to 2019 level by 2025 under the Mid and High CAEP/13 scenarios (2027 under the Low CAEP/13 scenario).



Legend:

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

2025 CORSIA Periodic Review*

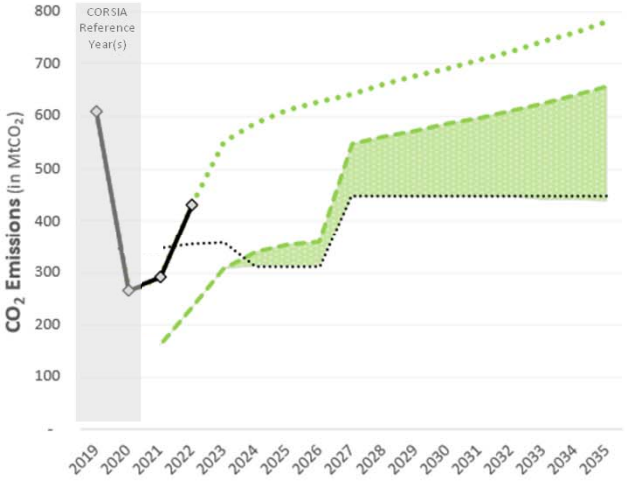
Actual/Historical CO_2 emissions (based on CORSIA reporting through the CORSIA Central Registry)

* Based on proxy CAEP/13 Trends using similar methodologies used during the CAEP/12 cycle. Pending final CAEP/13 Trends available in September 2024.

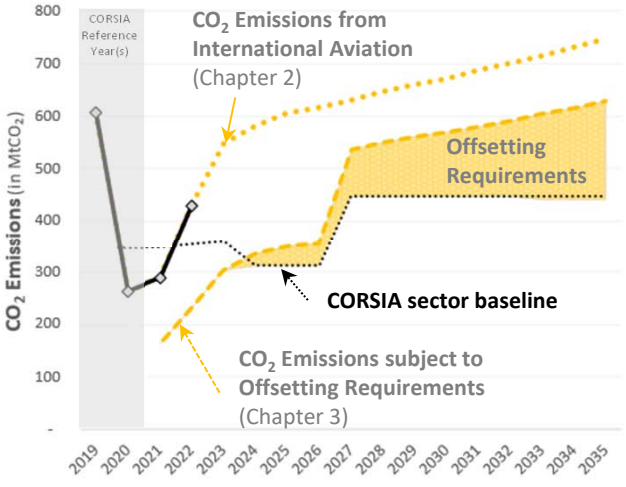
Estimation of Offsetting Requirements

- **Total offsetting requirements across international aviation sector are influenced by the impact of Covid19, and the rate of recovery in out years.**
- **Offsetting requirements are expected to start in 2024 under all CAEP/13 scenarios.**

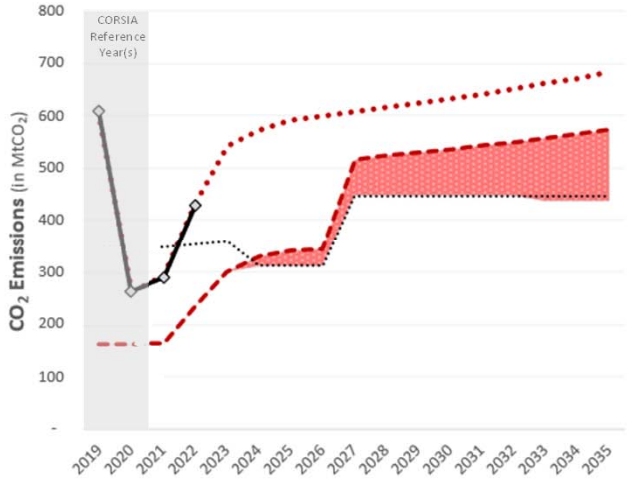
High CAEP/13 scenario



Mid CAEP/13 scenario

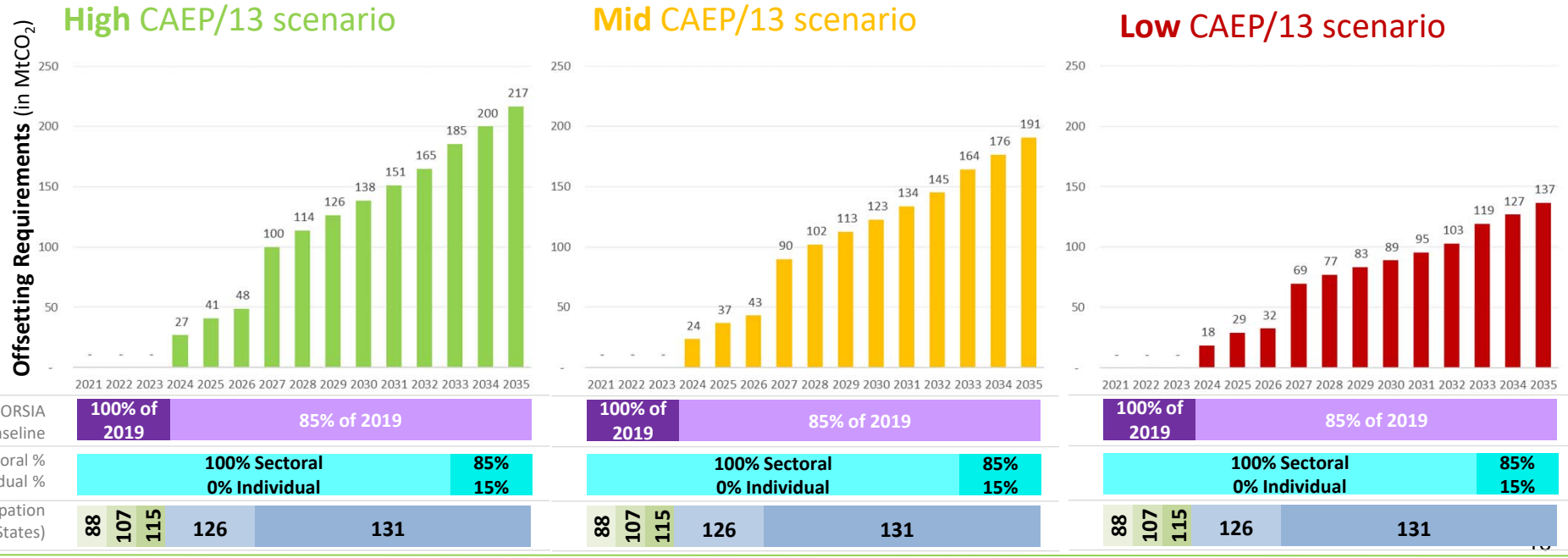


Low CAEP/13 scenario



Estimation of Offsetting Requirements (cont.)

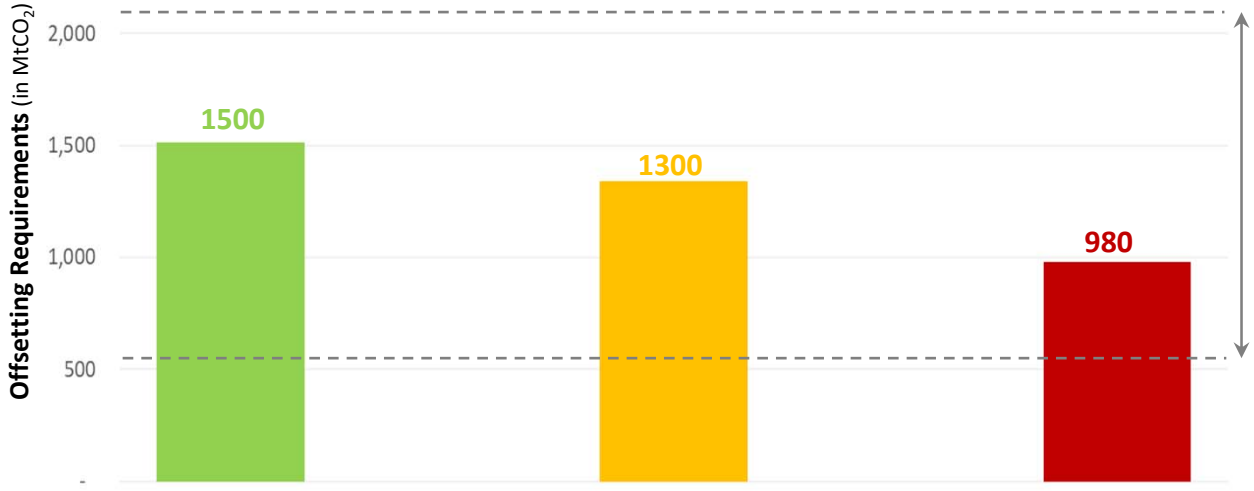
- **Total offsetting requirements across international aviation sector are influenced by the impact of Covid19, and the rate of recovery in out years.**
- **Offsetting requirements are expected to start in 2024 under all CAEP/13 scenarios.**



Estimation of Offsetting Requirements (cont.)

