



ICAO

ENVIRONMENT

ICAO Seminar on CORSIA

# Illustrative Exercise 2: Calculation of Offsetting Requirements in CORSIA

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ICAO Secretariat



# Exercise 2 - Assumption

**Assumption Table 4:** Routes covered by CORSIA in the first year of the pilot phase (2021) and in the first year of the first phase (2024) and respective emissions

Route-based approach		Pilot phase				First phase			
From	To	Route Covered?	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2021)	Route Covered?	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2024)
A	B	Yes	52	54	55	Yes	52	54	60
A	C	No	52	54	55	No	52	54	60
A	D	Yes	52	54	55	Yes	52	54	60
A	E	No	53	56	58	No	53	56	68
A	F	No	53	56	58	Yes	53	56	68
A	G	No	53	56	58	Yes	53	56	68
A	H	No	54	59	63	No	54	59	80
A	I	Yes	54	59	63	Yes	54	59	80
A	J	No	54	59	63	No	54	59	80
B	A	Yes	52	54	55	Yes	52	54	60
B	C	No	52	54	55	No	52	54	60
B	D	Yes	52	54	55	Yes	52	54	60
B	E	No	52	54	55	No	52	54	60
B	G	No	54	59	63	Yes	54	59	80
B	H	No	54	59	63	No	54	59	80
B	I	Yes	54	59	63	Yes	54	59	80
B	J	No	54	59	63	No	54	59	80
C	A	No	53	56	58	No	53	56	68
C	D	No	53	56	58	No	53	56	68
D	E	No	32	34	35	No	32	34	41
E	F	No	9	10	11	No	9	10	14
F	A	No	7	8	9	Yes	7	8	12
G	B	No	5	6	7	Yes	5	6	10
H	I	No	2	3	3	No	2	3	5
Total international aviation CO <sub>2</sub>		-	1062	1132	1181	-	1062	1132	1402
<b>TOTAL CO<sub>2</sub> COVERED BY CORSIA</b>		-	<b>316</b>	<b>334</b>	<b>346</b>	-	<b>488</b>	<b>519</b>	<b>638</b>

# Exercise 2-A / Instruction

Based on the Assumption Table 4:

- a) Calculate the average of total CO<sub>2</sub> emissions covered by CORSIA between 2019 and 2020 for the year 2021
- b) Calculate the sectoral growth factor for the year 2021
- c) Calculate the average of total CO<sub>2</sub> emissions covered by CORSIA between 2019 and 2020 for the year 2024
- d) Calculate the sectoral growth factor for the year 2024

Route-based approach		Pilot phase				First phase			
From	To	Route Covered?	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2021)	Route Covered?	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2024)
A	B	Yes	52	54	55	Yes	52	54	60
A	C	No	52	54	55	No	52	54	60
A	D	Yes	52	54	55	Yes	52	54	60
A	E	No	53	56	58	No	53	56	68
A	F	No	53	56	58	Yes	53	56	68
A	G	No	53	56	58	Yes	53	56	68
A	H	No	54	59	63	No	54	59	80
A	I	Yes	54	59	63	Yes	54	59	80
A	J	No	54	59	63	No	54	59	80
B	A	Yes	52	54	55	Yes	52	54	60
B	C	No	52	54	55	No	52	54	60
B	D	Yes	52	54	55	Yes	52	54	60
B	E	No	52	54	55	No	52	54	60
B	G	No	54	59	63	Yes	54	59	80
B	H	No	54	59	63	No	54	59	80
B	I	Yes	54	59	63	Yes	54	59	80
B	J	No	54	59	63	No	54	59	80
C	A	No	53	56	58	No	53	56	68
C	D	No	53	56	58	No	53	56	68
D	E	No	32	34	35	No	32	34	41
E	F	No	9	10	11	No	9	10	14
F	A	No	7	8	9	Yes	7	8	12
G	B	No	5	6	7	Yes	5	6	10
H	I	No	2	3	3	No	2	3	5
Total international aviation CO <sub>2</sub>		-	1062	1132	1181	-	1062	1132	1402
<b>TOTAL CO<sub>2</sub> COVERED BY CORSIA</b>		-	<b>316</b>	<b>334</b>	<b>346</b>	-	<b>488</b>	<b>519</b>	<b>638</b>

