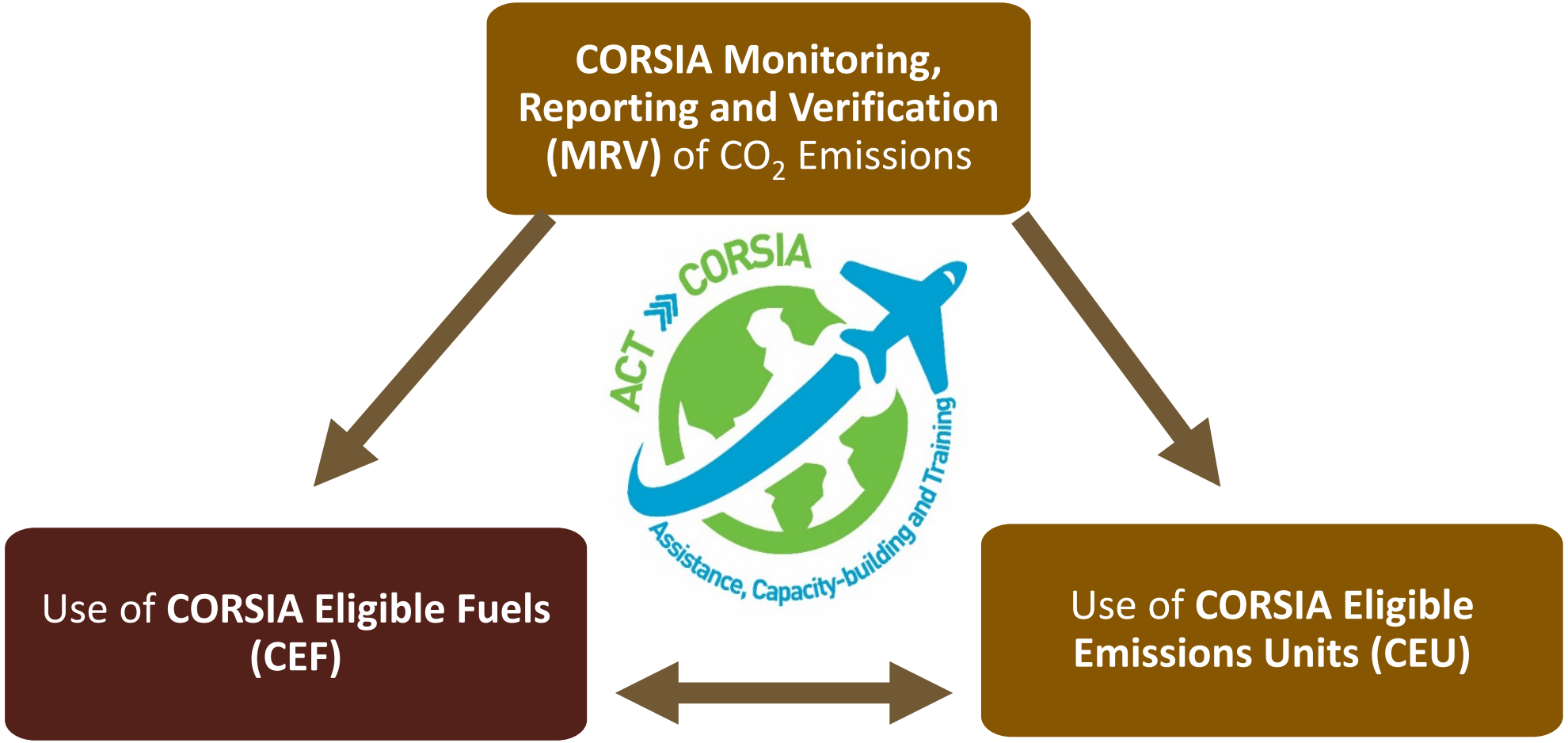
CORSIA Eligible Fuels - CEFs

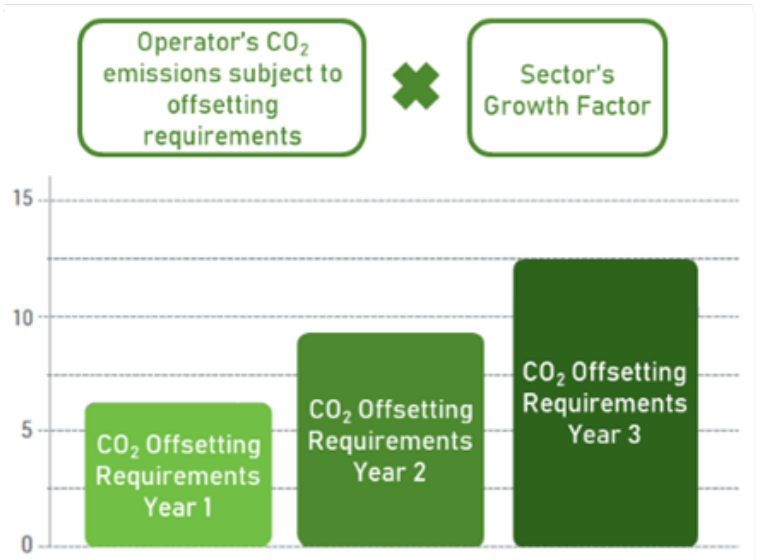
CORSIA Structure



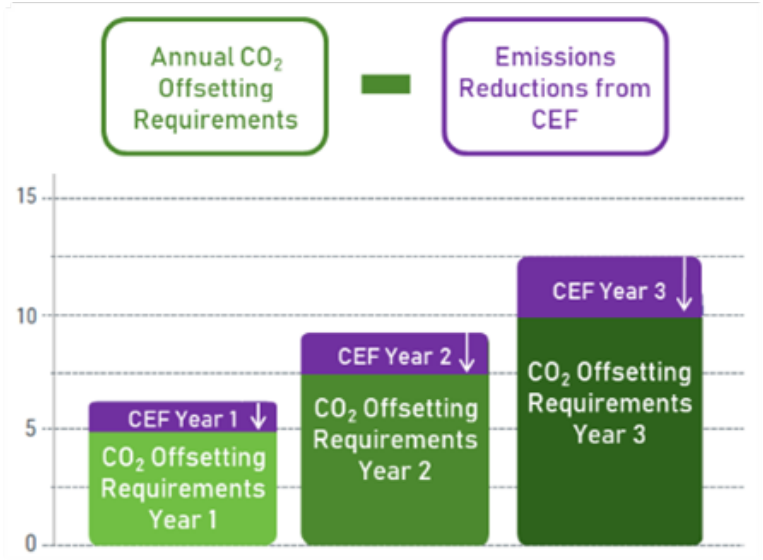
CORSIA offsetting requirements (until 2035) could be met by CEF or CEU

Three-step approach to determine an operator's offsetting requirements for a three-year compliance period

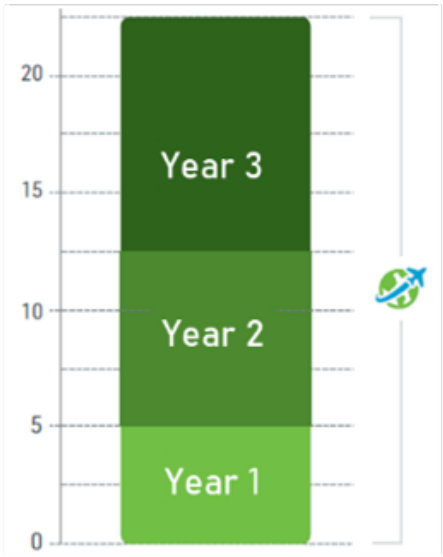
