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CORSIA Sourcing Requirements for Electricity and Waste Gases



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ACT-SAF Series #22 Speaker

ACT>SAF

Dr. Florian Allroggen
Executive Director, Instructor,
Research Scientist
MIT





- Opening
- Status update on ACT-SAF Programme
- CORSIA sourcing requirements for electricity and waste gases
- Q&A
- Closing



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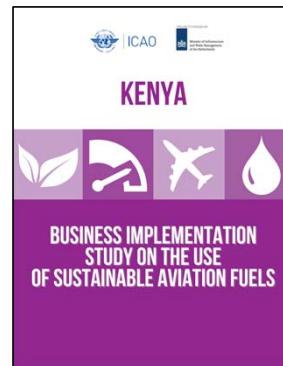


Status update of ACT-SAF Programme



Updates on ACT-SAF Recently published Studies

Kenya Business Implementation Study



- Analysis of **repurposing** the Kenya Petroleum Refinery (Mombasa) into a **180kt/year SAF production facility**
- Study includes detailed technical assessment and techno-economic analysis

Peru - Feasibility Study



- Production potential - **8.2 MT/year (1.7x national demand for fuel)**
- **Main feedstocks:** agricultural residues, waste gases, MSW, manure waste, sugarcane ethanol, vegetable oils, sorgo.

ACT-SAF series 21 provides more details on all ACT-SAF studies



Recent CORSIA Framework updates (November/December 2025)

New feedstocks

- New default LCA value - **HEFA-Palm Oil Mill Effluent (POME) pathway**
- **Classification of 8 new feedstocks** (spent bleaching earth, coconut testa, dry coconut pulp, sugarcane vinasse, and sugarcane filter, pangasius fish scrap, industrial waste of biogenic origin, and construction and demolition waste of biogenic origin)
- **57 feedstocks currently recognized in CORSIA**



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

Updates on CORSIA certification

- New documents related to the evaluation of Sustainability Certification Schemes: (SCSs)
 - new “Comments / Complaints Form” accessible to the public on the ICAO CORSIA Sustainability Certification Schemes [website](#)
 - New procedure documents on the SCS evaluation process
- Ongoing CAEP evaluation of ISCC LCAF Certification Approach under CORSIA
- Ongoing CAEP evaluation of a 4th Sustainability Certification Scheme
- **More than 700 economic operators currently certified under CORSIA**



<https://www.icao.int/CORSIA/corsia-certified-fuels>



ACT SAF Training | January 22, 2026

Enabling consideration of “Power-to-Liquid SAF” under CORSIA: *guiding thoughts and implementation*

Florian Allroggen, *Principal Research Scientist, LAE*

Continued interest in electrification of SAF through new “Power-to-Liquid technologies”

Continued industry interest

PTL

Airco's e-SAF Facility To Validate Scalable Technology



Twelve Breaks Ground On Power-To-Liquid SAF Production In Moses Lake

By CHARLOTTE BAR
October 5, 2023



Washington Governor Jay Inslee appeared at the ground breaking of Twelve's SAF production facility



eSAF Production Powers Up in Denmark:
Arcadia eFuels & Hitachi Energy's Game-Changing Partnership

By ANGIE BERGRENSEN

Continued policy push



EU eSAF quota

Shares of SAF referred to in Article 4

- (a) From 1 January 2025, each year a minimum share of 2 % of SAF;
- (b) From 1 January 2025, each year a minimum share of 4 % of SAF, of which:
 - (i) for the period from 1 January 2030 until 31 December 2031, an average share over the period of 12 % of synthetic aviation fuels, of which each year a minimum share of 10 % of synthetic aviation fuels;
 - (ii) for the period from 1 January 2032 until 31 December 2034, an average share over the period of 2.8 % of synthetic aviation fuels, of which each year a minimum share of 2.5 % of synthetic aviation fuels from 1 January 2033 until 31 December 2034 of synthetic aviation fuels;
- (c) From 1 January 2025, each year a minimum share of 20 % of SAF, of which a minimum share of 18 % of synthetic aviation fuels;
- (d) From 1 January 2026, each year a minimum share of 34 % of SAF, of which a minimum share of 19 % of synthetic aviation fuels;
- (e) From 1 January 2027, each year a minimum share of 42 % of SAF, of which a minimum share of 15 % of synthetic aviation fuels;
- (f) From 1 January 2028, each year a minimum share of 70 % of SAF, of which a minimum share of 35 % of synthetic aviation fuels.



UK eSAF quota

Obligation (1 January of the Debit)	Main obligation (% obligated fuel)	PTL fuel Obligation (% obligated fuel)	Total obligation (% obligated fuel)
2025	2.041%	-	2.041%
2026	3.734%	-	3.734%
2027	5.485%	-	5.485%
2028	7.082%	2.215%	7.296%
2029	8.634%	3.414%	8.779%
2030	10.506%	5.056%	11.111%
2031	11.485%	5.960%	12.055%
2032	12.465%	6.850%	13.314%
2033	13.445%	7.740%	14.185%
2034	14.423%	8.640%	15.942%
2035	15.862%	9.765%	17.474%
2036	17.301%	10.985%	18.676%
2037	18.856%	12.200%	21.055%
2038	20.421%	13.420%	23.822%
2039	22.046%	14.640%	25.686%
2040	23.711%	14.847%	28.205%
onwards	-	-	-

Table 2 The obligation trajectory. These percentages are converted to quantities by multiplying them by the obligated amount.