# Exercise 2-A / Solution

Based on the Assumption Table 4:

- a) Calculate the average of total CO<sub>2</sub> emissions covered by CORSIA between 2019 and 2020 for the year 2021 ✓
- b) Calculate the sectoral growth factor for the year 2021
- c) Calculate the average of total CO<sub>2</sub> emissions covered by CORSIA between 2019 and 2020 for the year 2024
- d) Calculate the sectoral growth factor for the year 2024

Route-based approach		Pilot phase				First phase			
From	To	Route Covered?	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2021)	Route Covered?	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2024)
A	B	Yes	52	54	55	Yes	52	54	60
A	C	No	52	54	55	No	52	54	60
A	D	Yes	52	54	55	Yes	52	54	60
A	E	No	53	56	58	No	53	56	68
A	F	No	53	56	58	Yes	53	56	68
A	G	No	53	56	58	Yes	53	56	68
A	H	No	54	59	63	No	54	59	80
A	I	Yes	54	59	63	Yes	54	59	80
A	J	No	54	59	63	No	54	59	80
B	A	Yes	52	54	55	Yes	52	54	60
B	C	No	52	54	55	No	52	54	60
B	D	Yes	52	54	55	Yes	52	54	60
B	E	No	52	54	55	No	52	54	60
B	G	No	54	59	63	Yes	54	59	80
B	H	No	54	59	63	No	54	59	80
B	I	Yes	54	59	63	Yes	54	59	80
B	J	No	54	59	63	No	54	59	80
C	A	No	53	56	58	No	53	56	68
C	D	No	53	56	58	No	53	56	68
D	E	No	32	34	35	No	32	34	41
E	F	No	9	10	11	No	9	10	14
F	A	No	7	8	9	Yes	7	8	12
G	B	No	5	6	7	Yes	5	6	10
H	I	No	2	3	3	No	2	3	5
Total international aviation CO <sub>2</sub>		-	1062	1132	1181	-	1062	1132	1402
<b>TOTAL CO<sub>2</sub> COVERED BY CORSIA</b>		-	<b>316</b>	<b>334</b>	<b>346</b>	-	<b>488</b>	<b>519</b>	<b>638</b>

$$B = (316 + 334) / 2 = 325.0$$

# Exercise 2-A / Solution

Based on the Assumption Table 4:

- a) Calculate the average of total CO<sub>2</sub> emissions covered by CORSIA between 2019 and 2020 for the year 2021 ✓
- b) Calculate the sectoral growth factor for the year 2021 ✓
- c) Calculate the average of total CO<sub>2</sub> emissions covered by CORSIA between 2019 and 2020 for the year 2024
- d) Calculate the sectoral growth factor for the year 2024

Route-based approach		Pilot phase				First phase			
From	To	Route Covered?	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2021)	Route Covered?	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2024)
A	B	Yes	52	54	55	Yes	52	54	60
A	C	No	52	54	55	No	52	54	60
A	D	Yes	52	54	55	Yes	52	54	60
A	E	No	53	56	58	No	53	56	68
A	F	No	53	56	58	Yes	53	56	68
A	G	No	53	56	58	Yes	53	56	68
A	H	No	54	59	63	No	54	59	80
A	I	Yes	54	59	63	Yes	54	59	80
A	J	No	54	59	63	No	54	59	80
B	A	Yes	52	54	55	Yes	52	54	60
B	C	No	52	54	55	No	52	54	60
B	D	Yes	52	54	55	Yes	52	54	60
B	E	No	52	54	55	No	52	54	60
B	G	No	54	59	63	Yes	54	59	80
B	H	No	54	59	63	No	54	59	80
B	I	Yes	54	59	63	Yes	54	59	80
B	J	No	54	59	63	No	54	59	80
C	A	No	53	56	58	No	53	56	68
C	D	No	53	56	58	No	53	56	68
D	E	No	32	34	35	No	32	34	41
E	F	No	9	10	11	No	9	10	14
F	A	No	7	8	9	Yes	7	8	12
G	B	No	5	6	7	Yes	5	6	10
H	I	No	2	3	3	No	2	3	5
Total international aviation CO <sub>2</sub>		-	1062	1132	1181	-	1062	1132	1402
<b>TOTAL CO<sub>2</sub> COVERED BY CORSIA</b>		-	<b>316</b>	<b>334</b>	<b>346</b>	-	<b>488</b>	<b>519</b>	<b>638</b>