① **CO_2 Offsetting Requirements** calculated by the State for each year



② Emissions reductions claimed from the use of **CORSIA Eligible Fuels (CEF)**



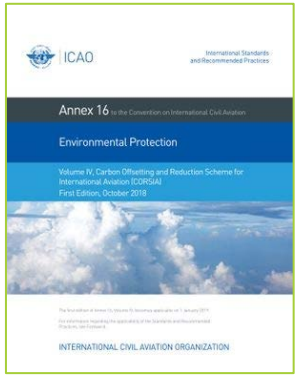
③ **Total Final CO_2 Offsetting Requirements** for a 3-year Compliance Period

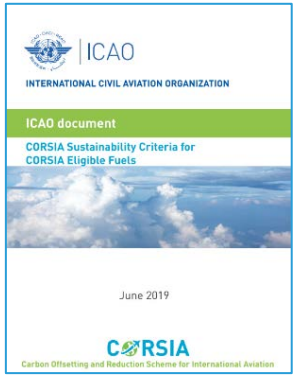


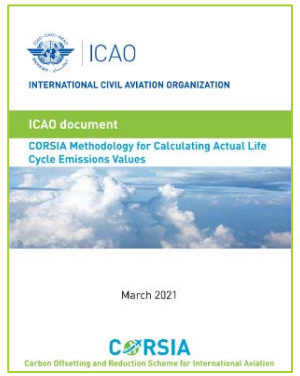
SAF basic definitions

What are Sustainable Aviation Fuels (SAF)?

