

REGIONAL WORKSHOP CORSIA IMPLEMENTATION AFTER ICAO 41st GENERAL ASSEMBLY

41st ICAO Assembly outcomes on CORSIA: changes to the percentage of sectoral and individual operator's growth factor for the calculation of offsetting

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Working for quieter and cleaner aviation.

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How to calculate the offsetting requirement?

Introduction

Operator's annual emissions subject
to offsetting requirements

X

Growth Factor

=

CO₂ offsetting requirements

Introduction – Operator's emissions



a) Summary of reported international flights and emissions

Total CO ₂ emissions from international flights (in tonnes):	20000
Total CO ₂ emissions from flights subject to offsetting requirements (in tonnes):	5000
Total number of international flights during reporting period:	1000
Total number of international flights subject to offsetting requirements:	250
Total emissions reductions claimed from the use of CORSIA eligible fuels (in tonnes):	0

Introduction – Growth Factor

Operator's annual emissions subject to offsetting requirements

X

Growth Factor

=

CO₂ offsetting requirements



$$f(w) = \int_0^{\infty} f(x) e^{-\gamma x} dx \frac{d}{d\omega}$$

$$p \left(\frac{\partial V}{\partial t} + v \cdot \nabla V \right) = -\nabla p + \nabla \cdot T + f$$

$$H = -\sum p(x) \log p(x)$$

$$TC(Q, q_i, m_i) = \sum_{i=1}^n \left[\frac{D_i}{m_i q_i} S_i + c_i D_i + \frac{q_i H_i v}{2} \left(m_i \left(1 - \frac{D_i}{P_i} \right) - 1 + 2 \frac{D_i}{P_i} \right) \right]$$

$$\frac{d \Delta p(s, \phi)}{d \Delta M(s, \phi)} = \begin{bmatrix} \beta & -\beta \\ -\beta & 0 \end{bmatrix} \begin{bmatrix} \Delta p(s, \phi) \\ \Delta M(s, \phi) \end{bmatrix}$$

$$\int_0^{\pi/2} (\log \sin x)^2 dx = -\int_0^{\pi/2} (\log \cos x)^2 dx = \frac{\pi}{2} \left\{ \frac{\pi^2}{12} + (\log 2)^2 \right\}$$

$\int = \int E_t dt$
 $\nabla \cdot E = 0$
 $\nabla \cdot H = 0$
 $\nabla \cdot \Psi = H \cdot \Psi$

$\frac{1}{2} G^2 S + \frac{\partial V}{\partial S^2} + S \frac{\partial V}{\partial S} + \frac{\partial V}{\partial t} - r \cdot V = 0$

$\frac{d \Delta p(s, \phi)}{d \Delta M(s, \phi)} = \begin{bmatrix} \beta & -\beta \\ -\beta & 0 \end{bmatrix} \begin{bmatrix} \Delta p(s, \phi) \\ \Delta M(s, \phi) \end{bmatrix}$