**A = 346**

**B = 325.0**

$$\text{Sectoral growth factor} = \frac{(A - B)}{A} = \frac{(346 - 325.0)}{346} = 0.061 = 6.1\%$$

# Exercise 2-A / Solution

Based on the Assumption Table 4:

- a) Calculate the average of total CO<sub>2</sub> emissions covered by CORSIA between 2019 and 2020 for the year 2021 ✓
- b) Calculate the sectoral growth factor for the year 2021 ✓
- c) Calculate the average of total CO<sub>2</sub> emissions covered by CORSIA between 2019 and 2020 for the year 2024 ✓
- d) Calculate the sectoral growth factor for the year 2024

Route-based approach		Pilot phase				First phase			
From	To	Route Covered?	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2021)	Route Covered?	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2024)
A	B	Yes	52	54	55	Yes	52	54	60
A	C	No	52	54	55	No	52	54	60
A	D	Yes	52	54	55	Yes	52	54	60
A	E	No	53	56	58	No	53	56	68
A	F	No	53	56	58	Yes	53	56	68
A	G	No	53	56	58	Yes	53	56	68
A	H	No	54	59	63	No	54	59	80
A	I	Yes	54	59	63	Yes	54	59	80
A	J	No	54	59	63	No	54	59	80
B	A	Yes	52	54	55	Yes	52	54	60
B	C	No	52	54	55	No	52	54	60
B	D	Yes	52	54	55	Yes	52	54	60
B	E	No	52	54	55	No	52	54	60
B	G	No	54	59	63	Yes	54	59	80
B	H	No	54	59	63	No	54	59	80
B	I	Yes	54	59	63	Yes	54	59	80
B	J	No	54	59	63	No	54	59	80
C	A	No	53	56	58	No	53	56	68
C	D	No	53	56	58	No	53	56	68
D	E	No	32	34	35	No	32	34	41
E	F	No	9	10	11	No	9	10	14
F	A	No	7	8	9	Yes	7	8	12
G	B	No	5	6	7	Yes	5	6	10
H	I	No	2	3	3	No	2	3	5
Total international aviation CO <sub>2</sub>		-	1062	1132	1181	-	1062	1132	1402
<b>TOTAL CO<sub>2</sub> COVERED BY CORSIA</b>		-	<b>316</b>	<b>334</b>	<b>346</b>	-	<b>488</b>	<b>519</b>	<b>638</b>

$$B = (488 + 519) / 2 = 503.5$$

# Exercise 2-A / Solution

Based on the Assumption Table 4:

- a) Calculate the average of total CO<sub>2</sub> emissions covered by CORSIA between 2019 and 2020 for the year 2021 ✓
- b) Calculate the sectoral growth factor for the year 2021 ✓
- c) Calculate the average of total CO<sub>2</sub> emissions covered by CORSIA between 2019 and 2020 for the year 2024 ✓
- d) Calculate the sectoral growth factor for the year 2024 ✓

Route-based approach		Pilot phase				First phase			
From	To	Route Covered?	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2021)	Route Covered?	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2024)
A	B	Yes	52	54	55	Yes	52	54	60
A	C	No	52	54	55	No	52	54	60
A	D	Yes	52	54	55	Yes	52	54	60
A	E	No	53	56	58	No	53	56	68
A	F	No	53	56	58	Yes	53	56	68
A	G	No	53	56	58	Yes	53	56	68
A	H	No	54	59	63	No	54	59	80
A	I	Yes	54	59	63	Yes	54	59	80
A	J	No	54	59	63	No	54	59	80
B	A	Yes	52	54	55	Yes	52	54	60
B	C	No	52	54	55	No	52	54	60
B	D	Yes	52	54	55	Yes	52	54	60
B	E	No	52	54	55	No	52	54	60
B	G	No	54	59	63	Yes	54	59	80
B	H	No	54	59	63	No	54	59	80
B	I	Yes	54	59	63	Yes	54	59	80
B	J	No	54	59	63	No	54	59	80
C	A	No	53	56	58	No	53	56	68
C	D	No	53	56	58	No	53	56	68
D	E	No	32	34	35	No	32	34	41
E	F	No	9	10	11	No	9	10	14
F	A	No	7	8	9	Yes	7	8	12
G	B	No	5	6	7	Yes	5	6	10
H	I	No	2	3	3	No	2	3	5
Total international aviation CO <sub>2</sub>		-	1062	1132	1181	-	1062	1132	1402
<b>TOTAL CO<sub>2</sub> COVERED BY CORSIA</b>		-	<b>316</b>	<b>334</b>	<b>346</b>	-	<b>488</b>	<b>519</b>	<b>638</b>