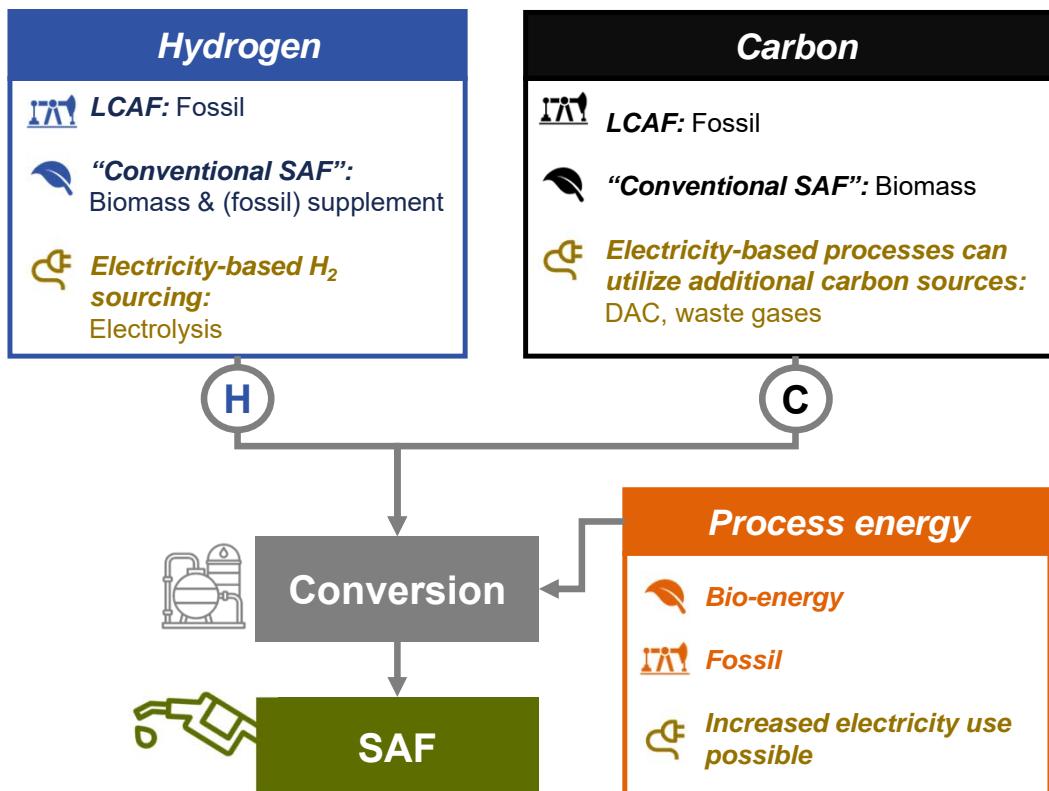


CORSIA

- There are no CORSIA Default Values for fuels produced with “PtL” technologies
- The Actual Value Method, as posted through May 2025, had insufficient provisions to calculate LCA values for such fuels:
 - Actual Value Method *only* acknowledged bio-based SAF and LCAF
 - Guidelines on LCA analysis considering electricity were written for electricity use as process energy.



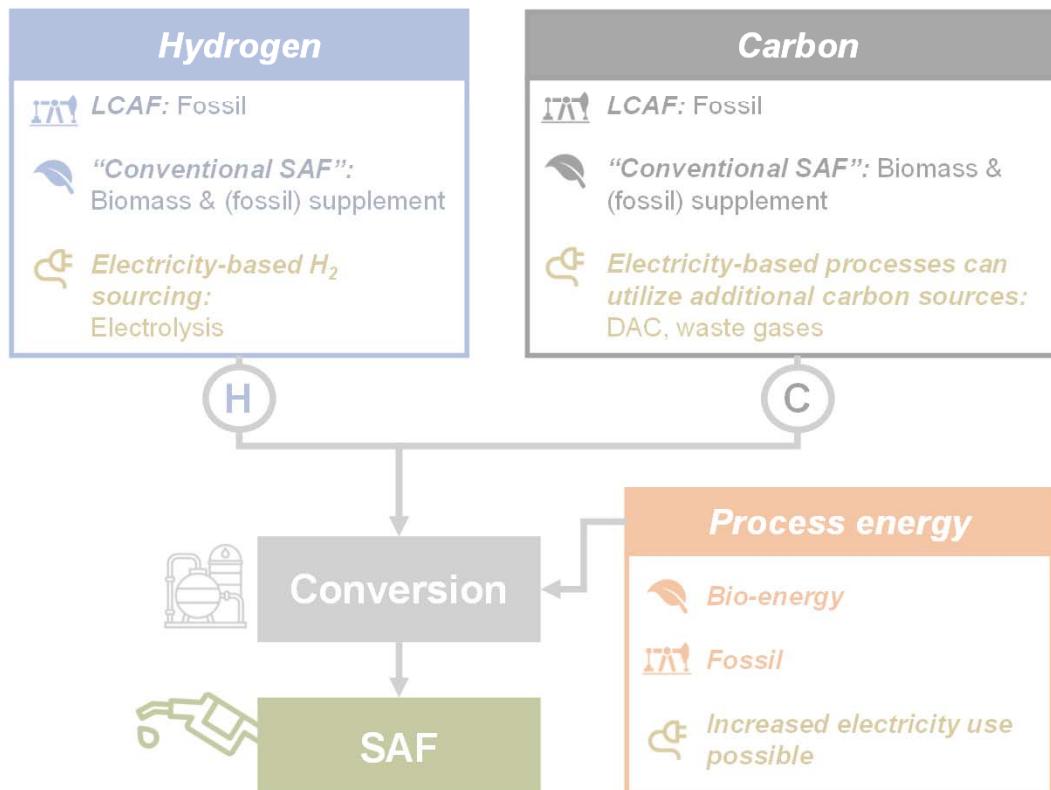
SAFs are long-chain hydrocarbon fuels –
electricity use can disrupt hydrogen and carbon
sourcing



Amendments to the
Actual Value Method
need to cover:

- 1 Increased electricity use (both for H_2 sourcing and process energy)
- 2 Use of additional carbon sources (typically associated with electricity-based SAF production)