- **Given the initial ICAO-CAEP/13 traffic forecasts and decisions at Assembly 41, cumulative offsetting requirements (O.R.) from 2024 to 2035 could range from 980 to 1500 $MtCO_2$.**

All Phases
(2021-2035)



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

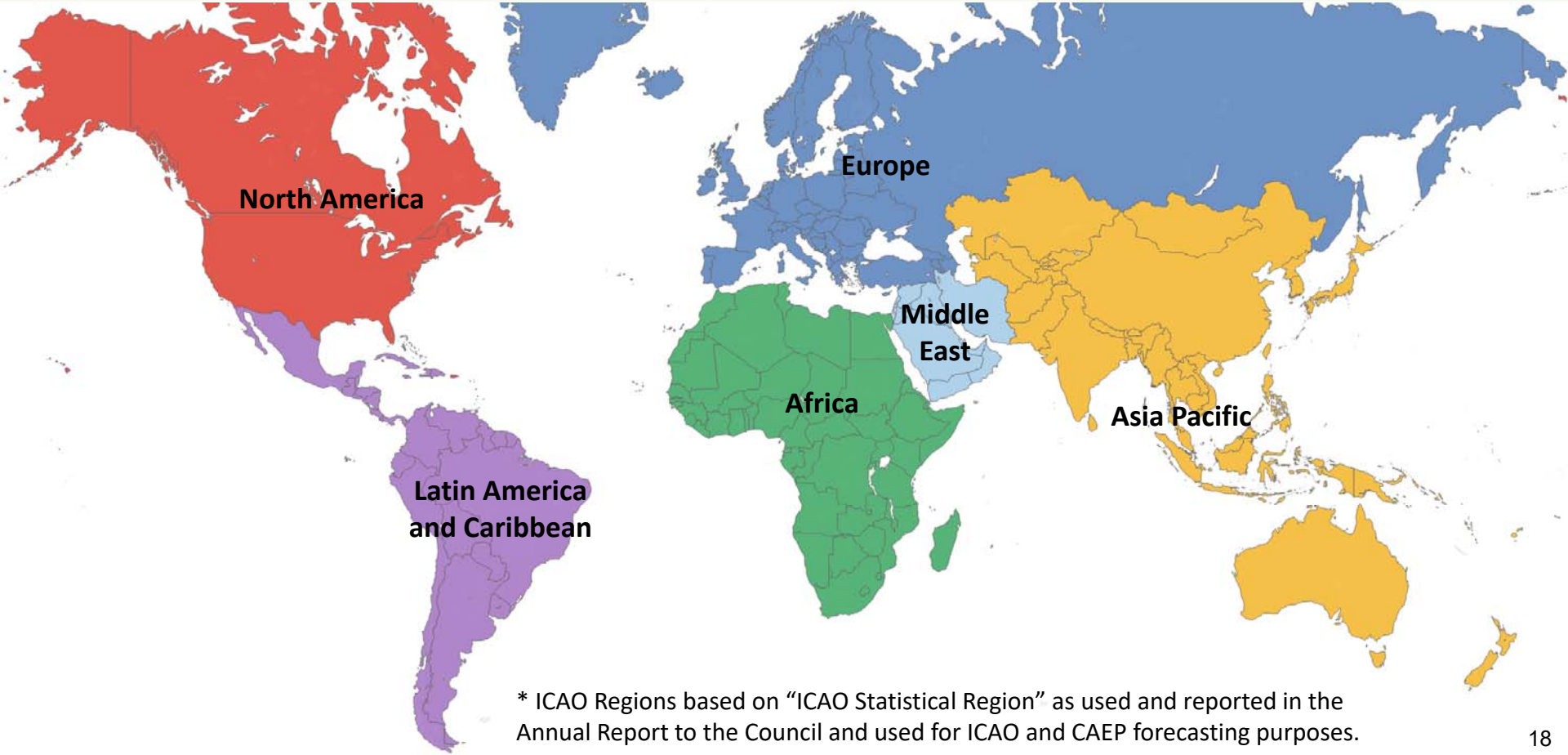
Scenario Assumptions

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*



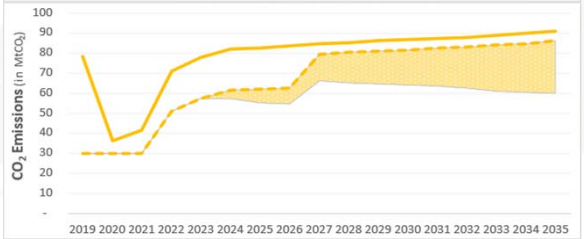
* ICAO Regions based on “ICAO Statistical Region” as used and reported in the Annual Report to the Council and used for ICAO and CAEP forecasting purposes.

Regional Breakdown of Offsetting Requirements by ICAO Regions

North America

Share of total CO_2 emissions (2021-2035)*: **13%**

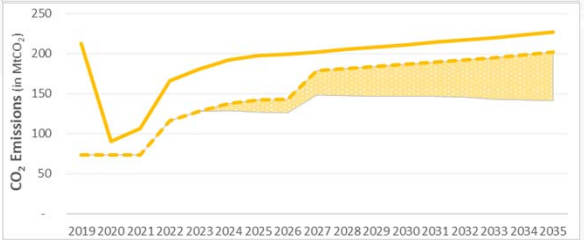
Avg. annual growth rate CO_2 emissions (2019-2035)**: **0.9%**



Europe

Share of total CO_2 emissions (2021-2035)*: **32%**

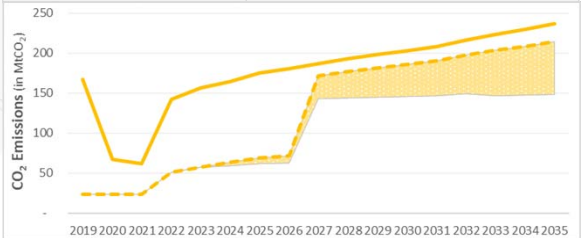
Avg. annual growth rate CO_2 emissions (2019-2035)**: **0.4%**



Asia Pacific

Share of total CO_2 emissions (2021-2035)*: **30%**

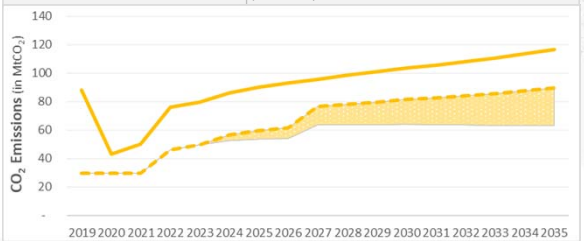
Avg. annual growth rate CO_2 emissions (2019-2035)**: **2.2%**



Middle East

Share of total CO_2 emissions (2021-2035)*: **15%**

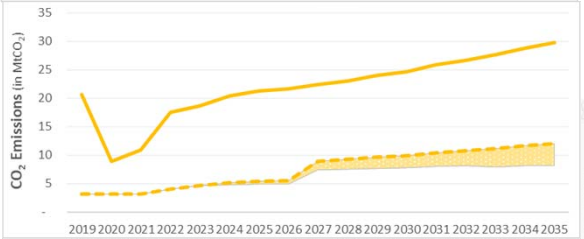
Avg. annual growth rate CO_2 emissions (2019-2035)**: **1.8%**



Latin America and Caribbean

Share of total CO_2 emissions (2021-2035)*: **4%**

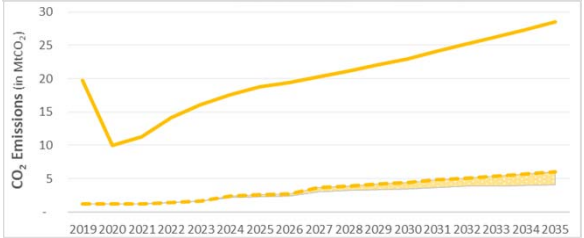
Avg. annual growth rate CO_2 emissions (2019-2035)**: **2.3%**



Africa

Share of total CO_2 emissions (2021-2035)*: **3%**

Avg. annual growth rate CO_2 emissions (2019-2035)**: **2.3%**



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 1-4 (Rev1)

Illustrative traffic scenario: Mid Covid19 recovery.