**A = 638**

**B = 503.5**

$$\text{Sectoral growth factor} = \frac{(A - B)}{A} = \frac{(638 - 503.5)}{638} = 0.211 = 21.1\%$$

# Exercise 2-B / Instruction

Based on the results of the Exercise 2-A, and the information on routes of airline A1 in Assumption Table 2 (refer to Exercise 1-A):

a) Calculate the CO<sub>2</sub> emissions covered by CORSIA in 2024 by the airline A1

b) Calculate the amount of offsetting requirements in 2024 by the airline A1, as well as the cost if the unit cost for the offsetting requirements is \$5:

- Offsetting Requirements:

- Cost:

**Assumption Table 2:** Emissions of Individual Airlines in selected years

State	Airline	From	To	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2021)	CO <sub>2</sub> (2024)
A	A1	A	B	52	54	55	60
A	A1	A	C	52	54	55	60
A	A1	A	D	52	54	55	60
A	A2	A	E	53	56	58	68
A	A2	A	F	53	56	58	68
A	A2	A	G	53	56	58	68
A	A3	A	H	54	59	63	80
A	A3	A	I	54	59	63	80
A	A3	A	J	54	59	63	80
B	B1	B	A	52	54	55	60
B	B1	B	C	52	54	55	60
B	B1	B	D	52	54	55	60
B	B1	B	E	52	54	55	60
B	B2	B	G	54	59	63	80
B	B2	B	H	54	59	63	80
B	B2	B	I	54	59	63	80
B	B2	B	J	54	59	63	80
C	C1	C	A	53	56	58	68
C	C1	C	D	53	56	58	68
D	D1	D	E	32	34	35	41
E	E1	E	F	9	10	11	14
F	F1	F	A	7	8	9	12
G	G1	G	B	5	6	7	10
H	H1	H	I	2	3	3	5
<b>Total international aviation CO<sub>2</sub></b>				<b>1062</b>	<b>1132</b>	<b>1181</b>	<b>1402</b>



# Exercise 2-B / Solution

Based on the results of the Exercise 2-A, and the information on routes of airline A1 in Assumption Table 2 (refer to Exercise 1-A):

a) Calculate the CO<sub>2</sub> emissions covered by CORSIA in 2024 by the airline A1

**60 + 60 = 120 t CO<sub>2</sub>**

**(A1 operates routes A-B, A-C, A-D; route A-C is not covered by CORSIA)**

b) Calculate the amount of offsetting requirements in 2024 by the airline A1, as well as the cost if the unit cost for the offsetting requirements is \$5:

- Offsetting Requirements:

- Cost:

**Assumption Table 2: Emissions of Individual Airlines in selected years**

State	Airline	From	To	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2021)	CO <sub>2</sub> (2024)
A	A1	A	B	52	54	55	60
A	A1	A	C	52	54	55	60
A	A1	A	D	52	54	55	60
A	A2	A	E	53	56	58	68
A	A2	A	F	53	56	58	68
A	A2	A	G	53	56	58	68
A	A3	A	H	54	59	63	80
A	A3	A	I	54	59	63	80
A	A3	A	J	54	59	63	80
B	B1	B	A	52	54	55	60
B	B1	B	C	52	54	55	60
B	B1	B	D	52	54	55	60
B	B1	B	E	52	54	55	60
B	B2	B	G	54	59	63	80
B	B2	B	H	54	59	63	80
B	B2	B	I	54	59	63	80
B	B2	B	J	54	59	63	80
C	C1	C	A	53	56	58	68
C	C1	C	D	53	56	58	68
D	D1	D	E	32	34	35	41
E	E1	E	F	9	10	11	14
F	F1	F	A	7	8	9	12
G	G1	G	B	5	6	7	10
H	H1	H	I	2	3	3	5
<b>Total international aviation CO<sub>2</sub></b>				<b>1062</b>	<b>1132</b>	<b>1181</b>	<b>1402</b>