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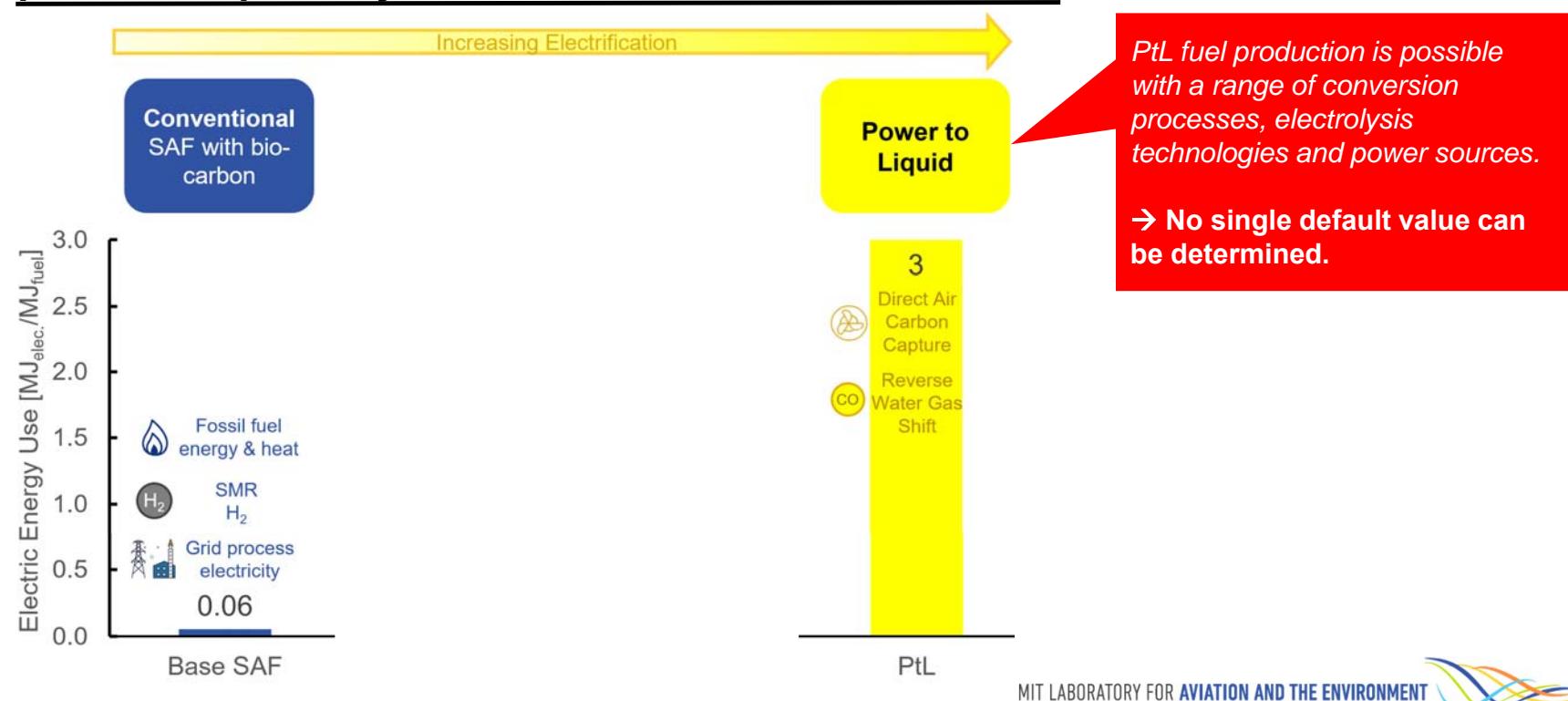


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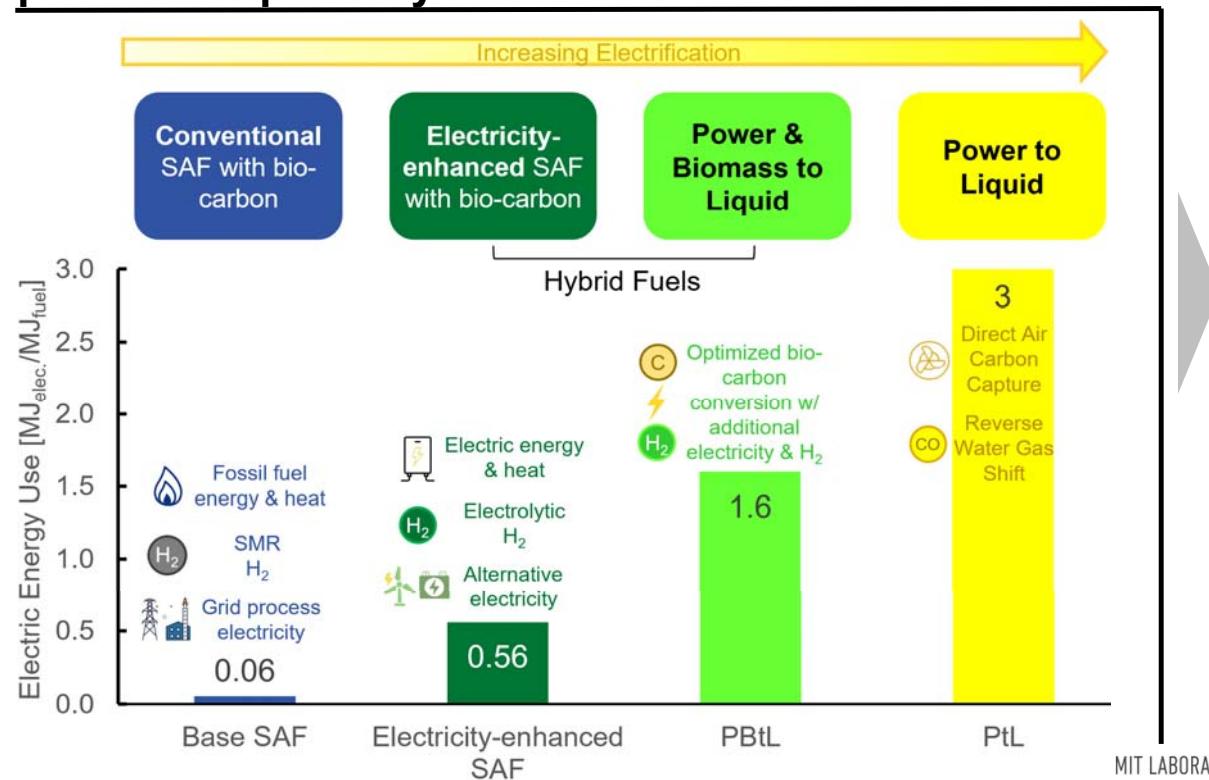
Electricity can be used as a major input to the production of SAFs

Electricity utilization can vary across SAF production pathways



Electricity can be used as a major input to the production of SAFs

Electricity utilization can vary across SAF production pathways



For schemes such as CORSIA: *Methods needed to:*

1. Track electricity used for CEF production
2. Assess the attributes of electricity used for SAF production (grid, costs, impacts on atmosphere)

Methods must be able to deal with electricity use across the spectrum of electrification options.