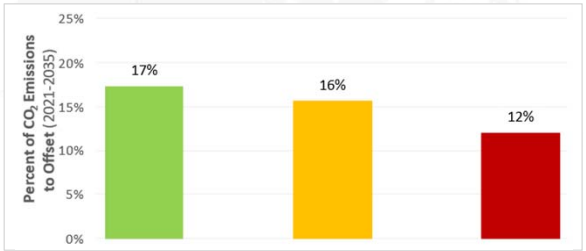
** Share of total international aviation CO_2 emissions (A16V4 Chapter 2) from 2021 to 2035. Shares very similar across Covid19 scenarios.*

*** Average annual growth of CO_2 emissions from international aviation (A16V4 Chapter 2) from 2019 to 2035.*

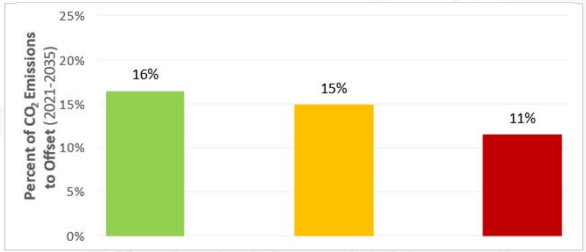
Percent CO_2 emissions to Offset by ICAO Regions

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

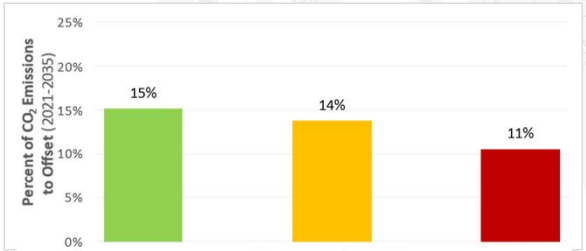
North America



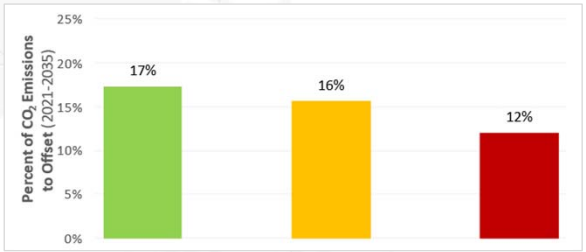
Europe



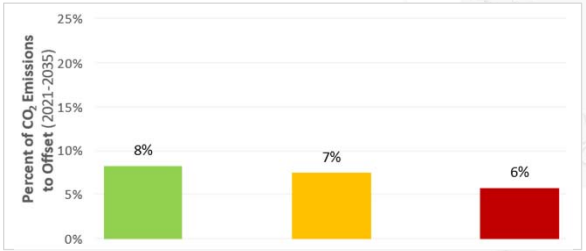
Middle East



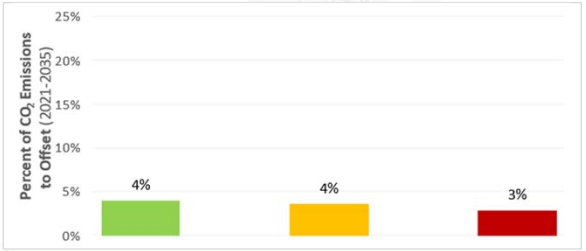
Asia Pacific



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.*

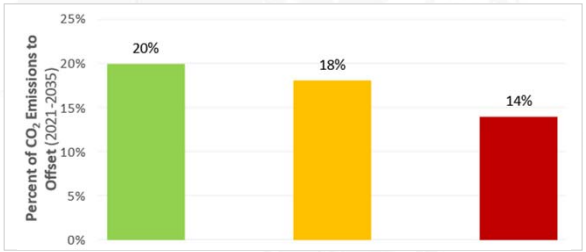
Summary of Assumptions:

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 – 4/Rev1

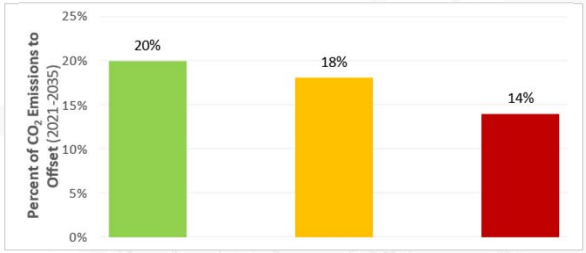
Percent CO_2 emissions to Offset by ICAO Regions

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

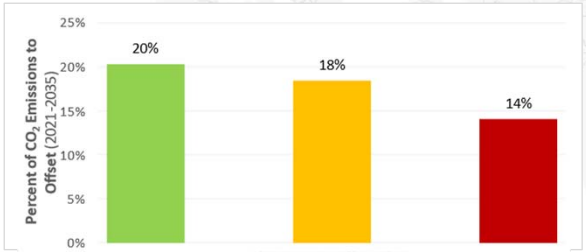
North America



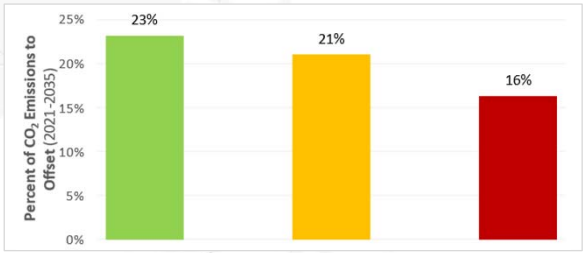
Europe



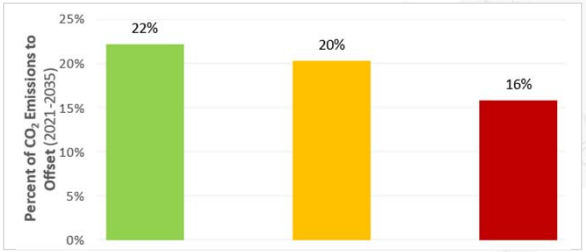
Middle East



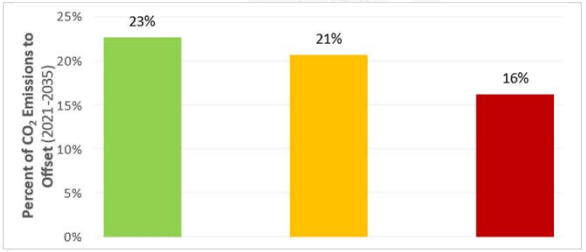
Asia Pacific



Latin America and Caribbean



Africa



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 – 4/Rev1

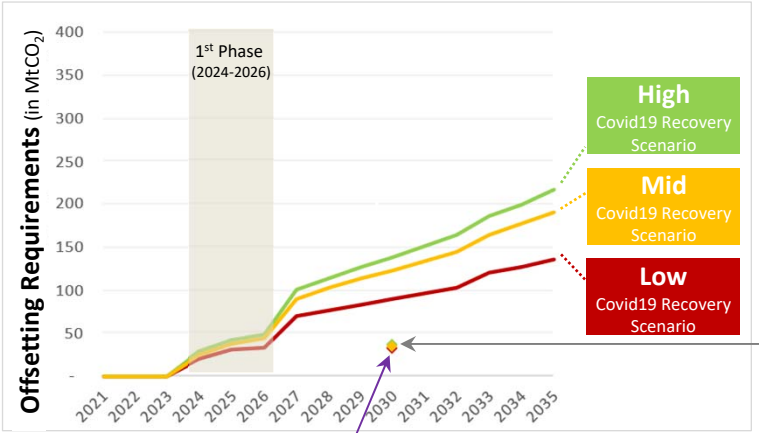
** Percent Chapter 3 CO_2 emissions to offset calculated as: total offsetting requirements (2021-2035) divided by total international aviation CO_2 emissions subject to offsetting requirements (A16V4 Chapter 3) from 2021 to 2035.*

Outcome of CAAF/3 in Context of CORSIA Offsetting Requirements and SAF Scenarios

- **Following the CAAF/3 in Nov. 2024, CAEP used relevant technical outcome to place the SAF scenarios in context.**

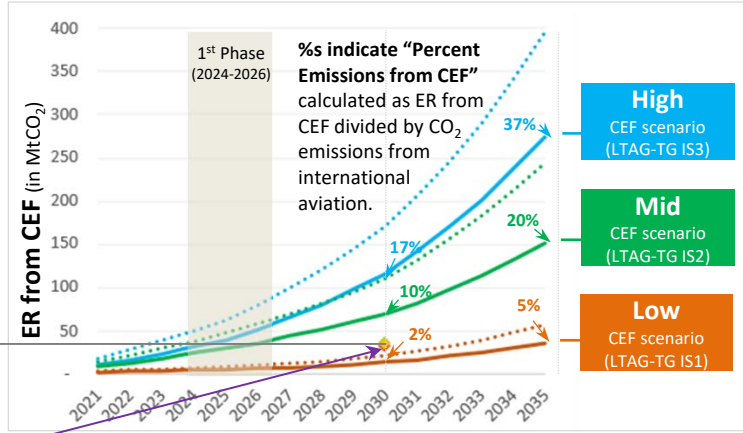
Offsetting Requirements

Assumptions:
- CAEP/13 (proxy) CO_2 emissions trends.
- CORSIA Baseline and Individual/Sectoral Shares reflecting decisions at the 41st session of the ICAO Assembly.



Emissions Reductions from CEF

Assumptions:
- Scenarios for Emissions Reductions from CEF based on CAEP LTAG-TG Fuels scenarios and assumptions (used as proxy).
- Same scenarios considered in CORSIA Analyses to 226th Council.