Definition	Which Sustainability Criteria?	What is a waste?
SAF is defined as a *renewable or waste-derived aviation fuel* that meets sustainability criteria. ***reference: Annex 16 Vol IV – CORSIA***	Sustainability Criteria are defined in the ICAO document *"CORSIA Sustainability Criteria for CORSIA Eligible Fuels"*	Waste is a feedstock with inelastic supply and no economic value (e.g. municipal solid waste, used cooking oil, waste gases etc.) ***reference:* ICAO document *"CORSIA Methodology For Calculating Actual Life Cycle Emissions Values"***







All documents available at https://www.icao.int/environmental-protection/CORSIA/Pages/CORSIA-Eligible-Fuels.aspx

CORSIA Eligible Fuels (CEFs)

CORSIA eligible fuel (CEF) is CORSIA sustainable aviation fuel (SAF) or CORSIA lower carbon aviation fuel (LCAF), which an operator may use to reduce its offsetting requirements.

CEF needs to be certified based on the **CORSIA Sustainability Criteria**, including its life-cycle emissions values, by an approved Sustainability Certification Scheme (SCS)

SAF Definition

SAF is defined as a *renewable or waste-derived aviation fuel* that meets the CORSIA Sustainability Criteria

LCAF definition

LCAF is defined as a *fossil-based aviation fuel* that meets the CORSIA Sustainability Criteria

CORSIA Sustainability Criteria for CORSIA Eligible Fuels**
Fourth Edition,
June 2025

All documents available at https://www.icao.int/environmental-protection/CORSIA/Pages/CORSIA-Eligible-Fuels.aspx

Sustainability of CORSIA Eligible Fuels

Set of Sustainability Criteria was approved by the ICAO Council, in the context of consideration of Sustainable Aviation Fuels and Lower Carbon Aviation Fuels under CORSIA.

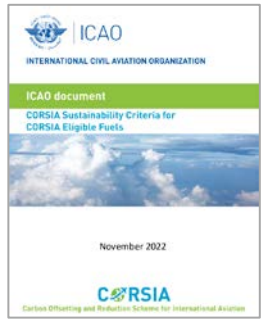
These Criteria are registered in the ICAO document "CORSIA sustainability criteria for CORSIA eligible fuels".

https://www.icao.int/CORSIA/corsia-eligible-fuels

Sustainability Themes
1. Greenhouse Gases (GHG)
2. Carbon stock
3. GHG reduction permanence
4. Water
5. Soil
6. Air
7. Conservation
8. Waste and Chemicals
9. Seismic and Vibrational Impacts
10. Human and labour rights
11. Land use rights and land use
12. Water use rights
13. Local and social development
14. Food security

Carbon-reduction themes
(applicable during CORSIA pilot phase, 2021-2023)

Environmental and socio-economic Themes, and GHG permanence
(Applicable after CORSIA pilot phase, from 2024, in addition to Carbon-reduction themes)

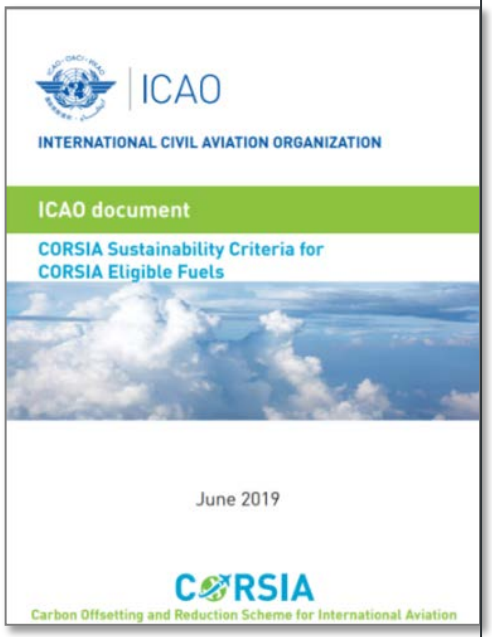


CEF shall meet the Sustainability Criteria defined in the ICAO document "CORSIA Sustainability Criteria for CORSIA Eligible Fuels" (Annex 16, Vol. IV, 2.2.4.1)