Sourcing arrangements are required to enable tracing of electricity to a generation source



Key challenge:
Electricity tracing is not possible using physical tracing (like it is done for biogenic feedstocks), especially for facilities connected to the grid



Electricity sourcing will have to rely on **factual (no grid connection) or contractual (grid connection) sourcing arrangements** for a specific fuel production facility

Potential contractual arrangements

(if electricity is not self-produced with direct connection)



Power Purchase Agreements

Contractual arrangement between power generation facility and CEF producer (or producer of an intermediate) to take ownership of the electricity and its non-energy attributes at the source.

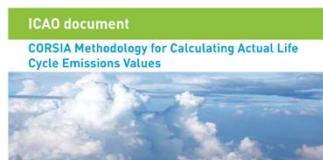


Environmental Attribute Certificates

Certificates establishing ownership of the non-power (e.g., environmental) characteristics of a unit of electricity produced and made available for use. EACs in verified systems can be traded separately from the electricity itself ("unbundled EACs").



Electricity sourcing arrangements – requirements



June 2025



Sourcing arrangement requirements are outlined in Section 10.1

Implementation in the Actual Value Document

For capacity in operation through 1 January 2033

“

Electricity sources for CEF production will be covered entirely [...] **by one or more of the following sourcing:**

- (a) CEF producer's own dedicated electricity generation facility; **or**
- (b) Energy Attribute Certificates (EACs) [...]; **or**
- (c) contractual mechanisms, where the producer takes possession of the electricity (e.g., a power purchase agreement (PPA)) and, if issued, any EACs associated with the electricity.

Claiming use of the electricity for CEF production requires demonstration that the EAC is owned and retired with CEF production. [...]

For capacity in operation from 1 January 2033

“

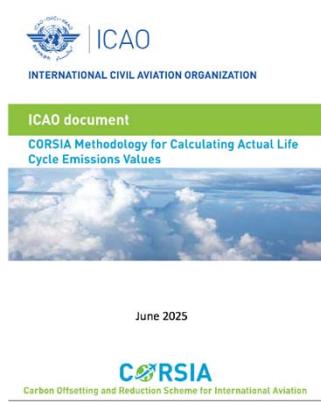
Electricity sources for CEF production will be **covered entirely (i.e., 100% of the electricity) by two types of sourcing arrangements:**

Type 1: Electricity will be sourced from the CEF producer's own dedicated electricity generation facility or contractual mechanisms, where the producer takes possession of the electricity (e.g., a power purchase agreement (PPA)) and, if issued, any energy attribute certificates (EACs) associated with the electricity. [...] **At least 70% of the electricity must be covered through this type of arrangement.**

Type 2: Electricity will be sourced via EACs, [...] **Up to 30% of the electricity demand for CEF production can be covered through qualifying EACs.**



Electricity sourcing arrangements – the case of using Environmental Attribute Certificates



Sourcing arrangement requirements are outlined in Section 10.1

Recap: Definition of EACs:

“ Energy Attribute Certificates (EACs) are defined as instruments that represent the legal property rights to non-power (i.e., environmental) attributes of electricity generation.

The Actual Value Document ties “valid” EACs to specific requirements

“

- Via the EAC, the environmental attribute of a ***unit of electricity can be traced to the facility and process*** through which it was created. [...]
- The EAC ***certifies all characteristics*** of the electricity generated, as stated in the certificate.
- The EAC is issued in ***an EAC registry or accounting system*** which meets the following requirements:
 - The environmental attribute of the generated electricity can be ***tracked to the source*** of the electricity (e.g., via a unique identification number).
 - The system ensures verification that ***only one EAC*** is associated with each unit of electricity generated.
 - The system ensures that certificates ***cannot be duplicated***.
 - The system verifies that the ***EAC is claimed and retired only once***.
 - The system identifies the ***owner of an EAC*** at any time, between the generation of the electricity and the retirement of the EAC.
 - The system is subject to ***regular audits by an independent auditor*** to affirm compliance with the requirements laid out above.



Sourcing arrangements are required to enable tracing of electricity to a generation source



Key challenge:
Electricity tracing is not possible using physical tracing (like it is done for biogenic feedstocks), especially for facilities connected to the grid



Electricity sourcing will have to rely on **factual (no grid connection) or contractual (grid connection) sourcing arrangements** for a specific fuel production facility



Additional requirements for sourcing arrangements to establish chain of custody



Additionality

Ensures new energy generation capacity is added to meet the extra electricity demand.



Additionality requirements – general approach



Intuition behind additionality requirements:

Addition of demand can displace other demand from preferred power generation sources and can lead to activation of less advantageous back-up capacity at grid-level.

This risk is documented in grid-level analyses for H₂ production.

Implementation in the Actual Value Document (Section 10.4)

“ CEF producers **must show additionality of electricity generation and storage capacity which is used for the production of a CEF** (or for the production of an intermediate such as hydrogen, if any). This means that CEF producers [...] will not utilize electricity generation and storage capacity which would otherwise be used for decarbonizing the grid and/or other parts of the economy [...]

This is met if the sourcing arrangements demonstrate **compliance with the following two requirements:**

(i) The electricity generation installation and storage facility **came into operation not earlier than 36 months before the operational date of the CEF production facility (or a production facility of an intermediate such as hydrogen, if any)**. [...]

(ii) Electricity generation and storage facilities **cannot receive subsidies (including tax credits and other mechanisms), which are explicitly intended to support decarbonization of electricity generation for other end uses**. A stated end use is established if the legislation underlying the subsidy mechanism explicitly defines the end use for the electricity. The acceptance of such subsidies earmarks an electricity generation or storage facility for a specific purpose, so that it cannot be claimed as additional for CEF production (or for the production of an intermediate such as hydrogen, if any). [...]