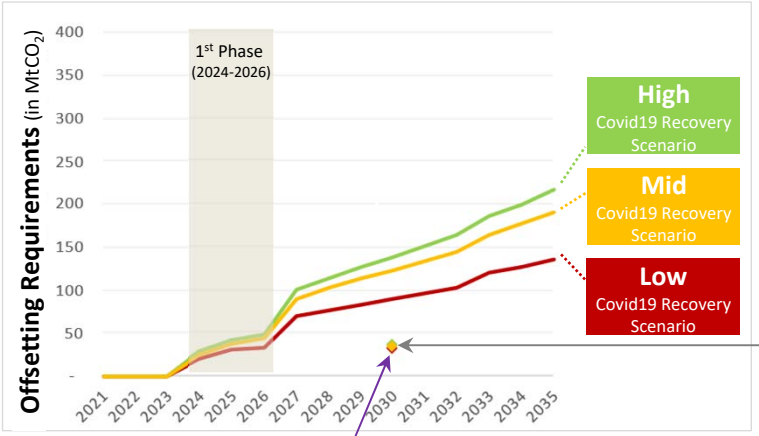
Note. Potential global emissions reductions from CEF (for domestic and international aviation) in dotted lines. Emissions reductions from CEF used on domestic aviation flights may be claimed towards CORSIA.

Outcome of CAAF/3 in Context of CORSIA Offsetting Requirements

- **In accordance with Annex 16 Volume IV, final offsetting requirements (i.e., demand for emissions units) are calculated by subtracting emissions reductions from CEF from offsetting requirements.**

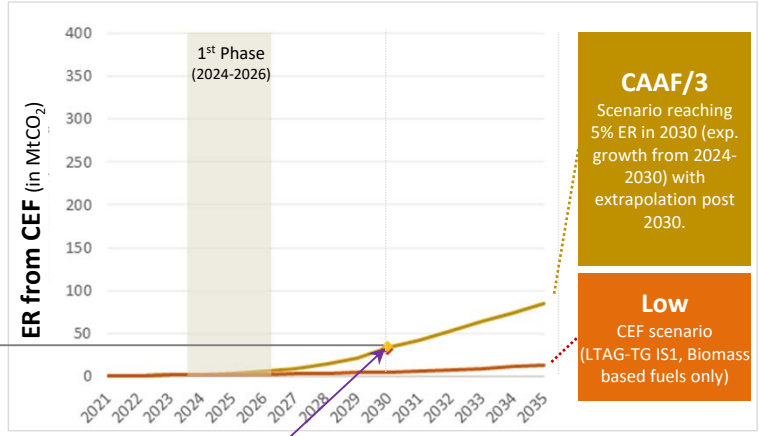
Offsetting Requirements

Assumptions:
- CAEP/13 draft/proxy traffic forecasts.
- CORSIA Baseline and Individual/Sectoral Shares reflecting decisions at the 41st session of the ICAO Assembly.



- Emissions Reductions from CEF

Assumptions:
- Scenarios for Emissions Reductions from CEF based on adjusted CAEP LTAG-TG Fuels scenario (F1).
- Additional scenario reflecting technical outcome of CAAF/3.



= Final Offsetting Requirements

Proxy for Demand for Emissions Units

(see next slide for details)

ICAO's Collective global aspirational Vision (CAAF/3)

Estimates of Demand for Emissions Units

- **Cumulative Final Offsetting Requirements (i.e., demand for emissions units) through 2035 as well as during the First Phase (2024-2026) would vary depending on traffic and emissions reductions from CEF scenarios.**

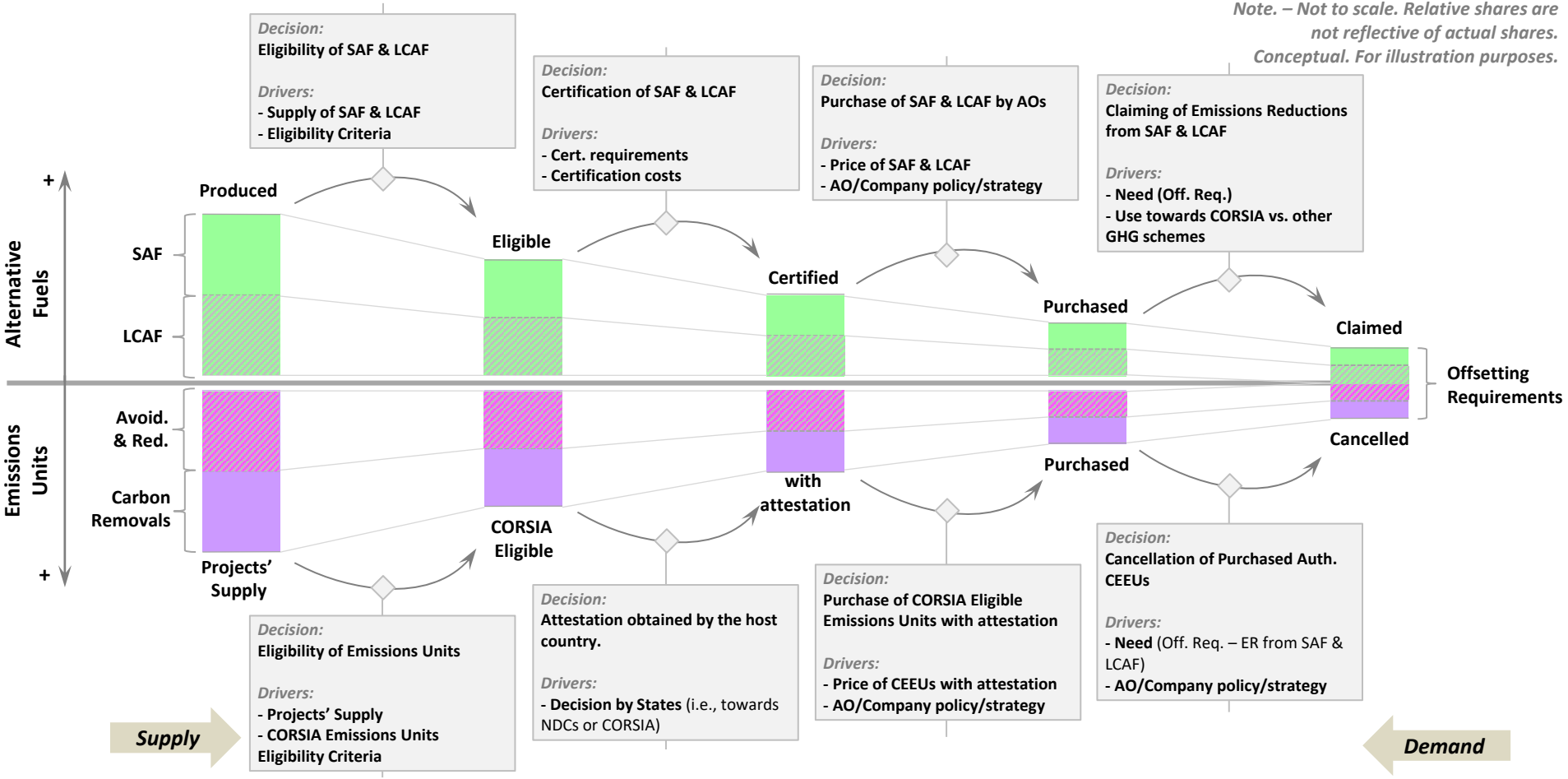
Cumulative Final Offsetting Requirements 2021-2035 (2024-2026)		No ER from CEF	Emissions Reductions from CEF Scenarios*	
			Low CEF scenario (LTAG-TG IS1)	**CAAF/3** scenario (Scaled LTAG-TG IS1)
Offsetting Requirements (given Traffic Scenario)	**High** Traffic Scenario *(proxy CAEP/13)*	**1510** (120) $MtCO_2$	**1440** (110) $MtCO_2$	**1100** (105) $MtCO_2$
	Mid Traffic Scenario *(proxy CAEP/13)*	**1340** (105) $MtCO_2$	**1300** (97) $MtCO_2$	**930** (92) $MtCO_2$
	Low Traffic Scenario *(proxy CAEP/13)*	**980** (80) $MtCO_2$	**910** (73) $MtCO_2$	**570** (68) $MtCO_2$