Introduction – Growth Factor

Operator's annual emissions subject to offsetting requirements

X

Growth Factor

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CO₂ offsetting requirements



$$SGF_y = \frac{(SE_y - SE_{B,y})}{SE_y}$$

Sector Growth Factor

$$OGF_y = \frac{(OE_y - OE_{B,y})}{OE_y}$$

Operator Growth Factor

Introduction – Growth factors overtime

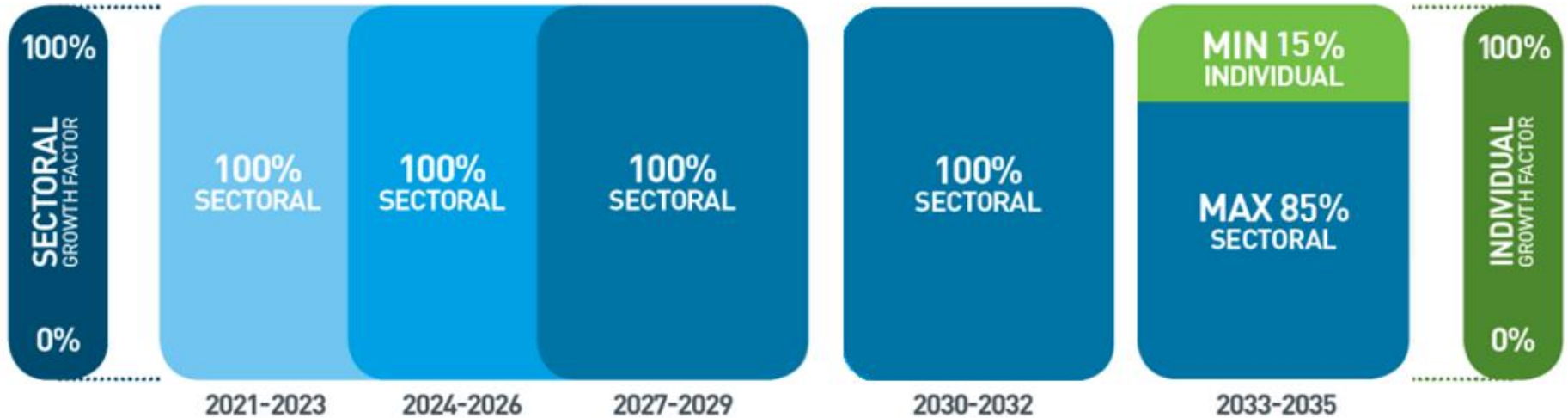
Operator's annual emissions subject to offsetting requirements