CORSIA Sustainability Criteria

ACT-SAF #2 SERIES

CORSIA sustainability criteria for CORSIA eligible fuels



For **next CORSIA Phases**:

- ✓ **13 themes applicable for SAF with specific criteria (Chapter 2) :**
  - ➢ **Environmental: GHG, Carbon Stocks, GHG savings permanence, Water; Soil; Air; Conservation; Waste and Chemicals;**
  - ➢ **Socio-Economic: Human and labor rights; Land use rights and land use; Water use rights; Local and social development; and Food security**
- ✓ **Same 14 themes for LCAF with specific criteria (Chapter 3)**

Theme	Principle	Criteria
1. Greenhouse Gases (GHG)	Principle: CORSIA SAF should generate lower carbon emissions on a life cycle basis.	Criterion 1.1: CORSIA SAF will achieve net greenhouse gas emissions reductions of at least 10% compared to the baseline life cycle emissions values for aviation fuel on a life cycle basis.
2. Carbon stock	Principle: CORSIA SAF should not be made from biomass obtained from land/aquatic systems with high biogenic carbon stock.	Criterion 2.1: CORSIA SAF will not be made from biomass that is either obtained/extracted from land or aquatic ecosystems converted after 1 January 2008 that was primary forest, wetlands, peat lands, coral reefs, kelp forests, seagrass meadows, estuaries, tidal salt marshes or mangrove forests or contributes to degradation of the carbon stock in primary forests, wetlands, peat lands, coral reefs, kelp forests, seagrass meadows, estuaries, tidal salt marshes or mangrove forests as these systems all have high carbon stocks.
		Criterion 2.2: In the event of land use conversion after 1 January 2008, as defined based on the Intergovernmental Panel on Climate Change (IPCC) land categories, direct land use change (DLUC) emissions will be calculated. If DLUC greenhouse gas emissions exceed the default induced land use change (ILUC) value, the DLUC value will replace the default ILUC value.
3. Greenhouse gas Emissions Reduction Permanence	Principle: Emissions reductions attributed to CORSIA SAF should be permanent.	Criterion 3.1: Operational practices will be implemented to monitor, mitigate and compensate any material incidence of non-permanence resulting from carbon capture and sequestration (CCS) activities.
4. Water	Principle: Production of CORSIA SAF should maintain or enhance water quality and availability.	Criterion 4.1: Operational practices will be implemented to maintain or enhance water quality.
		Criterion 4.2: Operational practices will be implemented to use water efficiently and to avoid the depletion of surface or groundwater resources beyond replenishment capacities.

Carbon Reduction Themes

Theme 1: Greenhouse gases

- CORSIA eligible fuel should generate lower carbon emissions on a life cycle basis

Theme 2: Carbon stock

- CORSIA eligible fuel should not be made from biomass obtained from land with high carbon stock

Theme 3: GHG reduction permanence

- Emissions reductions attributed to CORSIA SAF should be permanent.

For more details, please refer to CORSIA Sustainability Criteria for CORSIA Eligible Fuels (icao.int)

ACT-SAF #2 SERIES

Environmental themes

Theme 4: Water

- Production of CORSIA SAFs should maintain or enhance water quality and availability

Theme 5: Soil

- Production of CORSIA SAFs should maintain or enhance soil health

Theme 6: Air

- Production of CORSIA SAF should minimize negative effects on air quality

Theme 7: Conservation

- Production of CORSIA SAF should maintain biodiversity, conservation value and ecosystem services

Theme 8: Waste and chemicals

- Production of CORSIA SAF should promote responsible management of waste and use of chemicals

ACT-SAF #2 SERIES

Socio-economic themes

Theme 10: Human and labour rights

- Production of CORSIA SAF should respect human and labour rights

Theme 11: Land use rights and land use

- Production of CORSIA SAF should respect land and land use rights including indigenous and/or customary rights

Theme 12: Water use rights

- Production of CORSIA SAF should respect prior formal or customary water use rights

Theme 13: Local and social development

- Production of CORSIA SAF should contribute to social and economic development in regions of poverty

Theme 14: Food security

- Production of CORSIA SAF should promote food security in food insecure regions

ACT-SAF #2 SERIES

Sustainability Certification Schemes (SCS)

ICAO-approved "Sustainability Certification Schemes (SCS) are verifying compliance with CORSIA standards

Three approved SCSs as of 2025.