\+ Traffic (CO_2 Emissions) –

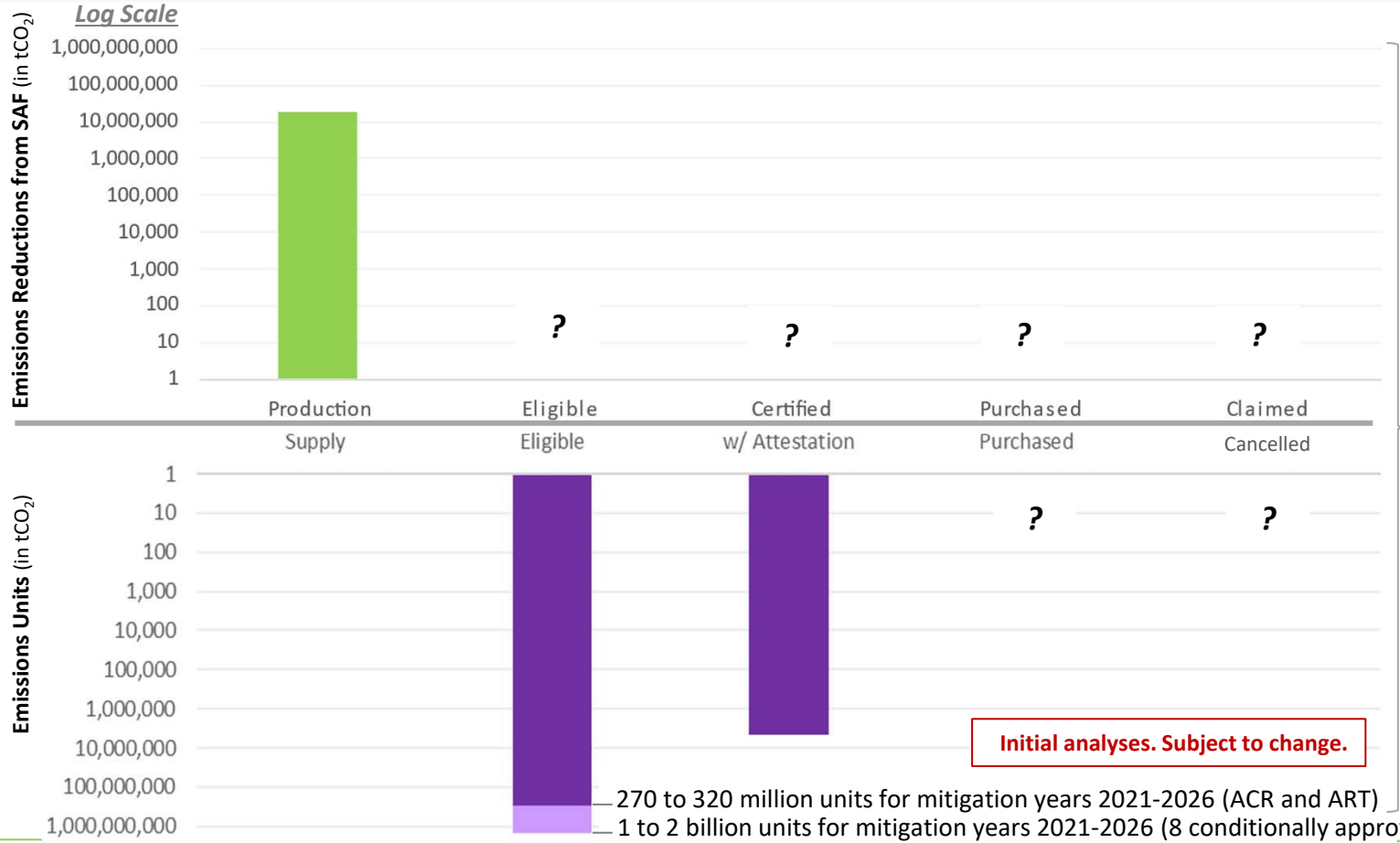
– Emissions Reductions from CEF +

* assuming Emissions Reductions from CEF i.e., Sustainable Aviation Fuels (SAF) and Lower Carbon Aviation Fuels (LCAF) corresponding to international aviation share of CEF use (i.e., excluding domestic aviation), consistent with LTAG-TG scenarios. Under the LTAG Integrated Scenarios 1-3, the use of LCAF starts in 2026 i.e., no use of LCAF in 2024 and 2025. These analyses assume that all Emissions Reductions from CEF associated with a CEF scenario are claimed under CORSIA. Note: Estimates of final O.R. reflect the constraint where ER from CEF can only be claimed within a given compliance cycle.

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



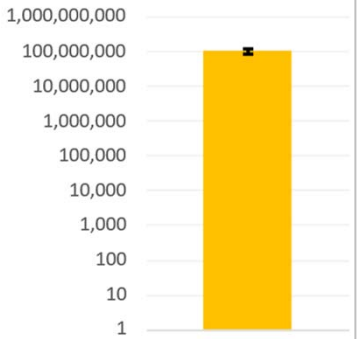
Focus on CORSIA First Phase (2024-2026)



Offsetting Requirements

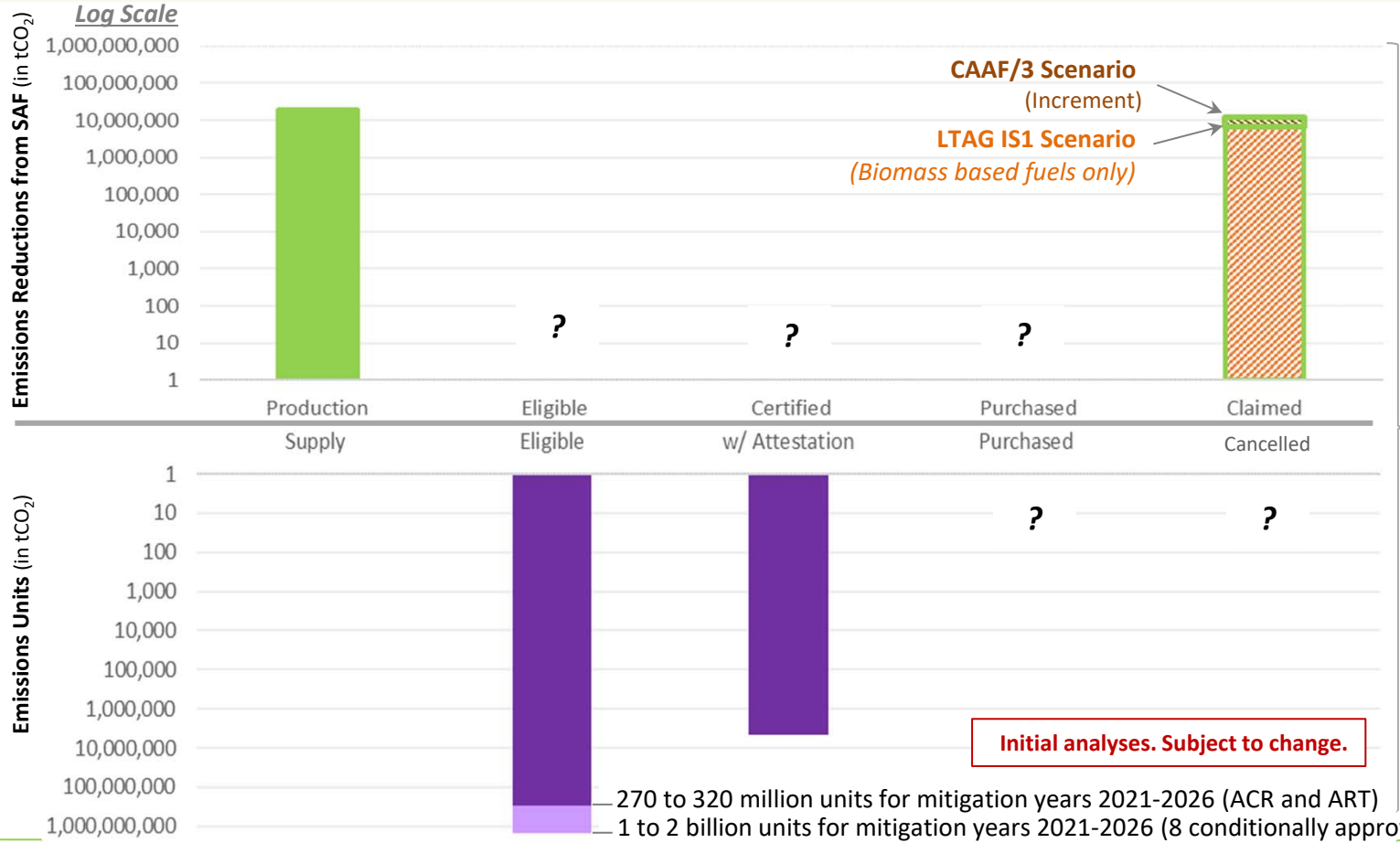
≈ **100** $MtCO_2$

during the First Phase of CORSIA



Focus on CORSIA First Phase (2024-2026)