X

Growth Factor

=

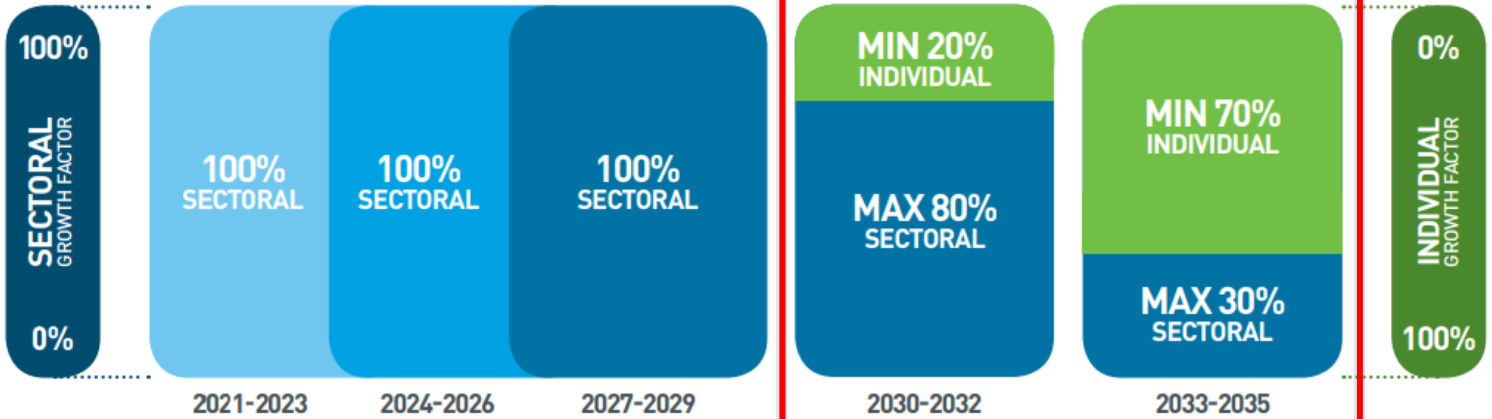
CO₂ offsetting requirements



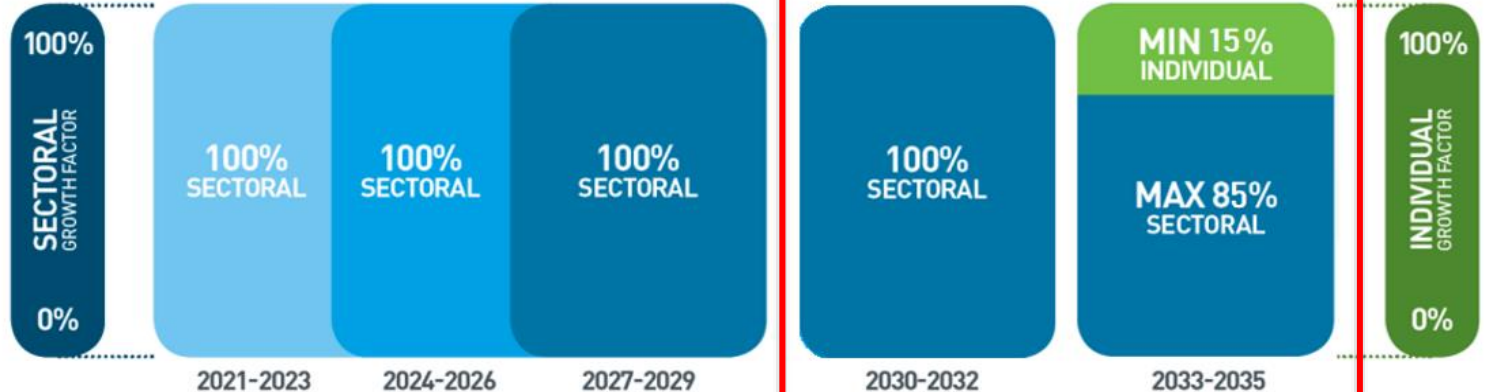
Source: ICAO

Introduction - Growth factors overtime

**Before the
41st ICAO
Assembly**



**After the
41st ICAO
Assembly**



How to calculate the Offsetting Requirements and the Growth Factors?

Offsetting Requirements calculation

Here is the famous formula for calculating the offsetting requirement by taking into account the sector and individual factors:

$$\text{CO}_2 \text{ offsetting requirements} = \left(\begin{array}{c} \% \text{ sectoral} \\ \times \\ \text{Operator's annual emissions} \\ \text{subject to offsetting requirement} \\ \times \\ \text{Sector Growth Factor} \end{array} \right) + \left(\begin{array}{c} \% \text{ individual} \\ \times \\ \text{Operator's annual emissions} \\ \text{subject to offsetting requirement} \\ \times \\ \text{Operator Growth Factor} \end{array} \right)$$

Offsetting Requirements calculation

Let's first understand the link between the two formulas

Operator's annual emissions subject to offsetting requirements

X

Growth Factor

=

CO₂ offsetting requirements

$$CO_2 \text{ offsetting requirements} = \left(\frac{\% \text{ sectoral}}{\text{Sector Growth Factor}} \times \text{Operator's annual emissions subject to offsetting requirement} \right) + \left(\frac{\% \text{ individual}}{\text{Operator Growth Factor}} \times \text{Operator's annual emissions subject to offsetting requirement} \right)$$

Example

With an example, it will be easier to digest and understand...

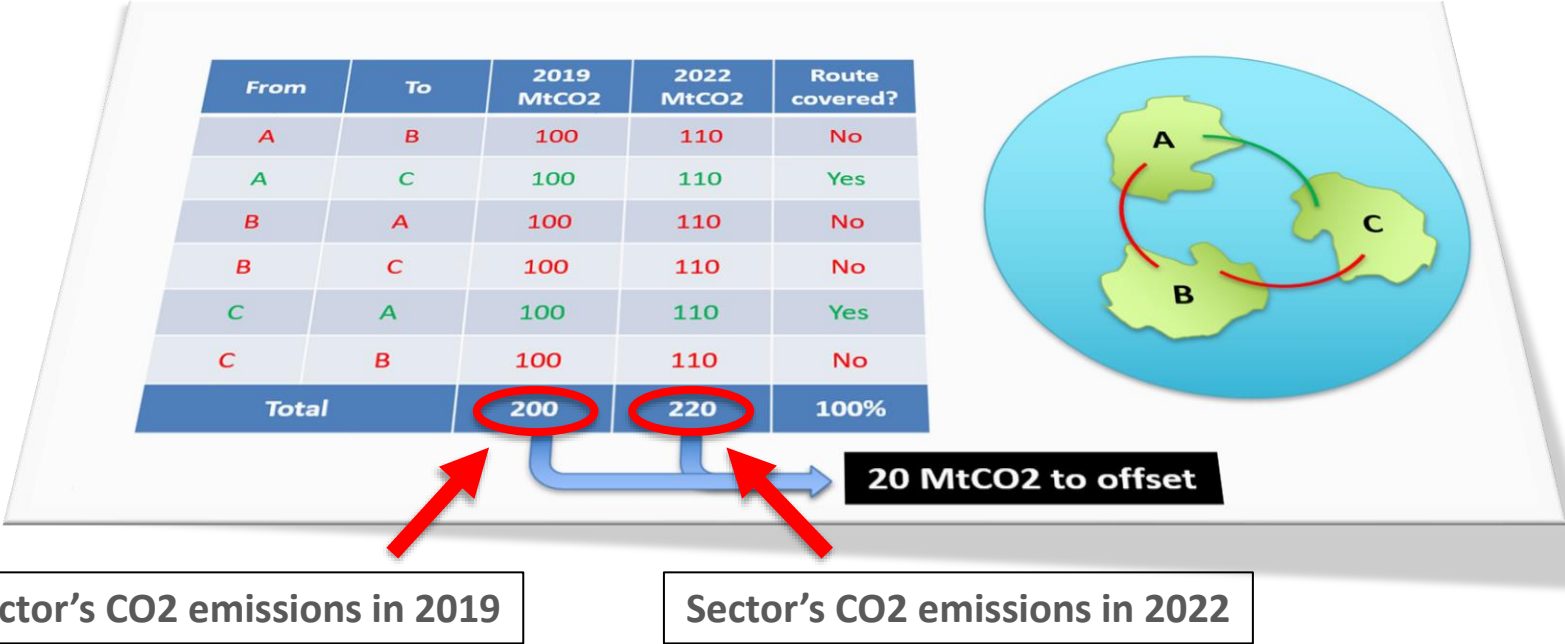
Context:

- Reporting year: 2022
- Sector's CO₂ emissions in 2019: 500 MtCO₂
- Sector's CO₂ emissions in 2022: 700 MtCO₂
- EASA Airways' emissions in 2019: 40'000 tCO₂
- EASA Airways' emissions in 2022: 50'000 tCO₂
- Sectoral Growth Factor: 100% and Operator Growth Factor: 0%



Sector's emissions

Reminder of the sector's emissions:



Example – Offsetting requirements (2022)

Context:

- Reporting year: 2022
- Sector's CO2 emissions in 2019: 500 MtCO2
- Sector's CO2 emissions in 2022: 700 MtCO2
- EASA Airways' emissions in 2019: 40'000 tCO2
- EASA Airways' emissions in 2022: 50'000 tCO2
- Sectoral Growth Factor: 100% and Operator Growth Factor: 0%

$$CO_2 \text{ offsetting requirements} = \left(\begin{array}{c} \% \text{ sectoral} \\ \times \\ \text{Operator's annual emissions} \\ \text{subject to offsetting requirement} \\ \times \\ \text{Sector Growth Factor} \end{array} \right) + \left(\begin{array}{c} \% \text{ individual} \\ \times \\ \text{Operator's annual emissions} \\ \text{subject to offsetting requirement} \\ \times \\ \text{Operator Growth Factor} \end{array} \right)$$

$$CO_2 \text{ offsetting requirements} = \left(\begin{array}{c} 100\% \\ \times \\ 50'000 \text{ tCO2} \\ \times \\ \text{Sector Growth Factor} \end{array} \right) + \left(\begin{array}{c} 0\% \\ \times \\ 50'000 \text{ tCO2} \\ \times \\ \text{Operator Growth Factor} \end{array} \right)$$

How to calculate the Growth Factors?

We need now to calculate the **Sector Growth Factor** and **Operator Growth Factor**.

$$SGF_y = \frac{(SE_y - SE_{b,y})}{SE_y}$$

SGF_y : Sector Growth Factor

SE_y : Sector's CO2 emissions in a given year

$SE_{b,y}$: Sector's CO2 emissions in 2019 (for the Pilot phase)

$SE_{b,y}$: 85% of the Sector's CO2 emissions in 2019
(for the First and Second phase)

$$OGF_y = \frac{(OE_y - OE_{b,y})}{OE_y}$$

OGF_y : Operator Growth Factor

OE_y : Operator's CO2 emissions in a given year

$OE_{b,y}$: Operator's CO2 emissions in 2019 (for the Pilot phase)

$OE_{b,y}$: 85% of the Operator's CO2 emissions in 2019
(for the First and Second phase)

Example – Growth Factors calculation (2022)

Context:

- Reporting year: 2022
- Sector's CO2 emissions in 2019: 500 MtCO2
- Sector's CO2 emissions in 2022: 700 MtCO2
- EASA Airways' emissions in 2019: 40'000 tCO2
- EASA Airways' emissions in 2022: 50'000 tCO2
- Sectoral Growth Factor: 100% and Operator Growth Factor: 0%

$$SGF_y = \frac{(SE_y - SE_{b,y})}{SE_y}$$

$$OGF_y = \frac{(OE_y - OE_{b,y})}{OE_y}$$

$$SGF_{2022} = \frac{(SE_{2022} - SE_{b,2022})}{SE_{2022}} = \frac{(700 \text{ MtCO2} - 500 \text{ MtCO2})}{700 \text{ MtCO2}} = 28.57\%$$

$$OGF_{2022} = \frac{(OE_{2022} - OE_{b,2022})}{OE_{2022}} = \frac{(50'000 \text{ tCO2} - 40'000 \text{ tCO2})}{50'000 \text{ tCO2}} = 20.00\%$$

Example – Offsetting requirements (2022)

Context:

- Reporting year: 2022
- Sector's CO2 emissions in 2019: 500 MtCO2
- Sector's CO2 emissions in 2022: 700 MtCO2
- EASA Airways' emissions in 2019: 40'000 tCO2
- EASA Airways' emissions in 2022: 50'000 tCO2
- Sectoral Growth Factor: 100% and Operator Growth Factor: 0%

$$CO_2 \text{ offsetting requirements} = \left(\frac{\% \text{ sectoral} \times \text{Operator's annual emissions subject to offsetting requirement}}{\text{Sector Growth Factor}} \right) + \left(\frac{\% \text{ individual} \times \text{Operator's annual emissions subject to offsetting requirement}}{\text{Operator Growth Factor}} \right)$$

$$CO_2 \text{ offsetting requirements} = \left(\frac{100\% \times 50'000 \text{ tCO}_2}{28.57\%} \right) + \left(\frac{0\% \times 50'000 \text{ tCO}_2}{20.00\%} \right) = 14\,285 \text{ tCO}_2$$

Example – Growth Factors calculation (2034)

Context:

- Reporting year: 2034
- Sector's CO2 emissions in 2019: 500 MtCO2
- Sector's CO2 emissions in 2034: 1500 MtCO2
- EASA Airways' emissions in 2019: 40'000 tCO2
- EASA Airways' emissions in 2034: 200'000 tCO2
- Sectoral Growth Factor: 85% and Operator Growth Factor: 15%

$$SGF_y = \frac{(SE_y - SE_{b,y})}{SE_y}$$

$$OGF_y = \frac{(OE_y - OE_{b,y})}{OE_y}$$

$$SGF_{2034} = \frac{(SE_{2034} - SE_{b,2034})}{SE_{2034}} = \frac{(1500 \text{ MtCO2} - 500 \text{ MtCO2})}{1500 \text{ MtCO2}} = 66.67\%$$

$$OGF_{2034} = \frac{(OE_{2034} - OE_{b,2034})}{OE_{2034}} = \frac{(200'000 \text{ tCO2} - 40'000 \text{ tCO2})}{200'000 \text{ tCO2}} = 80.00\%$$

Example – Offsetting requirements (2034)

Context:

- Reporting year: 2034
- Sector's CO2 emissions in 2019: 500 MtCO2
- Sector's CO2 emissions in 2034: 1500 MtCO2
- EASA Airways' emissions in 2019: 40'000 tCO2
- EASA Airways' emissions in 2034: 200'000 tCO2
- Sectoral Growth Factor: 85% and Operator Growth Factor: 15%

$$CO_2 \text{ offsetting requirements} = \left(\begin{array}{c} \% \text{ sectoral} \\ \times \\ \text{Operator's annual emissions} \\ \text{subject to offsetting requirement} \\ \times \\ \text{Sector Growth Factor} \end{array} \right) + \left(\begin{array}{c} \% \text{ individual} \\ \times \\ \text{Operator's annual emissions} \\ \text{subject to offsetting requirement} \\ \times \\ \text{Operator Growth Factor} \end{array} \right)$$

$$CO_2 \text{ offsetting requirements} = \left(\begin{array}{c} 85\% \\ \times \\ 200'000 \text{ tCO}_2 \\ \times \\ 66.67\% \end{array} \right) + \left(\begin{array}{c} 15\% \\ \times \\ 200'000 \text{ tCO}_2 \\ \times \\ 80.00\% \end{array} \right) = 113'339 \text{ tCO}_2 + 24'000 \text{ tCO}_2 = 137'339 \text{ tCO}_2$$

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