[...] **CEF production facilities (or a production facility of an intermediate such as hydrogen, if any) that come into operation before 2028** will not be required to comply with the additionality requirements set out in this section until the end date of the Second Phase of CORSIA.

Additionality requirements – exceptions



Note:

There are situations under which the additionality risk is mitigated!



"Stranded capacity"

Power generation facilities which would otherwise be retired.

Curtailed electricity

Electricity production which would otherwise be curtailed.

Low electricity use

Electricity use which is small and can be covered in the context of "normal" grid operations

Implementation of exceptions (Section 10.4)

“ Existing electricity generation installations whose off-taker agreements end, and which would otherwise be forced to retire.

“ Curtailment is a required reduction of electricity generation output (below what could have otherwise been produced) by way of operational or market response to ensure grid stability. The share of procured electricity that can be claimed as being sourced during periods of curtailment is based on the **average curtailment in the network** in which the CEF producer (or a production facility of an intermediate such as hydrogen, if any) is located. The curtailment allowance will be calculated on an annual basis. [...]

“ If electricity use is smaller than 30% of input energy as defined in Section 10.1 **and grid average emissions** are claimed.

If electricity is less than 7.5% of input energy as defined in Section 10.1.



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Temporal matching

Ensures that the electricity is generated at the same time when it is used.



Temporal matching requirements – general approach

Intuition behind temporal matching requirements:

Electricity is produced when used, unless accommodations for storage are made. Therefore, tracing requires matching of supply and demand over a reasonable timescale.

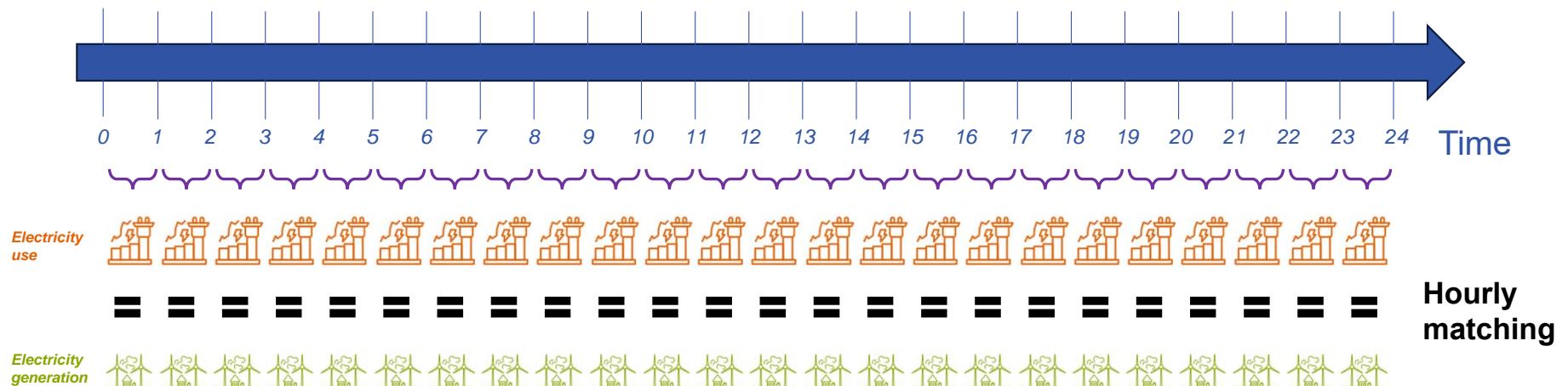
Mis-matches in timing have been shown to cause mismatches in actual and claimed generation profile.



Temporal matching – the concept

Temporal matching is the timescale over which the generated electricity must match the electricity consumed by the CEF producer (or a production facility of an intermediate such as hydrogen, if any).

An example for one day:



$$\text{Daily matching: } \sum_i \text{Factories} = \sum_i \text{Wind Turbines}$$

Annual matching (for 365 identical days): $365 * \sum_i \text{Factories} = 365 * \sum_i \text{Wind Turbines}$

Temporal matching requirements – general approach

Intuition behind temporal matching requirements:

Electricity is produced when used, unless accommodations for storage are made. Therefore, tracing requires matching of supply and demand over a reasonable timescale.

Mis-matches in timing have been shown to cause mismatches in actual and claimed generation profile.

Implementation in the Actual Value Document (Section 10.3)

Until 31 December 2029

“ The temporal matching requirements must be considered complied with if the **amount of electricity consumed by the CEF production facility** (or a production facility of an intermediate such as hydrogen, if any) is **matched with the electricity obtained under a sourcing arrangement** [...] **in the same calendar year**.

In the case an energy storage asset is used, evidence must be provided to demonstrate that (1) the storage asset was charged with electricity obtained under the sourcing arrangements [...] in the same calendar year; and (2) the discharge of the electricity from the storage asset and the electricity use for CEF production [...] is matched in the same calendar year.

From 1 January 2030

“ The temporal matching requirements must be considered complied with if the **electricity consumed by the CEF production** (or for the production of an intermediate such as hydrogen, if any) is **matched with electricity obtained under a sourcing arrangement** [...] **in the same one-hour period**.

In the case an energy storage asset is used, evidence must be provided that (1) the storage asset was charged with electricity obtained under the sourcing arrangements [...] in the same one-hour period; and (2) the discharge of the storage asset and the electricity use for CEF production [...] is matched in the same one-hour period.)

Note: Hourly matching places high demands on the reporting and data availability in grids. As such, hourly matching only applies if the grid is considered “ready” for annual matching (decision tree provided).



Temporal matching requirements – general approach

Intuition behind temporal matching requirements:

Electricity is produced when used, unless accommodation storage are made. Therefore, tracking requires matching of supply and demand over a reasonable timescale.

Mis-matches in timing have been shown to cause mismatches in actual and claimed generation profile.

Implementation in the Actual Value Document (Section 10.3)

Until 31 December

Exceptions only apply if:

- Grid average emissions factors are claimed.
- Electricity is less than 7.5% of input energy (annual or lifetime of sourcing arrangement, whichever is longer)

The temporal matching requirements must be considered complied with if the amount of electricity consumed by the CEF production facility (or a production facility of an intermediate such as hydrogen, if any) is matched with the electricity obtained under a sourcing arrangement [...] in the same calendar year.