ISCC

ISCC
International Sustainability & Carbon Certification

RSB

RSB
Roundtable on Sustainable Biomaterials

Class NK
New SCS Approved in 2024

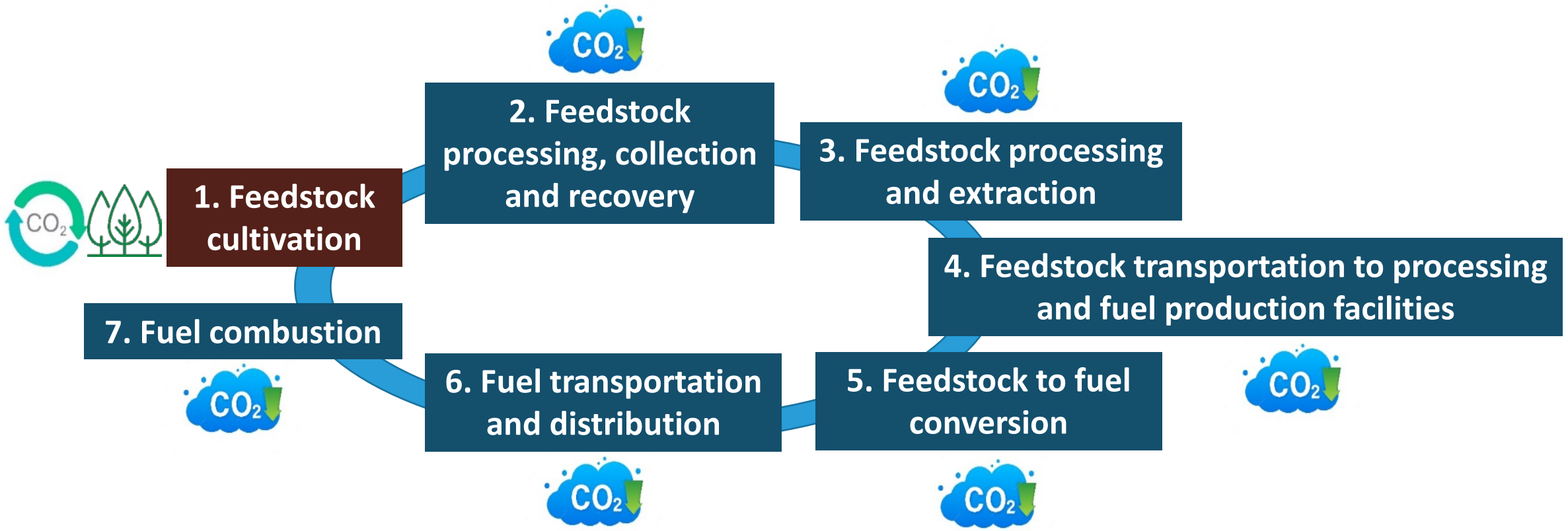
ClassNK
CHARTING THE FUTURE

- CORSIA eligible fuels come from fuel producers that are certified by a Sustainability Certification Scheme (SCS) approved by the ICAO Council to perform this certification
- SCSs currently only approved to certify CORSIA SAF
- Evaluation is ongoing for one LCAF certification scheme

Regulatory framework -Life cycle emissions of CEF

Core Life cycle assessment (core LCA value)

Emissions associated with all steps of CEF production and use



Regulatory framework -Life cycle emissions of CEF

CORSIA Sustainability Theme 1 requires lower carbon emissions on a **life cycle basis.**

CORSIA Sustainability Criterion 1.1 requires net greenhouse gas emissions **reductions of at least 10%** compared to a baseline.

These requirements are met with a **Life cycle assessment of the CEF:**

Induced Land use Change (ILUC value)
Emissions associated with possible land use change generated by feedstock production

+

Core Life cycle assessment (core LCA value)
emissions associated with all steps of CEF production and use

=

CEF Life cycle emission value (L_{CEF})
Unit – gCO2e/MJ

For LCAF, only core LCA values are considered (ILUC is considered zero).