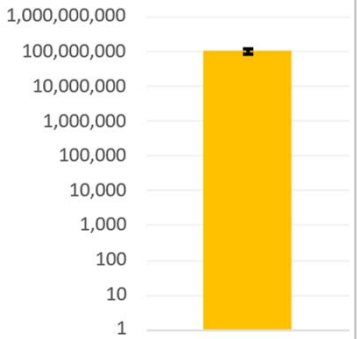
Scenario based Analysis on SAF Claims



Offsetting Requirements

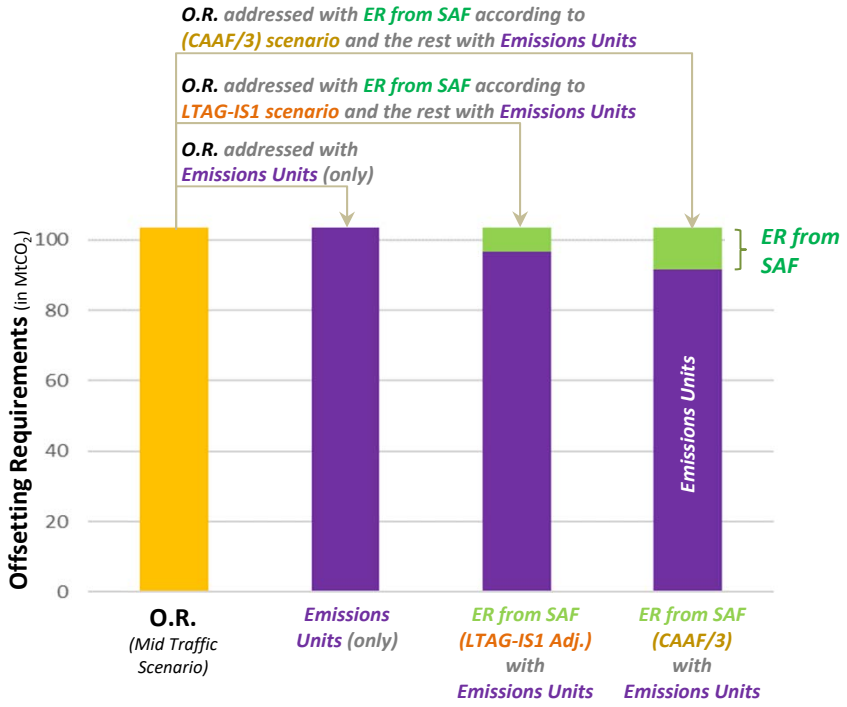
≈ **100** $MtCO_2$

during the First Phase of CORSIA



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

How Offsetting Requirements may be Addressed with SAF and/or Emissions Units?
(Scenario-based analysis)



- **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.**

- **Three scenarios considered:**

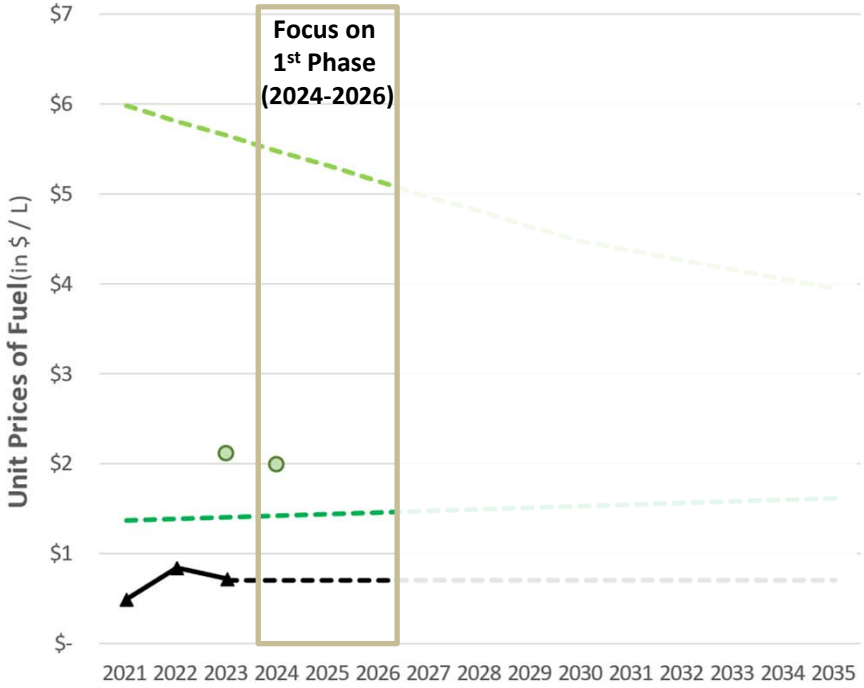
  (1) Offsetting Requirements addressed with **Emissions Units (only).**

  (2) Offsetting Requirements addressed with **Emissions Units** and **ER from SAF** (according to **LTAG-IS1 scenario, biomass-based fuels only**).

  (3) Offsetting Requirements addressed with **Emissions Units** and **ER from SAF** (according to **CAAF/3 scenario**).

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).**



Legend:

- IS1: LTAG-SAF Gaseous waste based fuels
- IS1: LTAG-SAF Biomass based fuel

Scenarios from LTAG Report (for context)

- SAF Unit Price: Historical & Est.
- Conventional Jet Fuel Unit Price
- Historical Jet Kerosene Price

* IATA, Industry Statistics, Industry Statistics, Fact Sheet, December 2023, www.iata.org/en/iata-repository/pressroom/fact-sheets/industry-statistics,

** Sources: IATA, Quantum Commodity Intelligence, Argus.

Summary of Estimates of Price of Emissions Units

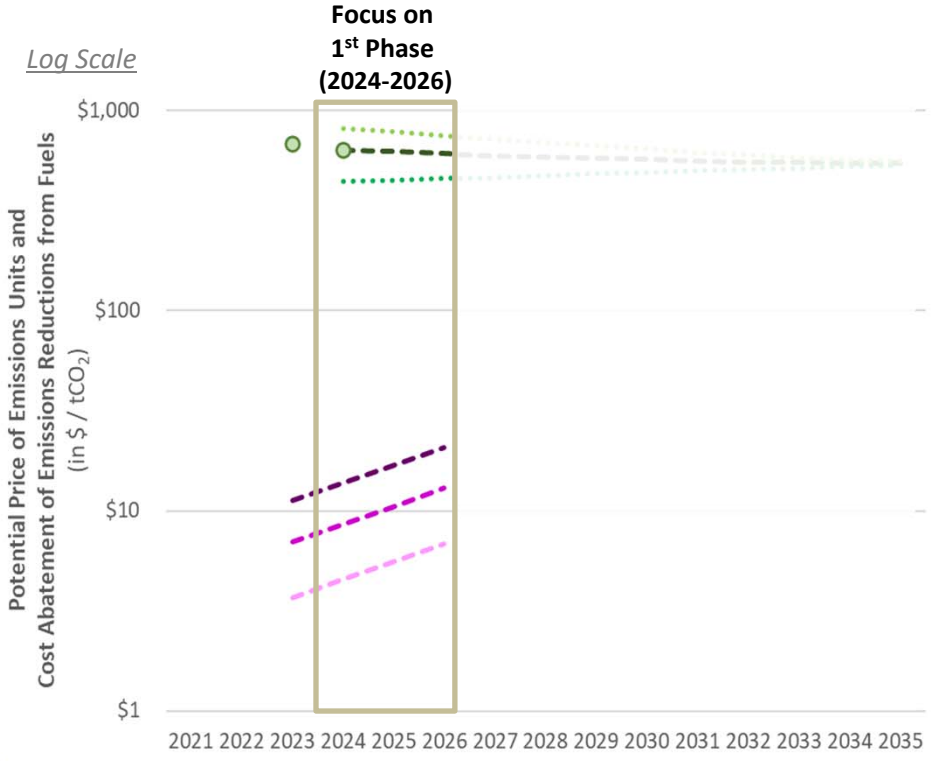
- The CAEP has updated its estimates of price of emissions units.
- Supply for emissions units from the TAB were considered.
- Updated demand estimates as presented in previous slides were also considered.
- For price, the CAEP noted that:
  - The market for CORSIA-eligible units remains at a nascent stage.
  - In recent years, most, if not all, carbon offset transactions are undertaken through bilateral contracts (over-the-counter or "OTC" transactions), making price information largely opaque.
  - Price forecasting, and assumptions applied, should be underpinned by robust data.
  - Additional sources of demand for carbon offsets are expected in the years to come, including from Parties to the Paris Agreement that may use carbon markets to help achieve their NDCs, as well as from private companies.

Initial 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[(1)] / tCO_2 abated) from the Emissions Reductions from SAF ranges from ≈ $600-800 per tCO_2. Average prices of emissions units may range from $5.70 to $17.20 per tCO_2 during the First Phase of CORSIA.**



Legend:

Price ER from CEF (Mid)	based on historical data and trend between High and Low
Price ER from CEF (High)	Weighted LTAG-IS1 (F1) Scenario [(2)]
Price ER from CEF (Low)	LTAG-IS1 (F1) Biomass based fuel only (High Price) [(2)]
Historical (SAF)	
CORSIA EEUs (High)	
CORSIA EEUs (Mid)	
CORSIA EEUs (Low)	

Notes:

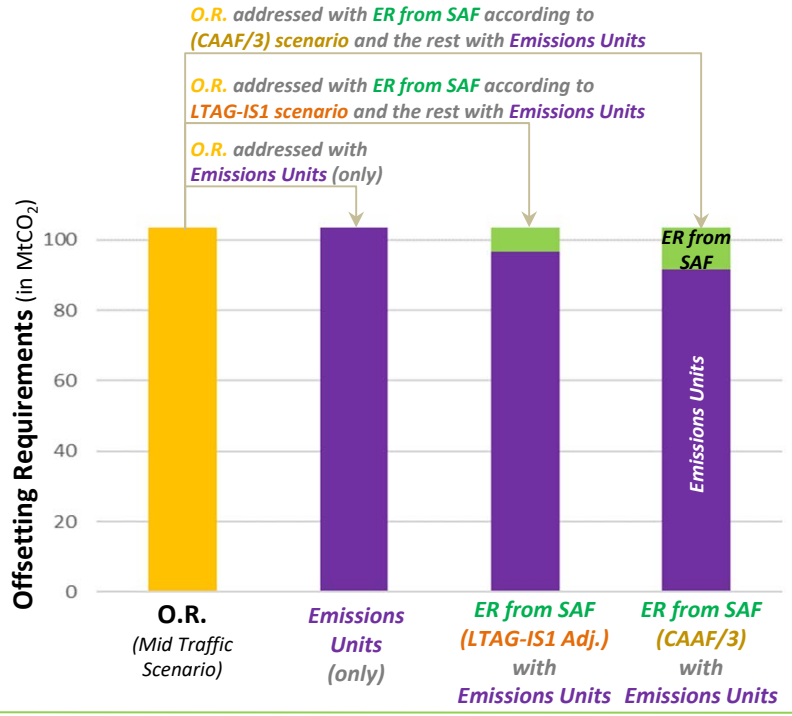
[(1)] The SAF Premium is calculated as the difference between the Unit Price of SAF and the unit price of Conventional Jet Fuel. It only includes the incremental cost of using SAF (compared to a scenario where Conventional Jet Fuel is used). It does not reflect the total cost of SAF.