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From 1 January 2030

consumed by the CEF production (or for the production of an intermediate such as hydrogen, if any) is matched with electricity obtained under a sourcing arrangement [...] in the same one-hour period.

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Additional requirements for sourcing arrangements to establish chain of custody



Additionality

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Temporal matching

Ensures that the electricity is generated at the same time when it is used.



Deliverability

Ensures that the electricity can be transported from where it is produced to where it is used.



Deliverability requirements –approach

Intuition behind deliverability requirements:

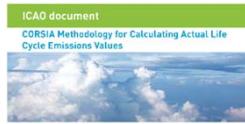
Electricity should, at least in theory, be transportable from where it is produced to where it is (claimed) to be used, in order to establish traceability.

Mis-matches in deliverability have been shown to lead to imbalances and grid-wide emissions impacts.

Implementation in the Actual Value Document (Section 10.2)

“ The electricity generation facility and the CEF production facility [...] **must be located on the same network**. A network is the **geographic area of an integrated grid that is managed by a single transmission system operator (TSO)**.

“ If electricity market regions are present (i.e. a jurisdiction with a market that exclusively uses zonal pricing), the electricity generation facility will be **located in the same electricity market region, an interconnected offshore electricity market region or neighboring interconnected electricity market region with equal or higher cost of electricity than the electricity market region of the CEF production facility** [...]. An electricity market region is a geographic area of the grid which is differentiated by electricity price.



June 2025



Exceptions:

- Claim of grid average emissions with proof of grid connection
- Direct connection with no further users



Sourcing arrangements are required to enable tracing of electricity to a generation source



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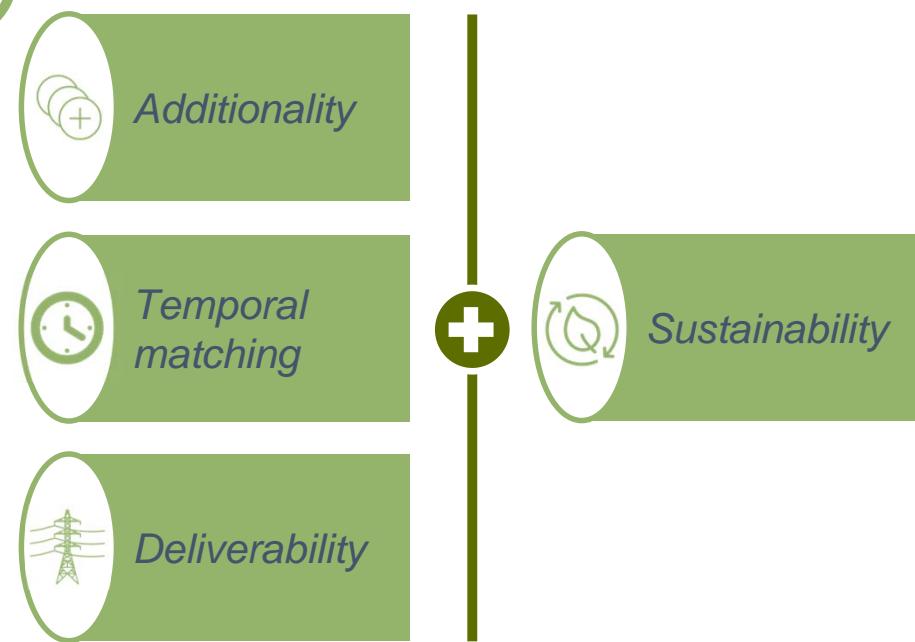


Sourcing arrangements are required to enable tracing of electricity to a generation source



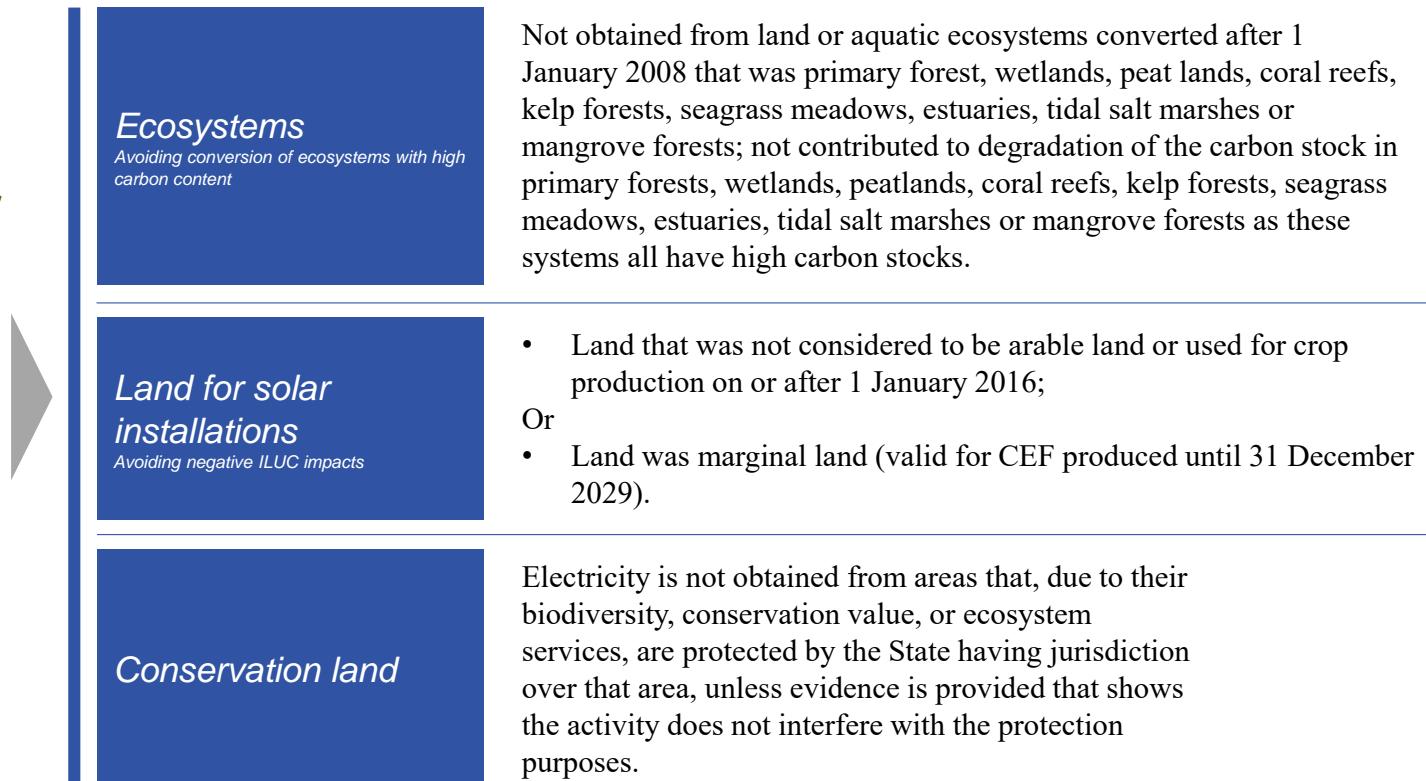
Electricity sourcing will have to rely on **factual (no grid connection) or contractual (grid connection) sourcing arrangements** for a specific fuel production facility