# Exercise 2-B / Solution

Based on the results of the Exercise 2-A, and the information on routes of airline A1 in Assumption Table 2 (refer to Exercise 1-A):

- a) Calculate the CO<sub>2</sub> emissions covered by CORSIA in 2024 by the airline A1

**60 + 60 = 120 t CO<sub>2</sub>**

**(A1 operates routes A-B, A-C, A-D; route A-C is not covered by CORSIA)**

- b) Calculate the amount of offsetting requirements in 2024 by the airline A1, as well as the cost if the unit cost for the offsetting requirements is \$5:

- Offsetting Requirements: **120 x 21.1% = 25.3 offsets**

- Cost:

**Assumption Table 2: Emissions of Individual Airlines in selected years**

State	Airline	From	To	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2021)	CO <sub>2</sub> (2024)
A	A1	A	B	52	54	55	60
A	A1	A	C	52	54	55	60
A	A1	A	D	52	54	55	60
A	A2	A	E	53	56	58	68
A	A2	A	F	53	56	58	68
A	A2	A	G	53	56	58	68
A	A3	A	H	54	59	63	80
A	A3	A	I	54	59	63	80
A	A3	A	J	54	59	63	80
B	B1	B	A	52	54	55	60
B	B1	B	C	52	54	55	60
B	B1	B	D	52	54	55	60
B	B1	B	E	52	54	55	60
B	B2	B	G	54	59	63	80
B	B2	B	H	54	59	63	80
B	B2	B	I	54	59	63	80
B	B2	B	J	54	59	63	80
C	C1	C	A	53	56	58	68
C	C1	C	D	53	56	58	68
D	D1	D	E	32	34	35	41
E	E1	E	F	9	10	11	14
F	F1	F	A	7	8	9	12
G	G1	G	B	5	6	7	10
H	H1	H	I	2	3	3	5
<b>Total international aviation CO<sub>2</sub></b>				<b>1062</b>	<b>1132</b>	<b>1181</b>	<b>1402</b>

# Exercise 2-B / Solution

Based on the results of the Exercise 2-A, and the information on routes of airline A1 in Assumption Table 2 (refer to Exercise 1-A):

- a) Calculate the CO<sub>2</sub> emissions covered by CORSIA in 2024 by the airline A1

**60 + 60 = 120 t CO<sub>2</sub>**

**(A1 operates routes A-B, A-C, A-D; route A-C is not covered by CORSIA)**

- b) Calculate the amount of offsetting requirements in 2024 by the airline A1, as well as the cost if the unit cost for the offsetting requirements is \$5:

- Offsetting Requirements: **120 x 21.1% = 25.3 offsets**

- Cost: **25.3 x \$5 = \$126.5**

**Assumption Table 2: Emissions of Individual Airlines in selected years**

State	Airline	From	To	CO <sub>2</sub> (2019)	CO <sub>2</sub> (2020)	CO <sub>2</sub> (2021)	CO <sub>2</sub> (2024)
A	A1	A	B	52	54	55	60
A	A1	A	C	52	54	55	60
A	A1	A	D	52	54	55	60
A	A2	A	E	53	56	58	68
A	A2	A	F	53	56	58	68
A	A2	A	G	53	56	58	68
A	A3	A	H	54	59	63	80
A	A3	A	I	54	59	63	80
A	A3	A	J	54	59	63	80
B	B1	B	A	52	54	55	60
B	B1	B	C	52	54	55	60
B	B1	B	D	52	54	55	60
B	B1	B	E	52	54	55	60
B	B2	B	G	54	59	63	80
B	B2	B	H	54	59	63	80
B	B2	B	I	54	59	63	80
B	B2	B	J	54	59	63	80
C	C1	C	A	53	56	58	68
C	C1	C	D	53	56	58	68
D	D1	D	E	32	34	35	41
E	E1	E	F	9	10	11	14
F	F1	F	A	7	8	9	12
G	G1	G	B	5	6	7	10
H	H1	H	I	2	3	3	5
<b>Total international aviation CO<sub>2</sub></b>				<b>1062</b>	<b>1132</b>	<b>1181</b>	<b>1402</b>