[(2)] LTAG-TG Cost Abatements based on updated 0.7 $/L for Conventional Jet Fuel.

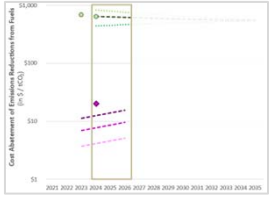
Addressing Offsetting Requirements during the First Phase of CORSIA with Cost Implications

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

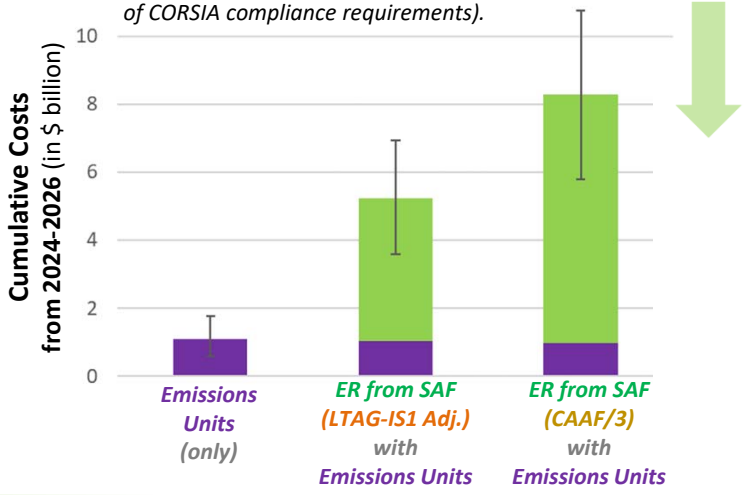


How much would it cost to address Offsetting Requirements during the First Phase ?

(Scenario-based analysis)

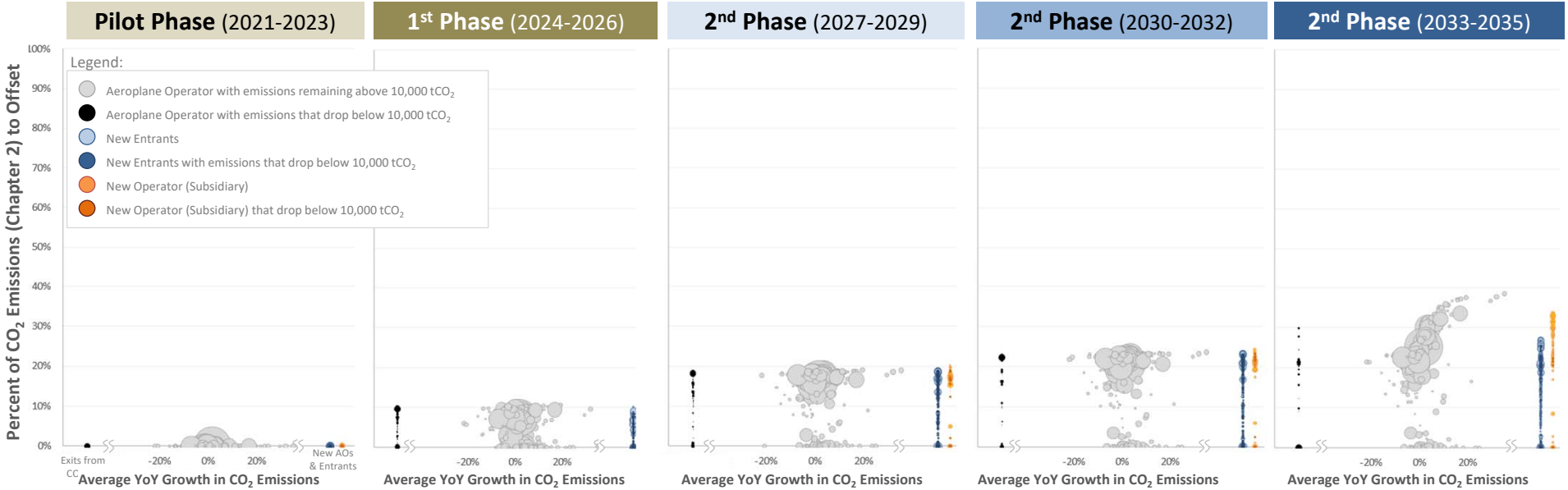
Initial analyses. Subject to change.

Notes:
(1) Actual cost of ER from SAF expected to be lower due to States' support e.g., tax credits, subsidies.
(2) the total cost abatement from SAF may not be fully attributable to CORSIA as airlines/operators have purchased and used SAF towards decarbonization efforts (in the absence of CORSIA compliance requirements).



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.**

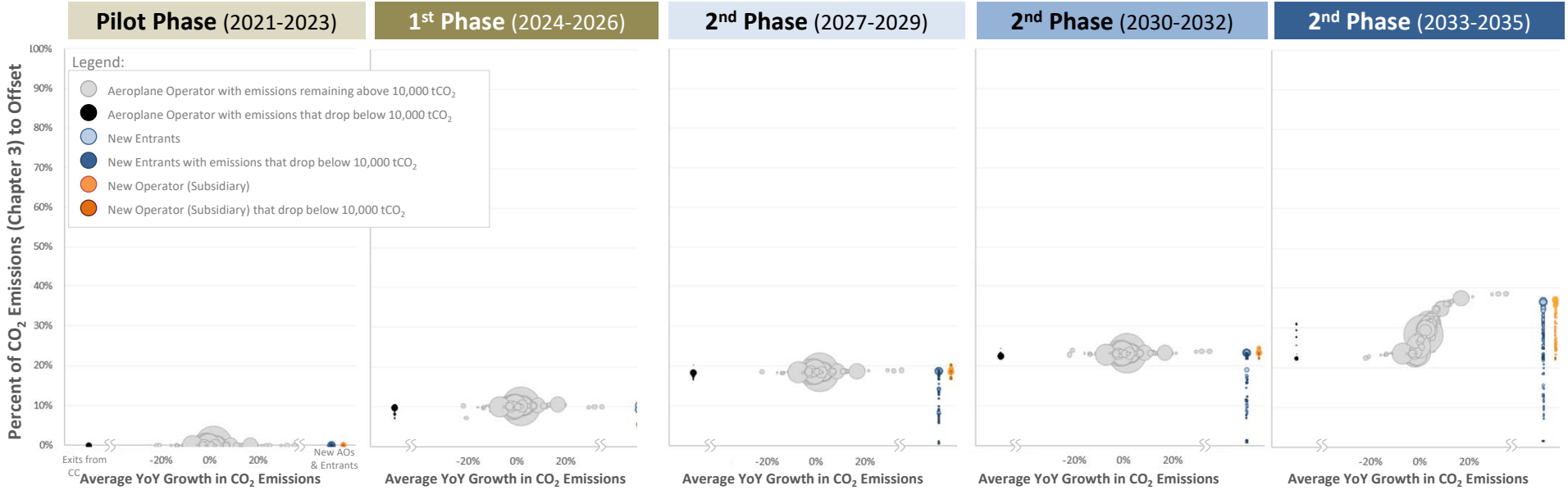


	Pilot Phase (2021-2023)	1st Phase (2024-2026)	2nd Phase (2027-2029)	2nd Phase (2030-2032)	2nd Phase (2033-2035)
Share of **CO_2 Emissions** across all CORSIA Phases:	**14 %**	**19 %**	**21 %**	**22 %**	**24 %**
Share of **Offsetting Requirements** (all phases):	**0 %**	**8 %**	**23 %**	**30 %**	**39%**

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 4/Rev1), New Entrant baseline option E.