Life cycle assessment

Example: life cycle emissions of sugarcane ethanol ATJ in Brazil

Production step	Associated emissions (gCO2e/MJ)
Feedstock growth	-74
Feedstock cultivation Feedstock processing, collection and recovery Feedstock processing and extraction	16.9
Feedstock transportation to processing and fuel production facilities	1.6
Feedstock to fuel conversion	5.2
Fuel transportation and distribution	0.4
fuel combustion on aircraft engine	74
total (core LCA value)	24.1
Induced Land use Change (ILUC value)	8.7
SAF Life cycle emission value (L_{CEF}) = core LCA + ILUC	**32.8**

63% emission reduction on a life cycle basis
(Compared with Baseline emission value of 89 gCO2e/MJ)

Regulatory framework -Life cycle emissions of CEF

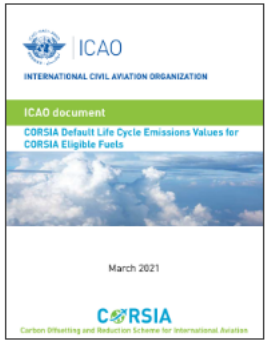
How is the life cycle emission of CEF obtained?

CORSIA allows two options:

DEFAULT Life Cycle Emissions

ICAO document "CORSIA Default Life Cycle Emissions Values for CORSIA Eligible Fuels"

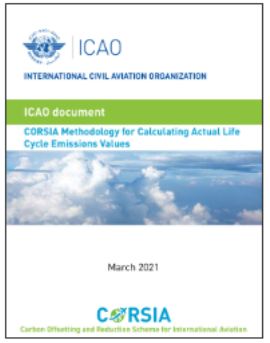
- Default emission values, as a function of the feedstocks and conversion processes.
- Look-up table: simpler process, but emission values are higher (more conservative assumptions)



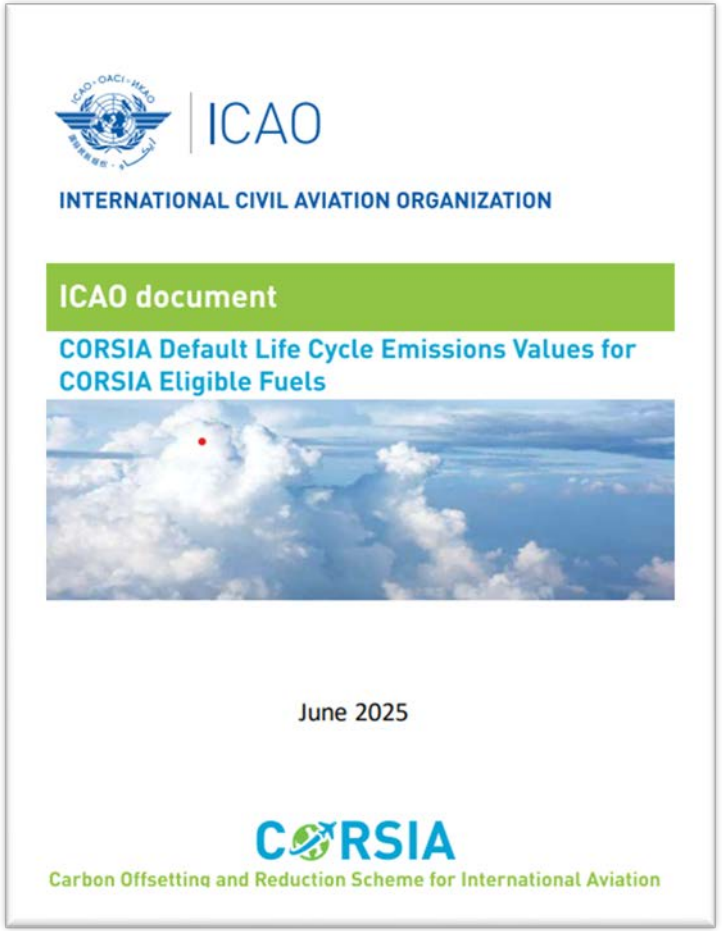
ACTUAL Life Cycle Emissions

ICAO document "CORSIA Methodology for Calculating Actual Life Cycle Emissions Values"

- Provides fuel producers with flexibility to calculate their specific values.
- Only option available for LCAF.