Additional requirements for sourcing

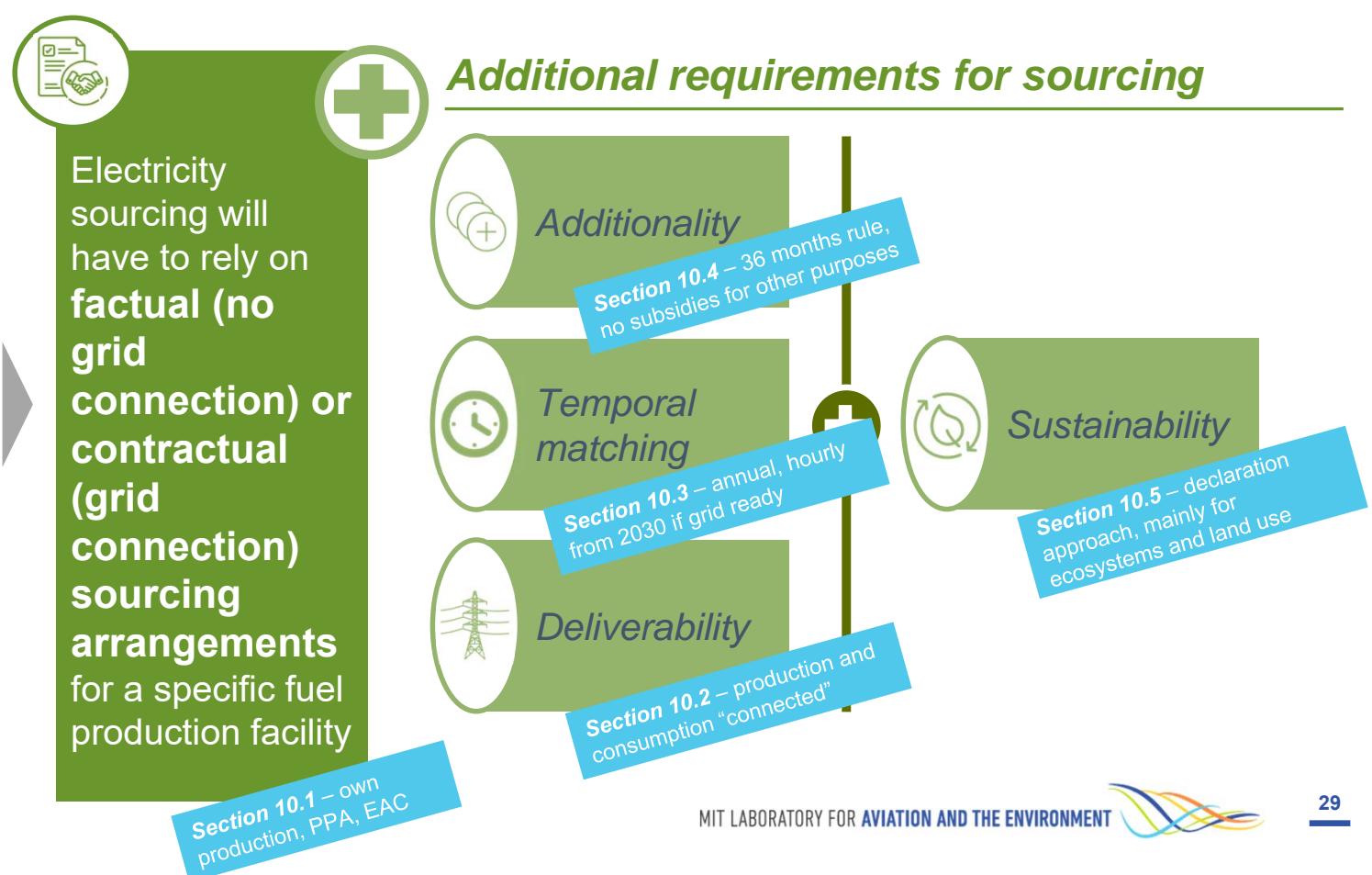


Sustainability requirements (Section 10.5)