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%

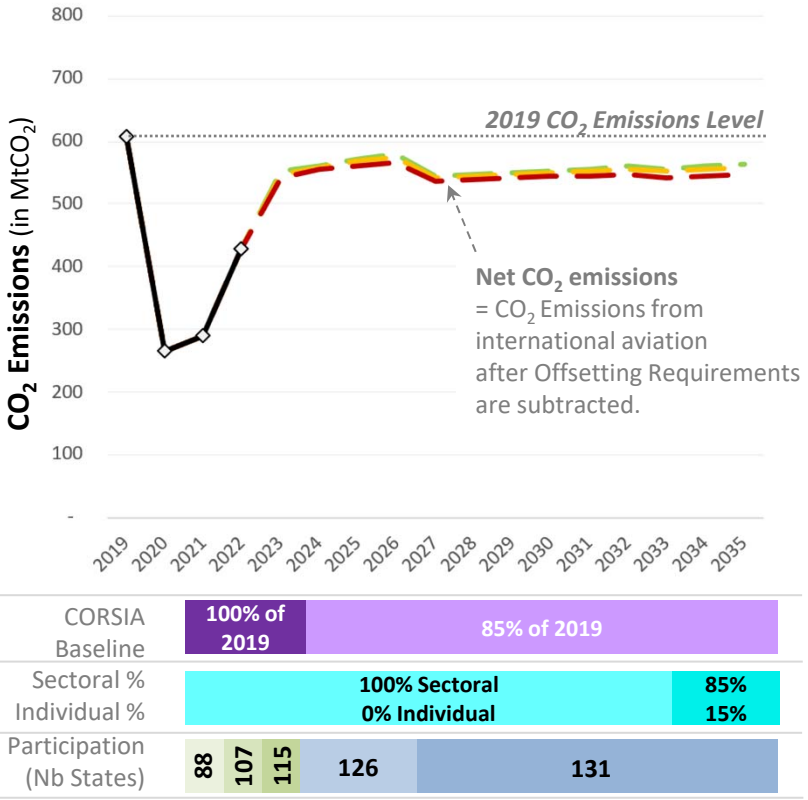
Assumptions: Traffic and Emissions Profile (CAEP/13 Mid Covid19 Scenario), CORSIA Baseline Ref. Year (2019 for 2021-2023 and 85% of 2019 for 2024-2035), Sectoral/Individual (100% / 0% in 2021-2032, 85% / 15% in 2033-2035), States for Chapter 3 State Pairs (Editions 1 through 4/Rev1), New Entrant baseline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

Projections of Net CO_2 Emissions through 2035

- **Under a draft proxy CAEP/13 Trends scenario, net CO_2 emissions may be ≈550 to 570 MtCO_2 in 2035** (≈ -7% to -10% below the 2019 level).

- **International aviation sector would possibly 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.***



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 COVID19 global pandemic coupled with a CORSIA baseline based on 2019 emissions, there were no offsetting required during the Pilot Phase** (to be confirmed in late 2024).
  - **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** (for future analysis).

Observations (cont.)

- **Based on its updated forward-looking assessments through 2035 with focus on First Phase (2024-2026), the CAEP noted that:**
  - **a) Given updated (proxy) CO_2 emissions forecasts and 85% of 2019 CORSIA baseline, offsetting requirements are expected to start in 2024 under all CAEP/13 traffic scenarios.**
  - **b) Cumulative offsetting requirements could range from 980 to 1500 $MtCO_2$ from 2024 to 2035 and 80 to 120 $MtCO_2$ during the First Phase.**
  - **c) Relevant technical information from CAAF/3 was considered to update scenarios for potential Emissions Reductions from CEF.**
  - **d) Updated scenario-based analysis suggests that emissions reduction from CEF may address on the order of ≈7% to ≈11% of offsetting requirements during the First Phase of CORSIA.**
  - **e) Costs associated with addressing offsetting requirements from 2024-2026 could range from:**
    - **≈ $1 billion ($0.6B to $1.8B) using Emissions Units only** to
    - **≈ $8 billion ($5.8B to $11B) using a mix of Emissions Units and ER from SAF given a scenario that takes into account the CAAF/3 vision.**

Agenda

- Background on CORSIA Periodic Review and Approach
- CORSIA Periodic Review: Review of CORSIA's Pilot Phase
  - Historical Trends
  - Tracking Contributions from Emissions Reductions from CEF and Supply, Demand and Price of Emissions Units
- CORSIA Periodic Review: Updated Forward Looking CORSIA Analyses
  - Tracking and development of scenarios for Emissions Reductions from CEF and Emissions Units
- Next Steps

Next Steps

- **CORSIA Periodic Review: Review of CORSIA's Pilot Phase**
  - **Continue to track the supply, demand and price of emissions units, along with emissions reductions from CEF.**
  - **Update assessments based on official 2023 CORSIA data (e.g., from the CCR).**
  - **Investigate possible approaches to access data on price information for CORSIA eligible units** (for future analysis).

- **CORSIA Periodic Review: Updated Forward Looking CORSIA Analyses**
  - **Continue to track the availability of CAEP/13 GHG (CO_2) emissions trends.**
  - **Update assessments based on official 2023 CORSIA data (e.g., from the CCR).**
  - **Further assess the potential emissions reductions from CORSIA Eligible Fuels and CORSIA Eligible Emissions Units.**

Proposed Updated Schedule for Assessments in Support of the 2025 CORSIA Periodic Review

232nd Session of the Council (June 2024):

Background
Ongoing Process

- **Key inputs to the CORSIA Analyses updated:**
  - a) Proxy CAEP/13 CO_2 emissions (same as towards the 231st Session).
  - b) Initial SAF scenarios (reflecting technical output from CAAF/3).
  - c) Updated CORSIA States for Chapter 3 State Pairs for 2024.
  - d) Regional distribution of offsetting requirements by ICAO Region.
  - e) Initial assessments of cost from CORSIA eligible fuels and CORSIA Eligible Emissions Units.

- **Update level: medium to high.**

- **Areas of CORSIA Analyses updated (or new):**
  - a) Backward looking assessment of the pilot phase
  - b) Estimates of volume of offsetting requirements.
  - c) Regional distribution of offsetting requirements by ICAO Region
  - d) Scenarios for emissions reductions from CORSIA eligible fuels and resulting demand for CORSIA Eligible Emissions Units.
  - e) Costs associated with offsetting requirements (i.e., emissions reductions from CORSIA eligible fuels and CORSIA Eligible Emissions Units).

Proposed Updated Schedule for Assessments in Support of the 2025 CORSIA Periodic Review

233rd Session of the Council (November 2024):

- **Key inputs to the CORSIA Analyses updated:**
  - a) CAEP/13 CO_2 emissions (tentatively available in August 2024, otherwise by end of Sept. 2024).
  - b) CORSIA States for Chapter 3 State Pairs for 2025.
  - c) Updated data on any other relevant input and metrics.

- **Update level: medium to high.**

- **Areas of CORSIA Analyses updated (or new):**
  - a) Backward looking assessment of the pilot phase.
  - b) Estimates of volume of offsetting requirements.
  - c) Regional distribution of offsetting requirements by ICAO Region.
  - d) Scenarios for emissions reductions from CORSIA eligible fuels and resulting demand for CORSIA Eligible Emissions Units.
  - e) Costs associated with offsetting requirements (i.e., emissions reductions from CORSIA eligible fuels and CORSIA Eligible Emissions Units).

Proposed Updated Schedule for Assessments in Support of the 2025 CORSIA Periodic Review

234th Session of the Council (March 2025):

- **Key inputs to the CORSIA Analyses updated:**
  - a) CAEP/13 emissions trends (if not available for the 233rd Session of the Council).
  - b) TAB's analysis on the supply of CORSIA Eligible Emissions Units, based on TAB's recommendations from the 2024 assessment on the eligibility of programmes for CORSIA's first phase (2024-2026), submitted to the 233rd Session of the Council (November 2024).
  - c) Forecast prices for CORSIA Eligible Emissions Units.
  - d) 2023 CO_2 emissions data reported through the CORSIA Central Registry (CCR).
- **Update level: high.**
- **Areas of CORSIA Analyses updated (or new):**
  - a) Backward looking assessment of the pilot phase (2023 data to be available in late 2024).
  - b) Estimates of volume of offsetting requirements.
  - c) Regional distribution of offsetting requirements by ICAO Region.
  - d) Scenarios for emissions reductions from CORSIA eligible fuels.
  - e) Costs associated with offsetting requirements (i.e., emissions reductions from CORSIA eligible fuels and CORSIA Eligible Emissions Units).

Proposed Updated Schedule for Assessments in Support of the 2025 CORSIA Periodic Review

235th Session of the Council (June 2025): *[Tentative – To Be Confirmed]*

- **Key inputs to the CORSIA Analyses updated:**
  - a) FTG SAF Production Short Term database (expected to be available around April 2025).
  - b) Forecast prices for CORSIA Eligible Emissions Units.
- **Update level: high.**
- **Areas of CORSIA Analyses updated (or new):**
  - a) Scenarios for emissions reductions from CORSIA eligible fuels.
  - b) Costs associated with offsetting requirements (i.e., emissions reductions from CORSIA eligible fuels and CORSIA Eligible Emissions Units).

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