Life Cycle Values for CEFs – ICAO document

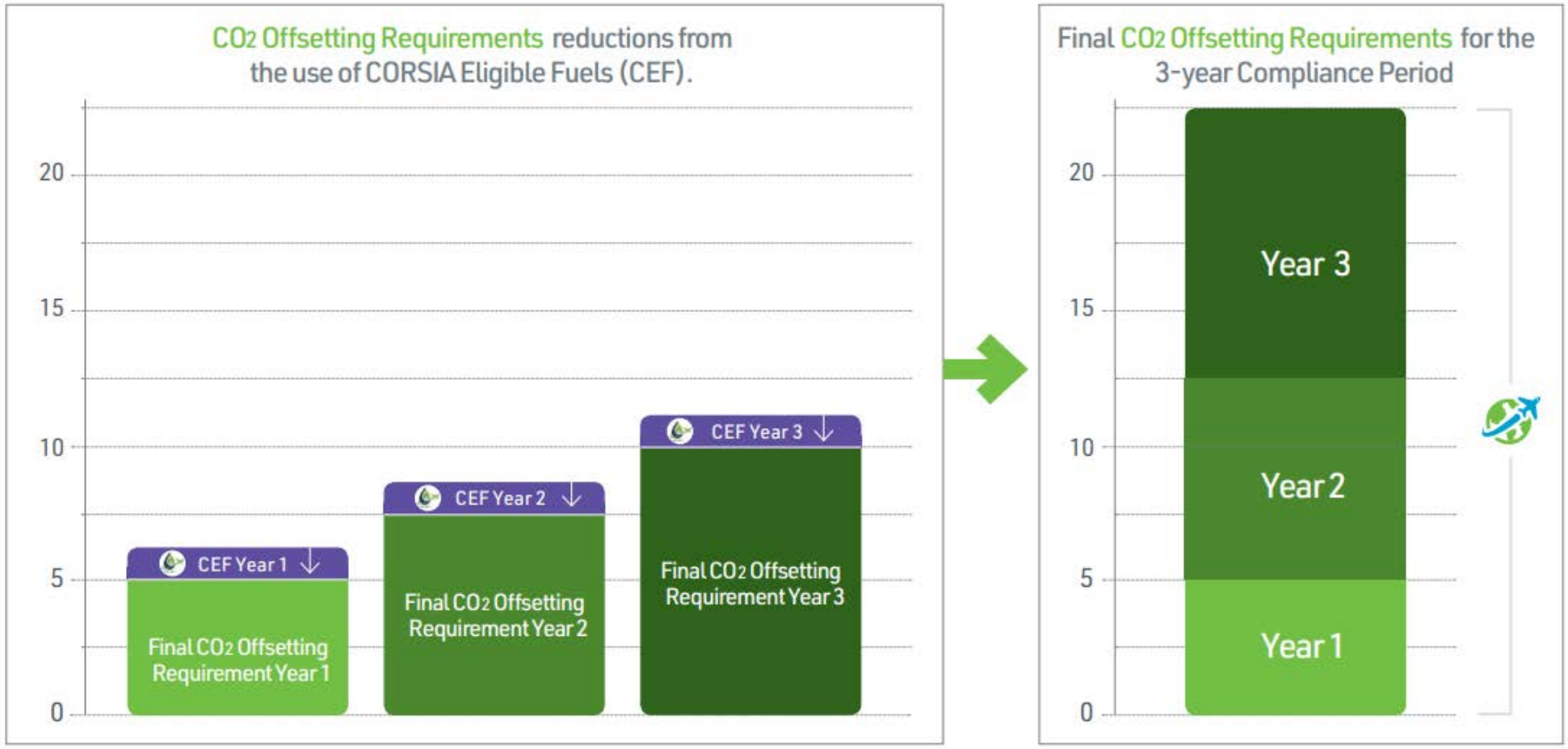


CORSIA Default Core LCA Values for CORSIA Eligible Fuels produced with the HEFA Conversion Process

2.5	Mixed Animal Fats	Relevant lifecycle starts with transportation from slaughterhouse to rendering facility Correction value if hydrogen used is produced from coal: + 6.6 gCO_2e /MJ Correction value if process heat is produced from coal: +5.3 gCO_2e /MJ	28.6	[1]
2.6	Used cooking oil	Correction value if hydrogen used is produced from coal: + 5.7 gCO_2e /MJ Correction value if process heat is produced from coal: +4.9 gCO_2e /MJ	13.9	[1]
2.7	Palm fatty acid distillate	Correction value if hydrogen used is produced from coal: + 6.7 gCO_2e /MJ	20.7	[1]
2.8	Corn oil	Oil from dry mill ethanol plant Correction value if hydrogen used is produced from coal: + 5.6 gCO_2e/MJ	17.2	[1]
2.9	Soybean oilseed	Correction value if hydrogen used is produced from coal: + 5.7 gCO_2e/MJ Correction value if process heat is produced from coal: +4.7 gCO_2e/MJ	40.4	[1]