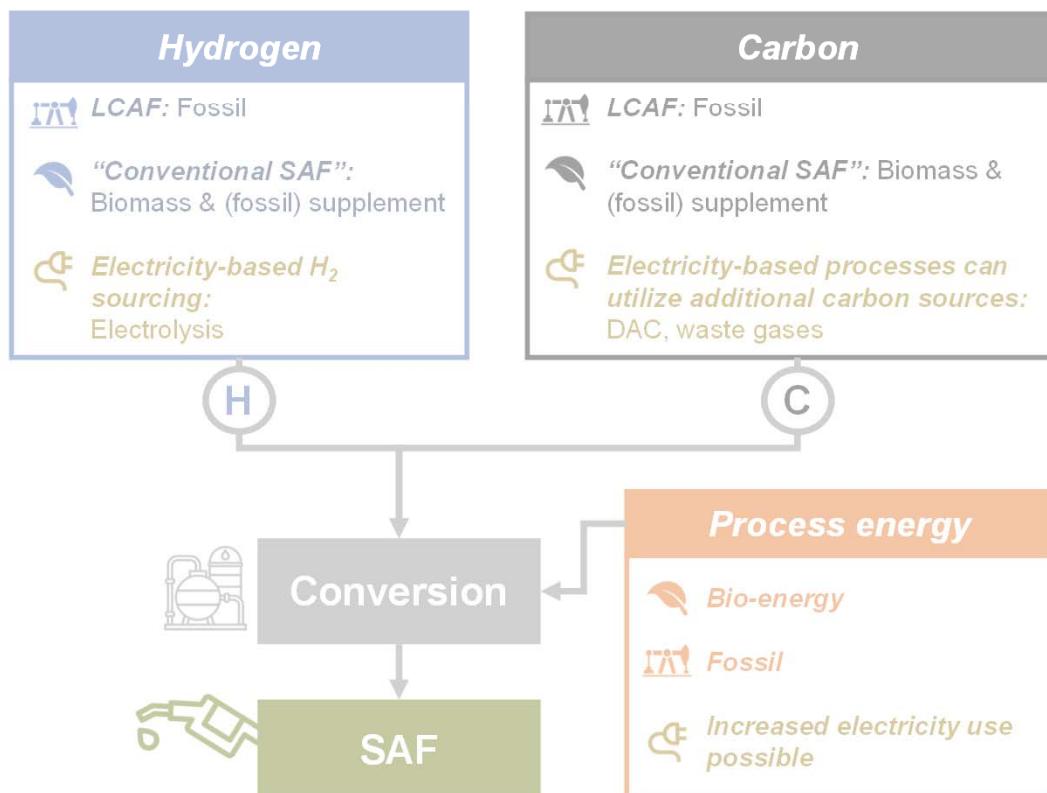
**CEF producer
presents
valid
declaration
for
compliance
with
sustainability
criteria**
(no full economic operator!)



Sourcing arrangements are required to enable tracing of electricity to a generation source



SAFs are long-chain hydrocarbon fuels –
electricity use can disrupt hydrogen and carbon
sourcing



Amendments to the
Actual Value Method
need to cover:

1

Increased electricity use
(both for H_2 sourcing and process
energy)

2

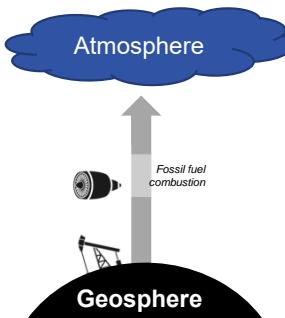
**Use of additional carbon
sources**
(typically associated with electricity-
based SAF production)



Considerations of different carbon sources under CORSIA

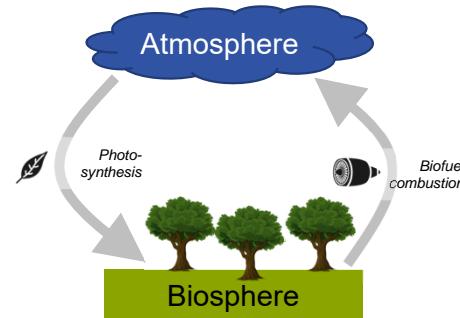
Fossil

Fossil crude oil, subsequently refined to Jet A.



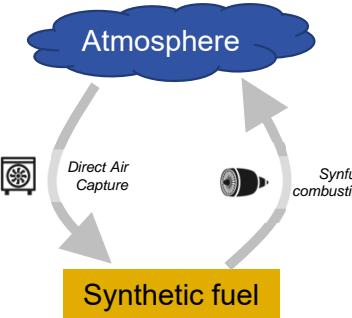
Biogenic

Carbon sourced from biomass (e.g., energy crops, biogenic wastes and by-products etc.)



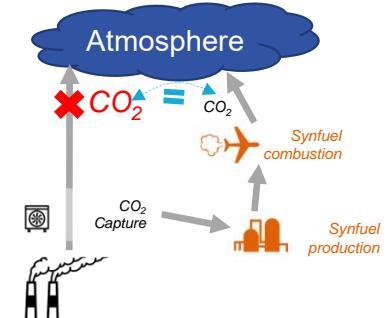
Atmospheric C

Carbon captured directly from the atmosphere



Waste gases (fossil origin)

Carbon that would have otherwise been released into the atmosphere



Under current method:
Combustion emissions counted.



Under current method: Combustion of biogenic CO₂ not counted in Core LCA analysis.



Previously: Combustion of CO₂ not carbon neutral
Since June 2025: Carbon neutrality established (Section 2.2.1)

Includes provisions on co-capture of process emissions.

Previously: Exemption for Waste gas process in default values
Since June 2025: Carbon neutrality possible (Section 2.4).



Considerations for waste and residue gases of fossil origin

The emissions of lifecycle stage 8 for a CEF made from waste and residues (of fossil origin):



Emissions associated with combustion process

$E_C = 0$ if:

1. Gas stream qualifies as waste or residue gas stream (*unavoidable, unintentional, obligation to discard / insignificant value*), and
2. Waste gas would have been released in the atmosphere (no substituting of CCS), and
3. Initial emitter maintains burden of emission

Emissions net realization changes

Captures benefits associated with transforming from a high-impact GHG stream in the waste and residue gas (e.g. methane) to CO_2 .

Emissions associated with process changes

Captures changes in process emissions, e.g., due to lost production of underlying emitting process or increased input needs.





ICAO

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ICAO document

**CORSIA Methodology for Calculating Actual Life
Cycle Emissions Values**



June 2025

CORSIA

Carbon Offsetting and Reduction Scheme for International Aviation

**For details and authoritative guidance on the
implementations:**

Read the CORSIA Actual Value Methodology

Carbon:

- Section 2.2.1: carbon sources
- Section 2.4: CEF produced from waste and residues of fossil origin (incl. Section 4.2 on wastes and residue specifications)

Electricity

- Section 2.2.4: electricity LCA
- Section 10: Electricity sourcing

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Cairo

Eastern and
Southern African
(ESAF) Office
Nairobi

Asia and Pacific
(APAC) Sub-office
Beijing

Asia and Pacific
(APAC) Office
Bangkok



THANK YOU