Calculating Emissions reduction from the use of CEFs

An aeroplane operator can reduce its CORSIA offsetting requirements in a given year by claiming emissions reductions from the use of CORSIA eligible fuels (CEF) by the following process



Calculating Emissions Reduction using CFEs

FCF = Fuel Conversion Factor, fixed value, 3.16 for Jet-A/ Jet A/ TS-1 or No. 3 Jet fuel or 3.10 for AvGas/Jet B (kg CO_2/kg fuel)

$$ER_y = FCF * \left[\sum_f MS_{f,y} * \left(1 - \frac{L_{CEF}}{LC}\right)\right]$$

L_{CEF} = Life cycle emission value for a CORSIA eligible fuel (g CO_2e/MJ)

$MS_{f,y}$ = Total mass of CEF claimed in the year y

LC = Baseline life cycle emissions fixed value, 89 for Jet-A/ Jet A/ TS-1 or No. 3 Jet fuel or 95 for AvGas (gCO_{2e}/MJ)

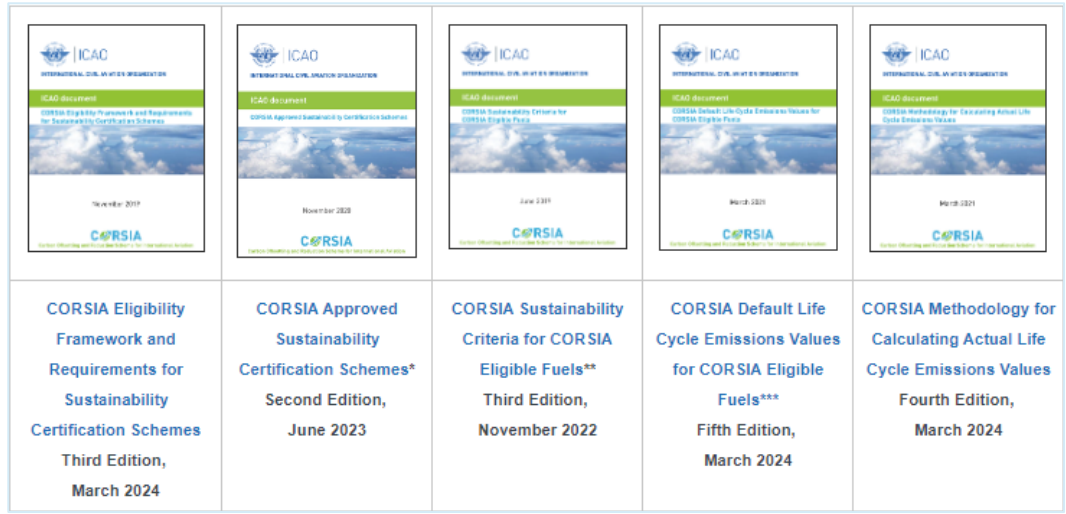
Example: If, in 2021, an operator uses 10,000 tonnes of Jet-A Fuel produced from Used Cooking Oil (Default $\mathbf{L_{CEF} = 13.9g\ CO2e/MJ}$), the amount of emissions reductions will be:

$$\mathbf{ER_{2021}} = 3.16 \times \left[10.000 \times \left(1 - \frac{13.9}{89}\right)\right] = 26.665 \text{ tonnes of } CO_2$$

CORSIA environmental standards for fuels

Recognized as the accepted basis for fuels used in international aviation

- **Agnostic methodologies**
- **49 types of feedstocks** currently recognized
- Open process for consideration of **new feedstocks**
- **New feedstocks -** beef tallow, poultry fat, lard fat, mixed animals fat, non-standard coconut, wheat starch slurry and cobs
  - Monitoring, Reporting, and Verification system (MRV) in place, including a **CORSIA Central Registry**



CORSIA Eligibility Framework and Requirements for Sustainability Certification Schemes Third Edition, March 2024	CORSIA Approved Sustainability Certification Schemes* Second Edition, June 2023	CORSIA Sustainability Criteria for CORSIA Eligible Fuels** Third Edition, November 2022	CORSIA Default Life Cycle Emissions Values for CORSIA Eligible Fuels*** Fifth Edition, March 2024	CORSIA Methodology for Calculating Actual Life Cycle Emissions Values Fourth Edition, March 2024

Thank You

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